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## CONTENTS

1. Amalia VELICIU, Implementation of modern managerial strategies in romanian pre-university education .....12-22
2. Gabriel Chidiebere ALONTA, Ozioma Precious UFELE, Comfort Chimezie OKOLOCHA, Roles of business subject teachers in promoting entrepreneurial skills among secondary school students in Anambra state.....23-33
3. Margaret Funke FAREMI, Yusuf Musibau ADEOYE, Florence Oluwaseye ADELEKE, School type and school location as predictors of students' learning outcomes in southwestern Nigeria secondary schools .....34-45
4. Valentina PASCARI, The dynamics of emotional development at preschool children.....46-58
5. Peter Sanjo ADEWALE, Anthony KOLA-OLUSANYA, Florence Adeoti YUSUF, Romoke Edu OGUNLANA, Uchenna Kingsley OKEKE, Martha Arit BASSEY, Ganiyu Adisa IROKO, Exploring climate change impact on teachers' efficiency and students' learning optimization in Lagos Nigeria .....59-70
6. Mihaela GRASU, Silvia POPOVICI, Special educators als bricoleur.....71-79
7. Kelly DREGER, Developing software-based statistical models for educational incentives in middle school .....80-110
8. Mutahir Oluwafemi ABANIKANND, Identifying spatial, functional and technological modifications and guidelines to cope with educational change and contemporary challenges.....111-136
9. Carmen Maria CHIȘIU, Developing the creative potential of young schoolchildren .....137-146
10. Ramona Iulia HERMAN, Letiția Muntean TRIF, Students perception of didactic feedback in university education .....147-161
11. Yusuf B. NUSIRAT, Imam T. BASHIRAT, Ahmed A. TAWA, Pre-service teachers' awareness of innovative tools in chemistry teaching .....162-175
12. Maria Iulia FELEA, Aspects of formative assessment in academic education .....176-180
13. Adesanya E. OLORUNLEKE, Emmanuel G. OLORUNFEMI, Views of undergraduates on the influence of farm practical training in motivating agricultural students for engagement in agricultural occupations in Nigeria.....181-196
14. Tiberiu DUGHI, Anca BULBOACĂ, Henrietta TORKOS, Personality traits and job satisfaction among teaching staff .....197-211
15. Ifeoma CHINYERE UMEJI, Impact of continuous assessment on primary education students' attitude towards learning in tertiary institutions in Anambra state .....212-224
16. Olukayode Solomon ABODERIN, Desmond Wesley GOVENDER, Exploring students' views on determinants of academic success of e-learners in a nigerian university .....225-243

|  |         |
|--|---------|
| 17. Bashirat Titilope IMAM, Dare Abdulraheem GBIGBADUA, Hafsat Imam ALABI, Technological pedagogical content knowledge self-efficacy of trainee science teachers in colleges of education in Ilorin, Nigeria .....                         | 244-259 |
| 18. Cornel Victor IGNA, Influence of personality traits on academic motivation in a small sample .....   | 260-271 |
| 19. Nkiruka Treasure OKOYE, Izunna Shedrack NWUBA, Probing computer-assisted instructional effect on academic achievement of secondary school students in physics .....  | 272-284 |
| 20. Melissa Beck WELLS, Enhancing accessibility and learning outcomes in higher education: the role of universal design for learning in digital formats .....  | 285-292 |
| 21. Ola Tokunbo ODEKEYE, Micheal Adelani ADEWUSI, Oluwadamilare Mattew SOBEMEKUN, Kabeerat Gbemisola OLAWOYIN, Podcast: a technological tool for improving learning performance in algebra among primary school pupils in osun state ..... | 293-307 |
| 22. Demirgean EMEL, Victor MIHALCEA, Merve-Nur MEMET, Mădălina MITU, Mona BĂDOI-HAMMAMI, Exploring learning styles to achieve academic performance .....   | 308-330 |
| 23. Dana DUGHİ, Editha COȘARBĂ, Diana PETCUȚ, Digital platforms and applications used in romanian language and literature classes at the high school level.....  | 331-339 |
| 24. Anthonia Ayobami OYELADE, Muhammed Lanre AKINLOYE, Impact of teachers' motivational strategies on performance of secondary school teachers in osun state, Nigeria .....  | 340-352 |
| 25. Oluyemi Akinleye OGUNDIWIN, Gabriel Segun ADEWUMI, Olayemi Aderokun ASAAJU, Effect of active review strategy on student's attitude to basic science in oyo state .....   | 353-366 |
| 26. Maxwel. C. OBIKEZIE, Angela Adanna ABUMCHUKWU, J. A. EKR, Rebecca. E. CHIKENDU, Social learning environment and problem – solving skills as correlates of students' performance competence in chemistry .....                          | 367-383 |
| 27. Anselem Abonyi UGWUANYI, Florence Obiageli EZEUDU, Monisade Folasade ADERANTI, Extraversion and gender as correlates of science process. Skills acquisition in chemistry qualitative analysis.....                                     | 384-397 |
| 28. Denisa Ramona CHASCIAR, Vasile CHASCIAR, The impact of limited access to cultural resources on the social development of rural children and educational solutions to overcome this obstacle .....                                      | 398-405 |
| 29. Vasile CHASCIAR, Denisa Ramona CHASCIAR, The contribution of sport to the development of emotional intelligence among adolescents: an educational perspective .....  | 406-413 |
| 30. Alina COSTIN, Traits of coparental alliances. Implications on parental education programs .....  | 414-424 |
| 31. Sabin CHIȘ, The impact of computer-aided design (CAD) on the education and training of students in food engineering, tourism, and environmental protection .....   | 425-434 |

## IMPLEMENTATION OF MODERN MANAGERIAL STRATEGIES IN ROMANIAN PRE-UNIVERSITY EDUCATION

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**Abstract:** *This article explores the transition towards modern managerial strategies within the pre-university education system in Romania, illustrating how this evolution responds to the dynamics of contemporary social changes. At the center of the discussion is the implementation of the concept of "new management" in education, an emerging paradigm that distances itself from traditional hierarchical approaches, moving towards a more fluid, adaptable and participative organizational framework. The article analyzes the key features of this new management model, such as distributed leadership, decentralization of decision-making and the emphasis on the development of key skills, as well as the benefits it brings to the current educational context. In addition, the study examines the role of institutional actors in this transition, from the Ministry of Education to individual educational units, highlighting how each contributes to the implementation and adaptation of these strategies. Particular attention is paid to the specific tools used to increase organizational performance, including the Institutional Development Plan (IDP), the School Action Plan (SAP) and the Management Plan.*

**Key words:** *new management; participatory leadership; pedagogical innovation; educational reform; educational management; organizational performance.*

### **1. Introduction to modern educational management**

Within the contemporary educational landscape, the pre-university education system in Romania is in a continuous process of evolution and adaptation. This transformation is driven both by demographic and socio-economic changes and by accelerated technological progress. These dynamics have generated an acute need to reevaluate traditional educational management methods, putting in the foreground the need to adopt modern, more flexible and innovative managerial strategies, starting from the premise that "the purpose of the school at the present

time is to prepare students for society not just for exams" (Alexe, 2017: 14).

In this context, the concept of "new management" in education has become a central point. It represents an emerging paradigm that distances itself from the hierarchical and rigid approaches of the past, moving towards a more fluid and adaptable organizational structure (Child, 2015). The new management in education assumes a participative and open leadership, which encourages autonomy and individual initiative, both on the part of teachers and students. This approach promotes a dynamic learning environment where collaboration, creativity and innovation are not only encouraged but essential.

The principles of new management include the decentralization of the decision-making process, thus providing greater flexibility and capacity to adapt to the specific needs of each educational institution (Altrichter et al, 2014). This transformation is not only limited to administrative methodology, but also extends to pedagogical practices, promoting a diversified curriculum and assessment methods oriented towards the development of key skills.

The adoption of these modern managerial strategies in pre-university education is a trend as well as a necessity dictated by the rapid changes in contemporary society. Integrating these innovative approaches is vital to ensure that the education system not only keeps up with these changes, but also anticipates them, thereby preparing students for the challenges and opportunities of the future. In this context, the new educational management aims at "the timely identification of the needs of the labor market for the formation of the necessary educational programs, the mastery by the educational institutions of innovative methods and management tools to eliminate outdated inefficient structures" (Al-Ababneh & Alrhaim, 2020: 777i). By promoting an educational environment that values critical thinking, creativity and adaptability, modern managerial strategies can significantly contribute to the development of a robust educational system capable of forming well-prepared citizens for a dynamic future and a constantly changing labor market.

Thus, the new management approach in the Romanian educational context is both a response to current needs and a strategic investment in the future of society, ensuring that future generations will be equipped with the necessary skills, knowledge and competences to navigate and thrive in a constantly changing world ((Alexe, 2017: 14)). This approach requires a clear vision, courage and commitment from all actors involved, from politicians and administrators to educators and parents, to transform education into a process not just of knowledge accumulation, but of holistic development of the individual.

## **2. Characteristics of modern management in education**

In the contemporary educational context, modern management is distinguished by a number of essential characteristics that significantly separate it from traditional practices. This new management model is based on a holistic and integrative approach, emphasizing continuous development and adaptation to rapid changes in society and technology. One of the most important characteristics of modern management is participative and distributed leadership. It involves a more democratic approach to leadership, where different actors in the school community - including teachers, students, parents and other stakeholders - are actively involved in the decision-making process. This form of leadership favors the development of a sense of ownership and shared responsibility over the educational process, contributing to the creation of a more open and inclusive environment.

In terms of practices associated with successful leadership models in new school management, Day et al (2020) discuss transformational, pedagogical/instructional and distributed leadership. Transformational leadership focuses on motivating staff by cultivating awareness of the importance of the organization's goals and inspiring them to transcend their own interests in favor of the organization. It includes setting vision and directions, restructuring and realigning the organization, developing staff and curriculum, and engaging the external community (Day et al, 2020: 15-17).

Pedagogical/instructional leadership, on the other hand, emphasizes the importance of setting clear educational goals, curriculum planning, and evaluating teachers and teaching. This model emphasizes promoting better outcomes for students, emphasizing the importance of teaching and learning and improving the quality of the instructional process (Day et al, 2020).

Finally, distributed leadership is a concept and set of practices that emphasize that the leadership function spans the activities of multiple individuals, groups, and situations. This model suggests that decision-making is improved by involving multiple stakeholders, contributing to organizational change and development (Day et al, 2020).

Another distinctive feature is flexibility and adaptability. Modern management in education continuously adapts to the changing needs and demands of students, the community and society as a whole. This entails not only adjusting the curriculum and teaching methodologies, but also the ability to integrate emerging technologies and respond to socio-cultural changes. This adaptability is crucial to maintaining the relevance and effectiveness of education in a dynamic world. Beycioglu & Kondakci (2021) identify the following dimensions of change specific to the new educational management:

- The paradigm shift (Beycioglu & Kondakci, 2021: 795-796): The authors emphasize the need for a paradigm shift in educational management to respond to the dynamic needs of modern society. This implies the transition from a traditional management, based on planning and predictability, to one capable of responding quickly to changes in technology, economy and society.
- Continuous change (Beycioglu & Kondakci, 2021: 796-797): The concept of continuous change is presented as a process integrated into the daily activities of the organization, not as large and separate events. This means a constant adaptation to small changes, which, accumulated, lead to the evolution of the school institution.
- The social dimension of managerial change (Beycioglu & Kondakci, 2021: 795-802): Change is seen as a product of social interactions and conversations within the organization. This aspect emphasizes the importance of organizational culture and communication in facilitating and directing change.
- Participative leadership (Beycioglu & Kondakci, 2021: 795-802): A leadership model is promoted where responsibility for initiating and managing change is shared between different levels of the organization. This type of leadership supports innovation and allows for greater adaptability at the grassroots level.
- Essential process factors (Beycioglu & Kondakci, 2021: 795-802): such as participation, communication and coordination, are fundamental to the success of continuous change in organizations, including education. These factors facilitate the adaptation and integration of changes, allowing the organization to respond effectively to external and internal challenges. For example, the active participation of all members of the organization in the change process increases commitment and acceptance of the proposed changes. Open communication ensures that all stakeholders are informed and engaged, which helps align visions and goals. Effective coordination between different departments or groups ensures that changes are implemented cohesively and consistently. Together, these factors help create an organizational culture where change is viewed as an opportunity for growth and continuous improvement.

In addition, modern management focuses on competency orientation and personal development (Nahaba, 2016). In contrast to traditional approaches, which often emphasized the accumulation of theoretical knowledge and standardized assessment, the new model values the development of transversal skills such as critical thinking, creativity, collaboration and self-learning. This approach prepares students not only for academic success, but also for efficient and adaptable integration into modern society and the labor market.

Comparing these practices with traditional educational management

methods, we notice fundamental differences. Traditional models were often based on a centralized system, with decisions made at higher levels and applied uniformly across institutions. In contrast, modern management promotes a decentralized and personalized model, adapted to the specific needs of each educational institution and its students. This transition to modern educational management brings a number of significant benefits. Through these innovative approaches, an educational environment is created that not only meets the immediate needs of students, but also prepares them for future challenges. Students become more engaged in the learning process, developing their skills and ability to think critically and creatively. Furthermore, teachers are encouraged to explore new teaching methods that stimulate students' curiosity and interest (Simeretçhii, 2015).

Moreover, this approach leads to the continuous improvement of academic performance and the development of essential skills for the age of technology. By promoting a collaborative and adaptive learning environment, it facilitates not only the accumulation of knowledge, but also the development of social and emotional skills, thus preparing students for a constantly changing world.

Thus, the implementation of modern management in education represents a crucial stage in the evolution of the educational system. Through its innovative and adaptable approaches, it promotes not only academic excellence but also the integral development of students, providing them with the competencies and skills needed to successfully navigate the complexities of contemporary society. This transformation process requires a deep and collaborative commitment from all educational actors, representing a significant step towards the formation of a more informed, adaptable and innovative society.

### **3. Institutional actors and their role in educational management innovation in Romania**

In the context of the implementation of modern management in pre-university education in Romania, the role of institutional actors is fundamental. This complex and multidimensional process involves a number of entities and organizations, each with specific responsibilities and contributions.

The Ministry of Education is the central institution in this equation, setting strategic directions and providing the legislative framework and resources necessary for educational reforms. Recently, the Ministry launched the SMART.Edu strategy, an ambitious plan aimed at digitizing education in Romania for the period 2021-2027 (<https://www.smart.edu.ro/>). This strategy proposes an integrated and comprehensive approach, emphasizing accessibility, connectivity, community, the digital educational ecosystem, innovation and



sustainability. The role of the Ministry is to coordinate and supervise the implementation of this strategy, ensuring that the objectives set are achieved efficiently and effectively. It aims to develop digital skills at all educational levels, improve digital infrastructure and promote inclusive and quality education. The strategy includes collaborations with various stakeholders and is aligned with European initiatives for digital education. The main objectives are to create a flexible and digitized educational system, prepare citizens for a digital economy and strengthen the resilience of the educational system in the digital age (<https://www.smart.edu.ro/>).

The Smart Edu strategy, dedicated to the digitization of education in Romania, presents both strengths and challenges. One of the most important assets is the emphasis on the development of digital skills, essential in an increasingly technological world. The strategy also promotes equal access to education and aims to improve the quality of education. On the other hand, its effective implementation is a major challenge, requiring adequate resources and continuous adaptation to technological changes. Monitoring and impact evaluation are also essential to ensure the long-term success of the initiative.

School inspectorates, as decentralized public services of the Ministry of Education, have an essential role in the implementation of educational policies at the regional and local level. They methodologically coordinate the teaching staff's homes and the county educational resource and assistance centers, facilitating the continuous training of teaching staff and supporting the development of the necessary skills for a modern educational environment. Through this coordination, inspectorates ensure that changes and innovations within the educational system are implemented uniformly and efficiently in all pre-university education units. The duties of school inspectorates in the implementation of educational management, according to Order No. 5530 of October 5, 2011, include (Ministry of Education, Research, Youth and Sports, 2011):

1. Application of the policies and strategies of the Ministry of Education at county or Bucharest city level.
2. Controlling the application of legislation and monitoring the quality of teaching-learning activities and national standards.
3. Evaluation of the quality of the management of educational units and institutions.
4. Coordination of high school admissions, national assessments and school competitions at the level of educational units.
5. Monitoring the implementation of national programs and projects in the field of education and youth.

Educational units with legal personality, led by boards of directors and directors, are also crucial actors in this process. Their primary

responsibility is to implement educational policies at the local level, ensuring compliance with national and international standards. School principals and teaching staff have a direct and active role in applying new managerial and pedagogical strategies, adapting them to the specifics and needs of the school community they serve (Feroiu, 2018). They are also responsible for maintaining a constant dialogue with students, parents and other stakeholders, ensuring that all measures adopted meet the real needs of students and improve the quality of the educational process.

The interaction between these institutional actors is essential for the successful implementation of the new management in education. The Ministry of Education, by establishing the strategic and legislative framework, ensures the general direction and the necessary resources. School inspectorates play a role in the implementation and monitoring of these policies, providing assistance and support to educational establishments. At the same time, the pre-university education units are the ones that implement the initiatives at the level of the school community, adjusting them to the specifics and local needs. Through this collaboration and coordination at all levels, the aim is to create a modern, adaptable and efficient educational system, capable of responding to the needs of students and contemporary society.

This complex interaction requires constant commitment and effective communication between all actors involved.

#### **4. Specific tools in the current educational management in Romania**

In modern educational management, specific tools, such as the Institutional Development Plan (IDP), the School Action Plan (SAP) and the Managerial Plan, have a significant impact on increasing organizational performance. These tools facilitate the process of strategic and operational planning, enabling educational institutions to adapt and respond effectively to the ever-changing challenges and demands of the educational environment.

The Institutional Development Plan (PDI) is a strategic document that defines the development directions of an educational institution in the medium and long term. The PDI includes the institution's vision, mission and strategic objectives, being developed following a careful analysis of the internal and external environment. This plan is essential for identifying educational needs and resources, laying the foundation for subsequent strategic and operational decisions, containing the following:

- "a) presentation of the unit: history and current state of human, material and financial resources, the relationship with the local community and the organizational chart;
- b) needs analysis, made up of internal environment analysis (SWOT

type) and external environment analysis (PESTE type);  
c) the vision, mission and strategic objectives of the unit;  
d) planning all the activities of the educational unit, namely managerial activities, objectives, deadlines, stages of achievement, necessary resources, responsibilities, performance indicators and evaluation" (Ministry of Education, 2022, Art. 33)

The School Action Plan (SAP), on the other hand, focuses on the detailed planning of educational activities for the coming school year. It includes resource allocation, curricular and extracurricular organization, and strategies for improving school performance. The PAS is a vital tool for ensuring that resources are allocated effectively and that educational objectives are aligned with the demands and expectations of the educational community (Ministry of Education, 2022, Art. 33).

The management plan is an annual operational tool that details the actions and initiatives that must be implemented to achieve the objectives established in the PDI and PAS. It includes detailed plans for the professional development of teachers, improving the educational infrastructure and promoting a conducive learning environment (Ardelean, 2017). The management plan is adaptable, allowing school principals to respond quickly to changes in the educational environment. These tools play an essential role in improving organizational performance in education. By setting clear directions and facilitating planning and decision-making, they help align educational activities with strategic and operational objectives, enabling institutions to respond effectively to student and community needs. Moreover, they ensure efficient management of resources and support the continuous development of educational quality.

## **5. Challenges and obstacles in school management reform**

Reforming school management in the context of modern education is a complex and challenging process. One of the most significant challenges in reforming school management is resistance to change. This can occur both from the teaching staff and from the administration or other interested parties. Resistance to change is often fueled by familiarity with existing procedures, fear of the unknown, or a lack of confidence in proposed new methods (Enache, 2019: 25-27). To overcome this barrier, it is crucial to implement training and continuous professional development processes that facilitate adaptation to new approaches and increase confidence in their effectiveness.

Another major challenge is the lack of resources, both financial and human. Limited resources can prevent the implementation of new management strategies or reduce the ability of schools to respond effectively to the needs of students (European Commission, 2020: 5).

Solutions to this problem include seeking alternative funding, such as grants or partnerships with the private sector, and optimizing the use of existing resources.

Also, discrepancies within the educational system, between urban and rural areas or between different regions, represent a major obstacle (,oc, 2019). These discrepancies can lead to inequities in access to quality education and affect the uniform implementation of reforms in school management. An approach focused on equality and equity is essential to ensure that all students benefit from a quality education, regardless of their location or context.

Rapid changes in technology and the need to integrate it into the educational system also represent a major challenge (Mihăilă, 2021). The adoption of educational technologies requires not only financial resources, but also the training of teachers to use them effectively. The solution lies in continued investment in educational technology and teacher training to ensure that schools are properly equipped to meet today's educational needs.

Reforming school management requires complex and adaptive approaches that take into account the diversity of existing challenges. Effective solutions require close collaboration between all stakeholders, including school administration, teachers, students, parents, and the local community. Through innovative approaches adapted to the specific context of each school, it is possible to overcome obstacles and achieve an effective reform in school management.

## **6. Conclusions**

The implementation of modern managerial strategies in Romanian pre-university education presents a significant evolution within the educational landscape. This transformation process, driven by demographic, socio-economic and technological changes, underlines the need to re-evaluate traditional methods and adopt more flexible and innovative approaches. With an emphasis on "new management", education is moving towards a more fluid and adaptable structure, putting in the foreground the autonomy and individual initiative of teachers and students.

Central to this new model is participatory and distributed leadership, which encourages the active involvement of all members of the school community in the decision-making process. This type of leadership fosters a dynamic and collaborative learning environment where creativity and innovation are essential. By decentralizing the decision-making process, each educational institution can adapt management strategies to the specific needs of its community, promoting a diversified curriculum and assessment methods oriented towards the development of key competencies.

Modern managerial strategies in pre-university education are not just a trend, but a necessity dictated by the rapid changes in contemporary society. This type of educational management aims at the timely identification of labor market needs and the acquisition by educational institutions of innovative methods and management tools. By promoting an educational environment that values critical thinking, creativity and adaptability, it contributes to the development of a robust educational system capable of training well-prepared citizens for a dynamic future and an ever-changing labor market.

In addition to these innovative approaches, the implementation of specific tools, such as the Institutional Development Plan (IDP), the School Action Plan (SAP) and the Managerial Plan, play a crucial role in improving organizational performance in education. These tools facilitate strategic and operational planning, enabling educational institutions to respond effectively to the challenges and demands of the changing educational environment.

However, the school management reform process faces various challenges and obstacles, including resistance to change, lack of resources and systemic discrepancies. Overcoming these barriers requires constant commitment and effective collaboration between all stakeholders, including school administration, teachers, students, parents and the local community. Through adapted and innovative approaches, specifically adapted to the context of each school, it is possible to achieve an effective reform in school management, thus ensuring a modern and efficient educational system, capable of responding to the needs of students and contemporary society.

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## ROLES OF BUSINESS SUBJECT TEACHERS IN PROMOTING ENTREPRENEURIAL SKILLS AMONG SECONDARY SCHOOL STUDENTS IN ANAMBRA STATE

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**Abstract:** *This study investigated the Role of Business Subject Teachers in Promoting Entrepreneurial Skills among Secondary School Students in Awka South L.G.A of Anambra State. A descriptive research design was adopted, with a population comprising 80 Business Subject Teachers from 19 public secondary schools in Awka South Local Government Area. A sample of 67 respondents was selected using simple random sampling. Data were collected using a 16-item structured questionnaire titled “Role of Business Subject Teachers in Promoting Entrepreneurial Skills among Secondary School Students Questionnaire (RBSTPESSSSQ)” and analyzed using mean scores. The findings revealed that business subject teachers can enhance students’ knowledge of effective technical writing techniques and identify necessary technological software to meet new business trends. Additionally, business subject teachers assist students in developing interpersonal skills and financial literacy to avoid impulse buying. The study recommends adequate funding of business studies subjects by stakeholders at all levels and emphasizes the importance of procurement of requisite teaching materials.*

**Key words:** *business subject teachers; entrepreneurial skills; secondary school students; Anambra State.*

## Introduction

Education serves as the cornerstone of development and human progress, acting as a conduit through which individuals acquire the necessary skills and knowledge to thrive in society. Ndudi (2015) underscores education's role in elevating political, social, and economic standards, offering a pathway to combat ignorance, disease, and poverty. Similarly, Okene (2019) highlights education's pivotal role in national development, emphasizing the correlation between educational attainment and a nation's prosperity. Recognizing this importance, international and local laws have enshrined the right to quality education as a fundamental human right.

In Nigeria, the formal education system comprises three levels: primary, secondary, and tertiary. At the primary level, basic literacy skills are imparted, while secondary education introduces students to subjects geared toward their future careers. Among these subjects, business studies stand out as fundamental, equipping students with practical skills essential for navigating the commercial world. In today's economic climate, business studies play a crucial role in fostering entrepreneurship and reducing unemployment rates. Ahmed (2015) views business studies as integral to vocational education, combining theoretical knowledge with practical training to prepare students for the business world. Oluwalola (2018) stresses the importance of technical, psychomotor, and critical thinking skills in business studies, highlighting their role in fostering self-reliance among students.

Entrepreneurship education, as described by Agu (2016), aims to instill the skills and mindset necessary for starting and managing businesses. Eneji (2014) emphasizes the importance of developing entrepreneurial skills, attitudes, and competencies among youths to drive economic growth. Business subject teachers play a pivotal role in transmitting entrepreneurial skills to students, guiding them toward successful entrepreneurship. Given the current economic challenges, it is imperative for business teachers in Awka to possess the requisite entrepreneurial skills to effectively promote entrepreneurship among secondary school students.

Business subject teachers serve as subject specialists, role models, and mentors within the school environment (Mena, Hennissen, & Loughran, 2017). Through teaching entrepreneurial skills, they empower students to recognize opportunities, create businesses, and operate ethically and professionally (Biesta, 2009; Putri et al., 2019). Teachers facilitate students' journey toward independence and responsible citizenship by imparting financial, technical, and marketing skills essential for entrepreneurship (Kim & Park, 2019). In essence, business studies teachers play a vital role in preparing future entrepreneurs, equipping them with the knowledge and skills needed to thrive in the business



world (Fayolle, 2018).

Business teachers play a pivotal role in imparting essential entrepreneurial skills to students, including financial management, technical proficiency, and marketing acumen. Financial management, as defined by Conradie and Fourie (2002), encompasses the strategic acquisition and optimal utilization of financial resources to achieve both short-term and long-term objectives. Brijlal, Enow, and Isaacs (2014) emphasize the importance of financial planning, accounting record-keeping, and financial analysis in small and medium-sized enterprises (SMEs).

Moreover, technical skills are crucial in today's knowledge society, contributing significantly to individuals' overall life satisfaction (Leelakulthanit, 2018). Business teachers equip students with the technical knowledge and competencies necessary for leveraging technology to enhance business productivity and efficiency. These technical skills, coupled with critical thinking, problem-solving, and communication abilities, are integral to entrepreneurial success (Leelakulthanit, 2018).

Furthermore, marketing skills are essential for entrepreneurs to identify market needs, develop products or services, and effectively promote them to target customers (Adamu, 2019). Business teachers play a vital role in teaching students the principles of marketing management, enabling them to conduct market research, understand consumer behavior, and formulate effective marketing strategies. Olaleye (2017) identifies marketing skills as indispensable for self-employment, emphasizing their role in sustaining businesses in competitive markets. Without adequate financial, technical, and marketing skills, graduates may struggle to establish and maintain successful businesses (Obi, 2015). Therefore, it is imperative for business subject teachers to instill these entrepreneurial skills in secondary school students, preparing them for future economic independence and business growth.

In the context of Awka South Local Government Area in Anambra State, Okpochefo and Alika (2017) highlight the socioeconomic benefits of well-managed enterprises, including job creation, income generation, and revenue generation for the government. Recognizing the significance of entrepreneurship in driving economic development and social stability, this study aims to investigate the role of business subject teachers in promoting entrepreneurial skills among secondary school students in Awka South L.G.A of Anambra State.

#### Statement of the Problem

The statement of the problem underscores the importance of equipping secondary school students with entrepreneurial skills to enhance their self-reliance and employability in Nigeria. Despite government efforts to prioritize the teaching of business subjects and the employment of

business teachers, there remains a significant implementation gap, leading to persistently high rates of poverty and unemployment.

In Awka South Local Government Area of Anambra State, the role of business subject teachers in fostering entrepreneurial skills among secondary school students is particularly crucial. However, there is a concern that without proper guidance and encouragement from teachers, students may struggle to effectively employ the entrepreneurial skills they acquire.

Therefore, this study aims to investigate the role of business subject teachers in promoting entrepreneurial skills among secondary school students in Awka South Local Government Area of Anambra State. By addressing this issue, the study seeks to identify potential barriers to effective entrepreneurship education and propose recommendations to improve the teaching and learning of entrepreneurial skills in secondary schools. Ultimately, the goal is to empower students with the knowledge and confidence to pursue self-employment opportunities and contribute to socioeconomic development in their communities.

### **Research Questions**

The research questions for this study are as follows:

1. What financial management skills do business subject teachers utilize to promote entrepreneurial skills among secondary school students in Awka South Local Government Area of Anambra State?
2. What technical skills do business subject teachers employ to foster entrepreneurial skills among secondary school students in Awka South Local Government Area of Anambra State?
3. What marketing skills are employed by business subject teachers to enhance entrepreneurial skills among secondary school students in Awka South Local Government Area of Anambra State?

### **Method**

The research employed a descriptive survey design to investigate the roles of business subject teachers in promoting entrepreneurial skills among secondary school students in Awka South Local Government Area, Anambra State. Descriptive surveys are suitable for collecting and systematically describing characteristics, features, or facts about a given population (Nwogu, 2015). This design was chosen as it aimed to gather the opinions of business subject teachers regarding their roles in fostering entrepreneurial skills among secondary school students. The study was conducted within the Awka South Local Government Area of Anambra State, focusing on all business subject teachers in the 19 public secondary schools in the area. According to the Post-Primary Secondary School Service Commission (PPSSC) report for the 2022-2023 academic year, there were an estimated 80 business subject teachers among the total of 987 teachers in the local government area. A sample size of 67 respondents was selected using a simple random sampling

technique from the population of business subject teachers in the public secondary schools. The research instrument used was a questionnaire titled “Role of Business Subject Teachers in Promoting Entrepreneurial Skills among Secondary School Students Questionnaire (RBSTPESSSQ)”, developed by the researcher. To ensure the validity of the instrument, it was reviewed by two experts in the Department of Technology and Vocational Education at Nnamdi Azikiwe University, Awka. The reliability of the instrument was assessed using Cronbach's alpha statistics, yielding a coefficient value of 0.88, indicating high reliability. Data collected through the questionnaire were analyzed using mean scores, with a mean cut-off point of 2.50 employed for decision-making. Items scoring 2.50 and above were considered positive responses, while those scoring below 2.50 were deemed negative responses. This analytical approach enabled the identification of perceptions and attitudes of business subject teachers towards their roles in promoting entrepreneurial skills among secondary school students.

**Presentation of Results**

Research Question 1: What are the roles played by business subject teachers in promoting financial management skills among secondary school students in Awka South Local Government Area of Anambra state?

Table 1: Mean response of respondents on the roles played by business subject teachers in promoting financial management skills among secondary school students.

| S/N | Item   | Mean | Remark |
|-----|--|------|--------|
| 1.  | Business subject teachers help students increase their knowledge of recording business transactions  | 3.50 | Agreed |
| 2.  | Business subject teachers will aid students to understanding how to budget and forecast  | 3.32 | Agreed |
| 3.  | Business subject teachers teach students how to classify financial information in a firm   | 3.43 | Agreed |
| 4.  | Business subject teachers aid in understanding pay roll and various operational documents  | 3.37 | Agreed |
| 5.  | Through financial management skills, business subject teachers assist students to improve their knowledge of accounting and costing in an organization | 2.70 | Agreed |
| 6.  | Business subject teachers assist students with the skills needed to interpret financial statement  | 3.37 | Agreed |

|            |   |      |        |
|------------|---|------|--------|
| 7.         | They help students to understand cash flow management.                          | 3.40 | Agreed |
| 8.         | They also help students to make strategic planning considering their resources. | 3.32 | Agreed |
| Grand Mean |   | 3.30 | Agreed |

Table 1 illustrates that respondents overwhelmingly agree that items 1 to 8 significantly contribute to promoting financial management skills among secondary school students, with mean scores ranging from 2.70 to 3.50. The grand mean of 3.30 confirms that business subject teachers play a crucial role in promoting financial management skills among secondary school students.

Research Question 2: What are the roles played by business subject teachers in promoting technical skills among secondary school students in Awka South Local Government Area of Anambra state?

Table 2: Mean response of respondents on the roles played by business subject teachers in promoting technical skills among secondary school students.

| S/N | Item   | Mean | Remark    |
|-----|--|------|-----------|
| 9.  | Business subject teachers aid students, teaching them the necessary techniques on how to make effective entrepreneur   | 3.47 | Agreed    |
| 10. | Business subject teachers through business subject enhance students' knowledge on the needed techniques for effective technical writing in an organization.      | 2.98 | Agreed    |
| 11. | Business subject teachers help students to identify necessary technological software to meet up to new trends in business.                                       | 3.01 | Agreed    |
| 12. | Business subject Teachers assist students in understanding the necessary environmental observation, coordination and specific operation technology skills gives. | 3.31 | Agreed    |
| 13. | Business subject teachers help students acquire software proficiency.  | 2.41 | Disagreed |
| 14. | Business subject teachers help students understand basic programming languages.  | 3.22 | Agreed    |
| 15. | Business subject teachers help students develop fundamental skills for managing small projects/businesses.   | 2.29 | Disagreed |

|            |      |        |
|------------|------|--------|
| Grand Mean | 2.95 | Agreed |
|------------|------|--------|

Table 2 illustrates that respondents agree that items 9, 10, 11, 12, and 14 play a significant role in promoting technical skills among secondary school students, with mean scores ranging from 2.98 to 3.47, which are above the average mean value of 2.50. However, item 15, with a mean score of 2.29, disagreed, with a mean value less than 2.50. The grand mean of 2.95 confirms that business subject teachers play a key role in promoting technical skills among secondary school students.

Research Question 3: What are the roles played by business subject teachers in promoting Marketing skills among secondary school students in Awka South Local Government Area of Anambra state?

Table 3: Mean response of respondents on the roles played by business subject teachers in promoting marketing skills among secondary school students

| S/N        | Item  | Mean | Remark    |
|------------|---|------|-----------|
| 16.        | Business subject teachers help students to understand the methods on implementing promotional marketing strategy. | 2.31 | Disagreed |
| 17.        | Business subject teachers assists students to develop interpersonal skills.                                       | 3.10 | Agreed    |
| 18.        | Business subject teachers help students in developing financial literacy to avoid impulse buying.                 | 3.00 | Agreed    |
| 19.        | Business subject teachers assist students to develop bargaining skills.   | 3.14 | Agreed    |
| 20.        | Business subject teachers boost students' knowledge on managing customers through planning and motivation.        | 2.41 | Disagreed |
| 21.        | They help students to identify trending strategies needed for marketing   | 3.88 | Agreed    |
| 22.        | Help students to communicate to an audience and convey concepts to others in a clear and engaging way.            | 3.46 | Agreed    |
| 23.        | They help students to develop marketing soft skills like paying attention to details & creativity.                | 3.50 | Agreed    |
| Grand Mean |   | 3.1  | Agreed    |

Table 3 demonstrates that respondents agreed with items 17, 18, 19, 21, 22, and 23, with mean values ranging from 3.00 to 3.88, all above the average mean value of 2.50. However, respondents disagreed with items 16 and 20, with mean scores of 2.31 and 2.41, respectively, which are

below 2.50. The grand mean of 3.1 confirms that business subject teachers play a key role in promoting marketing skills among secondary school students.

### **Discussion of findings**

#### **The Roles Played by Business Subject Teachers in Promoting Financial Management Skills among Secondary School Students**

The findings of this study reveal that business subject teachers play a significant role in enhancing financial management skills among secondary school students in Awka South Local Government Area of Anambra State. Specifically, the results indicate that business subject teachers contribute to improving students' knowledge of recording business transactions, budgeting and forecasting, interpreting financial information, understanding payroll and operational documents, as well as grasping accounting and costing principles. These findings are consistent with Kiyosaki's (2015) assertion that business studies students require financial skills to understand financial principles, make informed decisions, and manage financial products effectively, such as savings, which impact their financial well-being.

Moreover, the findings align with Oheneme's (2019) research, which reported similar financial skills training among small-scale operators from both business and non-business backgrounds. This suggests that the role of business subject teachers in promoting financial management skills transcends academic boundaries and extends to practical applications in various entrepreneurial contexts. Therefore, it can be concluded that business subject teachers play a crucial role in equipping secondary school students with essential financial management skills necessary for entrepreneurial success.

#### **The Roles Played by Business Subject Teachers in Promoting Technical Skills among Secondary School Students**

The findings of this study shed light on the essential roles played by business subject teachers in promoting technical skills among secondary school students in Awka South Local Government Area of Anambra State. Specifically, the results indicate that business subject teachers assist students in acquiring the necessary techniques to become effective entrepreneurs. Moreover, these teachers enhance students' knowledge of technical writing techniques relevant to organizational contexts and help them identify technological software to keep up with evolving business trends. Additionally, business subject teachers aid students in understanding environmental observation, coordination, and specific operational technology skills.

These findings are consistent with Uzoka's (2017) research, which highlighted the importance of similar technical skills training for business education graduates. The similarities between the findings of the present study and previous research suggest that business studies

students share common characteristics and require similar skills training to perform their job tasks effectively.

Overall, the findings underscore the crucial role of business subject teachers in equipping secondary school students with the technical skills necessary for success in entrepreneurial endeavors. By imparting these skills, teachers contribute to preparing students for the dynamic and technology-driven business landscape they will encounter in the future. **The Roles Played by Business Subject Teachers in Promoting Marketing Skills among Secondary School Students**

The findings of this study illuminate the significant roles played by business subject teachers in promoting marketing skills among secondary school students in Awka South Local Government Area of Anambra State. Specifically, the results indicate that business subject teachers assist students in developing interpersonal skills essential for effective marketing. Moreover, these teachers provide students with financial literacy to prevent impulse buying and aid in the development of bargaining skills crucial for negotiation in business transactions. Additionally, business subject teachers help students identify trending marketing strategies and cultivate marketing soft skills, such as attention to detail and creativity.

These findings are consistent with the research conducted by Aneke (2021), which highlighted the influence of a business background on individuals' responses regarding the skills required by secondary school graduates in various business endeavors, including marketing.

Overall, the findings underscore the vital role of business subject teachers in equipping secondary school students with the marketing skills necessary for success in the competitive business world. By imparting these skills, teachers contribute to preparing students to navigate the complexities of marketing and excel in entrepreneurial ventures.

## **Conclusion**

Based on the findings of this study, it is evident that business subject teachers play a pivotal role in promoting financial, technical, and marketing skills among secondary school students in Awka South Local Government Area of Anambra State. Through their instructional efforts, these teachers enhance students' knowledge and capabilities in various aspects of entrepreneurship, thereby equipping them for success in the business world.

## **Implications of the Study**

The study underscores the importance of providing adequate support and resources to business studies teachers in Awka South L.G.A of Anambra State. By ensuring that teachers have a thorough understanding of their roles in promoting entrepreneurship, educational authorities can

facilitate effective teaching and learning experiences. Additionally, the findings highlight the need for ongoing professional development opportunities for business studies teachers to continually enhance their instructional practices and stay abreast of evolving trends in entrepreneurship education. Such initiatives can contribute to the overall improvement of entrepreneurial skills among secondary school students, ultimately fostering economic growth and development in the region.

### **Recommendations**

Based on the findings of this study, the following recommendations are proposed:

1. Government at all levels, corporate organizations, NGOs, philanthropic individuals, and the Parents-Teachers' Association (PTA) should collaborate to ensure adequate funding for business studies subjects in secondary schools. This funding should prioritize the procurement of necessary teaching materials to enhance the quality of instruction in entrepreneurship education.
2. Secondary school students should receive comprehensive career counseling both at home and in school, with a specific emphasis on the benefits and opportunities associated with studying business studies. Additionally, awareness campaigns conducted by organizations such as the National Orientation Agency (NOA) can help highlight the importance of entrepreneurship education and its potential impact on societal development.
3. Government educational bodies should work towards developing entrepreneurship-focused curriculum content within the business studies curriculum. These curriculum contents should be designed to equip students with the requisite competencies and skills needed for successful entrepreneurship activities. Moreover, the curriculum should be regularly updated to reflect current trends and emerging practices in entrepreneurship.

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## SCHOOL TYPE AND SCHOOL LOCATION AS PREDICTORS OF STUDENTS' LEARNING OUTCOMES IN SOUTHWESTERN NIGERIA SECONDARY SCHOOLS

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**Abstract:** *This study investigated the effect of school types and locations on students' learning outcomes in southwest Nigerian secondary schools. The study was a descriptive research of the survey type. The sample for this study was 1650 respondents comprising of 150 Principals and 1500 students from 150 secondary schools selected for the study. Two sets of instruments were used to collect relevant data from the subjects. The first instrument was tagged "Questionnaire on School Plants (QSP) while the second instrument was tagged Affective and Psychomotor Domain Questionnaire (APDQ). The reliability coefficient for each section was as follows: section C (0.85), section D (0.82), section E (0.72), section F (0.85), section G (0.74) and section H (0.87) for School plants instrument. The Affective and Psychomotor Domain instrument had a reliability coefficient of 0.77. Data collected were analyzed using percentage score, multiple regression, step-wise regression, F-ratio Pearson Product Moment Correlation and t-test statistics. All the hypotheses generated were tested at 0.05 level of significance.*

*The study revealed that there was no significant difference between rural and urban areas and students' learning outcomes (with  $t$ -cal 0.2,  $P > 0.05$ ). There was significant difference in students learning outcomes between private and public schools (with  $t$ -cal 2.11,  $P < 0.05$ ).*

*Governments should continue to lay more emphasis on some private and public- school partnership in order to improve the students' learning outcomes.*

**Key words:** *students' learning outcomes; private and public schools;*

*rural and urban areas.*

## **Introduction**

Learning can be used to refer to either a process or product. As a product, learning produces progressive series of changes in behaviour and experience. Learning is a permanent change in behaviour, which results from activities trainings and observations. It is a relatively permanent change in behaviour as a result of continuous reinforced practice. As a process, learning has been defined as process by which we acquire and retain attitudes, knowledge, understanding, skills and capabilities that cannot be attributed to inherited behaviour pattern or physical growth (Farrant 1991).

Onwuka (1981) maintained that, learning is a permanent acquisition and habitual utilization of newly acquired knowledge and experience. Gagne (1970) opined that learning is a change in human disposition and capability which can be retained and which is not simply ascribable to the process of growth. However learning is any relatively permanent change in behaviour or knowledge resulting from experience and practice. Oyinloye (2003) opined that learning is a change in human behaviour or disposition arising from experience which persists over a period of time and which is not simply ascribable to processes of growth. Learning was described by, Mbakwem (2001) as a sum of the changes, which occur in an individual stemming from his responses to representative stimuli, past or present based on interaction. Learning may therefore, leads to attitude formation, perception, preferences and interests.

The statement of learning outcomes at any educational system clarifies for all stakeholders the knowledge, skills and abilities a student must possess to successfully complete an educational level and earn a certificate from the educational system. Learning outcomes is the comprehensive and systematic process of assessing students' levels of learning. It went further to say that learning outcomes identify the specific knowledge, information, competencies students had achieved during the process of teaching and learning. McGraw, Piper, Banks and Evans (1992) opined that learning outcomes is the development of a positive relationship with learning, positive self-concept and a sense of self-discipline, self-worth and the development of life skills to become a productive and confident adult. Moore, (2007), opined that students learning outcomes as a convenient measures of schools' performance.

The performance of students in pubic examinations such as West African Examination Council (WAEC), General Certificate of Education (GCE), National Examination Council (NECO) and Joint Admission Matriculation Board (JAMB) has been a major concern to many researchers, parents and even the government. In a study carried

out on the performance of students in public examinations, Iluyemi (1986) remarked that education has not escaped from the socio-economic problems currently plaguing the Nigerian society and that the poor academic performance by students is an unfortunate outcome of the unhealthy social milieu.

Yusuf (2002) reported that the school variables contribute significantly to students' academic performance. Supporting Iluyemi (1986), Omotosho (1992), in reference to the fall in students' academic performance in public examinations, is tracing the causes to poor financial position of the educational sector, which has made the funding of the system inadequate. This situation has placed a greater burden on the Parents Teacher Association, which now paddle the canoe of most capital projects that is going on in the secondary school system. Adeyemi (1994) observed that with the introduction of structural adjustment programmes, cost of textbooks and stationeries has risen. Many parents found it difficult to purchase textbooks for their children. This should equally affect the performance of students negatively. Moreover, Adeyemi (2000), Adeyegbe (2002), Oderinde (2003), Onipede (2003) and Adeyemi (2003) in their different studies found out that there was a low success rate, among secondary schools students in SSC examinations and gave reason why many candidates find it difficult to pass their examination which include: the teaching of candidates by professionally unqualified teachers as well as uncondusive teaching and learning environment.

In a study conducted by EPA (2000), and Kennedy (2001) it was reported that the planning of school plants affects the performance of students. Oyinloye (2003) in his own study confirmed the earlier views of Obemeata (1995), Iluyemi (1986) and Omotoso (1992) and asserted that the causes of poor academic performance was due to young age of students, the parents, the government, the school and the students themselves while Yusuf (2003) is of the opinion that the low performance of student could be attributed to low parental educational background, lack of facilities in schools, poor supervision of teachers; poor finance and laziness of students.

Lamenting on the low pace of educational development in the country, Omolayole (2002) asserted that poor funding of the sector, bad remuneration for teachers, over congestion of classrooms and poor planning of school plants contribute greatly to the poor academic performance of students in public examinations among secondary school students

Research findings on the school type and students' learning outcomes are conflicting. Carpenter and Hayden (1985) stressed that; the question of whether the type of school attended affects the learning outcomes of young people is one of continuing debate both overseas and developing

countries. Keeves (1978), for example has demonstrated that type of school, government, Catholic and other independent did not make a contribution to the learning outcomes of a sample of Australian adolescents, independently of the influence of their home backgrounds. William *et al* (1980) in another study of Australian seventeen years old has revealed that other things being equal:

*Students attending Catholic or other independent schools had higher levels of achievement in both literacy and numeracy tests than students from government schools.*

Supporting this, Henry (2000) in his study found out that school type significantly influence learning outcomes of students. He went further to say that the learning outcomes of the students in private schools is better compared with their counterparts in government colleges. Yusuf (2001) found out in his study that school type had no significant influence on students' learning outcomes.

Carpenter and Western (1985) in their study reveal that:

- i. School type affects boy's success, Catholic and Government school students, but especially the former, are much likely to do well than their independent peers;
- ii. Catholic and Government school boys are more likely than their private school peers to display a high level of academic achievement at the completion of high schools;
- iii. Among girls, independent school students were found to have better school result than girls who attended other types of schools;
- iv. Types of school and interests in studies both help determine girls' final high school results. Compared with girls attending independent schools girls at Catholic high school suffer a disadvantage of some 60+ points in their rescaled aggregate achievement score;
- v. There are definite advantages for senior girls in term of learning outcomes if they have attended independent schools, been keen about their school work and have come from home where the father holds a high prestige job and is well educated.

However, Keeves (1978) and Yusuf (2001) in there are different studies acceded that school type did not make a contribution to academic achievement while William *et al* (1980), Carpenter and Western (1985) and Ajayi (1999) found out that school type makes a difference in students' learning outcomes. In view of the conflicting findings of these studies, this study will find out whether students' learning outcomes can be influenced by school type (private and public).

The difference between the educational achievement of urban and rural students is so important that in 1974, UNESCO declared that with all due regard to the principle that schools should be adapted to their

environment, the education provided in rural areas should be equivalent to, if not identified with, that provided throughout the rest of the country. The implication of this is that there need not be any significant difference between the achievement of pupils located in urban areas and of students located in rural areas.

Writing on the influence of school location on learning outcomes of students, Obe (1984) observed a significant difference in rural-urban performance of 480 primary six-school finalists on the aptitude sub-test of the National Common Entrance Examinations (NCEE) into secondary schools. He concluded that children from urban schools were superior to their rural counterparts. Obemeata (1976) and Owoeye (2000) hold similar view with Obe that there was a significant difference between learning outcomes of students in rural and urban areas in public examinations. Kemjika (1989) in his studies on urban and rural differences in creative talents among primary schools in Lagos State observed that their results generally showed that location of the community in which the school is sited has effect on the performance of students. Giving credence to the above views, Ajayi (1988) found significant difference in learning outcomes of students in urban and rural areas. He concluded that achievement must have been borne out of many facilities which the urban areas were used to which were not available in the rural set-up. Omisade (1985) also observed a significant positive relationship between size and location of school and performance in examinations in Oyo State. He concluded that large schools in urban areas tend to perform better in examinations than small school in rural areas.

Ajayi and Ogunyemi (1990) in their study on the relationship between instruction resources and students' learning outcomes in selected secondary schools in Ogun State found out that there was no significant difference between learning outcomes of students in urban and rural schools. Also, in his study Ajayi (1999) found out that there was no significant difference between students' academic achievement of rural and urban secondary schools. Yusuf (2001) revealed that school location did not significantly influence students' learning outcomes.

In view of the contradictory findings, the literature on the influence school type and school location on students' learning outcomes in South-West Nigerian secondary schools.

### **Statement of the Problem**

The poor students' learning outcomes could be attributed to several factors such as poor finance, poor motivation of teachers, lack of parental involvement in decision-making process in the school system, poor leadership style, high student-teacher ratio and poor school plants. Most observers of this situation such as parents, government and philanthropists and the society at large perhaps believe that the poor

students' learning outcomes might not be unconnected with the state of school plants in secondary schools in southwest Nigeria. In view of the contradictory findings, the research focuses on the influence school type and school location on students' learning outcomes in South-West Nigerian secondary schools.

### **Research Hypotheses**

On the basis of the problems raised in this study, the following null hypotheses were raised:

Ho1. There is no significant difference in students' learning outcomes between rural and urban areas.

Ho2. There is no significant difference in school plants between private and public schools

### **Methodology**

The research design for this study is a descriptive research of the survey type. Descriptive research is a systematic investigation into the existing variables in an attempt to solve a given problem. It also involves collection of data for the purpose of describing existing situation. The research is descriptive, as the study describes the existing situations regarding school plants and students' learning outcomes in South West Nigerian secondary schools without the manipulation of variables.

A survey research studies large population to discover the relative incidents, distribution and interrelationship of existing variables. This research conforms to the characteristics of the survey research described above. Therefore, the survey research provides appropriate conceptual and methodology design for investigating the problems of this study.

### **Population**

The population of this study consists of principals and students of all the secondary schools in the South West Nigeria. South West Nigeria consists of six states namely, Ekiti, Lagos, Ogun, Ondo, Osun and Oyo states. As at the time of the study, there were 247 secondary schools in Ekiti State. Ondo State had a total number of 361 secondary schools, Oyo had 589 secondary schools, Osun had 492 secondary schools, Ogun had 392 secondary schools while Lagos had 6,163 secondary schools. The schools are located in rural and urban areas.

### **Sample and Sampling Techniques**

The sample for this study was 1650 respondents, comprising of 150 principals and 1500 students selected from 150 secondary schools.

Multistage sampling techniques were used to determine the state, the school, (the principals) and the student to be used for the study. The first stage was a simple random selection of 3 states out of 6 states in South West Nigeria. The states randomly selected are: Ekiti, Ondo and Osun states. The second stage involved the use of stratified random sampling technique to select schools based on rural/ urban and private/public stratum. A proportional stratified sampling technique was used to

determine the number of schools selected from each state based on and private/public stratum. A simple random sampling technique was used in each school to select 10 students who are to responding to the second instruments used in the study. Senior secondary school students class one were purposively sampled for the study to enable the researcher make use of their Junior WAEC results for the academic performance aspect of the instrument.

### **Research Instrument**

Data for this study were gathered through the use of two sets of instruments. The first instrument was a Questionnaire on School plants (QSP) and had eight sections A-H. Section A was for background information of the school such as name of school, type of school and local government area. Section B consisted of items to indicate the academic performance (cognitive) of students and their enrolment in the school system. Section C consisted of items on school site, section D consisted of items designed to measure the instructional space while section E elicited information on administrative space. Section F was designed to elicit information on space of conveniences section G had items on circulation space and section H elicited information on water and lighting facilities in the school system.

Moreover, the second instrument was Affective and Psychomotor Domain Questionnaire (APDQ). The instrument was of two sections A and B. Section A elicits information on the name of the school, school type, school location and local government area. Section B was designed to elicit information on affective and psychomotor achievement (learning) of the students.

### **Validity of the Instrument**

The instruments for the study (QSP and APDQ) were subjected to screening by the researcher supervisor and other specialists in the area of Test and Measurement, Educational Planning and Economics of Education both within and outside the University. For face validity, the experts determine at face level the appropriateness of the instruments in measuring what its purports to measure to ensure that the instruments contains the appropriate items that can actually elicit the intended responses on school plants and students' learning outcomes in cognitive, affective and psychomotor domains. However, the experts reviewed the items in terms of the clarity to ensure that all words that could confuse respondents or research assistants were removed.

Expert judgments were also used to determine the content validity. Moreover, the experts took time to check the extent to which the items of the instruments were representative of the content and behaviour and suitability specified by the theoretical concept being measured. Furthermore, the general questions, hypotheses and the instruments were made available to the experts who confirmed that the instruments were



valid.

**Reliability of the Instrument**

Reliability of the instrument is a measure of its consistency in measuring what it is expected to measure. The reliability of the instruments was established through a test-retest method. This involved the administration of instruments in Oyo state secondary schools. Ten schools and one hundred students were used and were not included in the sample. The instruments were administered on them twice within an interval of two weeks. The scores from the two sets of responses were correlated using Pearson Product Moment Correlation coefficient to determine the reliability coefficients. This was done for sections C to H of School plants Questionnaire and Affective and Psychomotor Domain Questionnaire. The reliability coefficient for each section was as follows: section C (0.85), section D (0.82), section E (0.72), section F (0.85), section G (0.74) and section H (0.87) for School plants instrument. The Affective and Psychomotor Domain instrument had a reliability coefficient of 0.77. These were considered high enough for reliability.

**Administration of the Instrument**

The data for the study were collected by the researcher with the help of research assistants. The researcher trained the research assistants used in the administration of the instruments. During the personal contact with respondents, the researcher explained the various terminologies of school plants and the concept of students’ learning outcomes to the students for them to be able to respond appropriately to the instruments. All the instruments were properly filled and returned.

**Data Analysis**

Data collected for the study were analyzed using inferential statistics of multiple regression, step-wise regression, F-Ratio, Pearson Moment Correlation and t-test statistics. All the hypotheses were tested at 0.05 level of significance.

**RESULTS**

**Hypothesis 1:** There is no significant difference in students’ learning outcomes between rural and urban areas.

This hypothesis was tested using the responses to items 2ii of section A and items 1-28 of section B of APDQ and items 5 of section B of QSP. The result was presented in table 11.

**Table 11:** t-test Analysis of Difference in Students’ Learning Outcomes between Rural and Urban areas

| School Location | N | Mean | Sd | Df | t-cal | t-crit |
|-----------------|---|------|----|----|-------|--------|
|                 |   |      |    |    |       |        |

|       |     |       |      |     |     |      |
|-------|-----|-------|------|-----|-----|------|
| Rural | 41  | 82.44 | 6.12 | 148 | 0.2 | 1.96 |
| Urban | 109 | 82.68 | 6.52 |     |     |      |

$P > 0.05$

Table 11 shows the difference in students' learning outcomes between rural and urban areas. The result obtained from the analysis shows that the value of t-calculated value of 0.2 is less than the t-table value of 1.96 at 0.05 level of significance. Therefore, the null hypothesis is not rejected. This means there is no significant difference in students' learning outcomes in rural and urban areas.

**Hypothesis 2:** There is no significant difference in students' learning outcomes between private and public schools.

This hypothesis was tested using the responses to item 2 of section A and items 1-28 of section B for APDQ and item 5 of section B of QSP. The result was presented in table 13.

**Table 13:** t-test Analysis of difference in Students' Learning Outcomes between Private and Public Schools

| School Type | N   | Mean  | Sd   | Df  | t-cal | t-crit |
|-------------|-----|-------|------|-----|-------|--------|
| Public      | 119 | 82.06 | 6.60 | 148 | 2.11  | 1.96   |
| Private     | 31  | 84.75 | 5.22 |     |       |        |

$P < 0.05$

Table 13 reveals the difference in students' learning outcomes in private and public secondary schools. The result obtained from the analysis reveals the value of t-calculated (2.11) is greater than the t-table (1.96) at 0.05 level of significance. However, the null hypothesis is rejected. This means there is a significant difference in students' learning outcomes between private and public secondary schools. The mean score for both private and public schools on students' learning outcomes showed that the mean score of private schools 84.75 is greater than the mean score of public schools 82.06. This showed that there is significant difference in students' learning outcomes between private and public secondary schools.

### Discussion

It was found out in the study that there was no significant difference in students' learning outcomes between rural and urban schools. The study implies that whether a students attend schools in rural or urban areas, does not make a difference in their learning outcomes. It could be expected that learning outcomes would be better in urban areas when

compared with rural areas on the basis of students' learning outcomes, but the study has proved otherwise. However, the reason for no difference between rural and urban areas in terms of learning outcomes might not be unconnected with the fact that the teachers are more alive to their responsibilities in teaching and give moral instructions to the students. The finding of this study contradicts that of Obe (1984), Obemeata (1976), Kemjika (1989) and Ajayi (1988). The study supports that of Ajayi and Ogunyemi (1990).

The study further revealed that there was significant difference in students' learning outcomes between private and public schools. The mean score of private schools is greater than that of public secondary schools. This showed that private secondary schools had better students' learning outcomes than public secondary schools. The reason for this might not be unconnected with thorough supervision of teachers and students in private schools by their school proprietors and low students teacher ratio. The finding of this study contradicts that of Carpenter and Hayden (1985), Keeves (1978) and Yusuf (2001). The study supports that of Williams et al (1980), Carpenter and Western (1984) and Ajayi (1999).

### **Recommendations**

Based on the findings of this study, the following recommendations were made:

1. In view of the fact that the levels of relationship between private and public schools and their students' learning outcomes were relatively high, the stakeholders should not relent in their effort in sustaining students' learning outcomes within the private and public schools. The Governments should continue to encourage the support of Parent Teacher Association, Philanthropist and the society in improving the private and public schools and students' learning outcomes.
2. In view of the fact that there was no difference between rural and urban areas and students' learning outcomes the parents should not discriminate between these schools in enrolling their wards in their desire for better students' learning outcomes.

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## THE DYNAMICS OF EMOTIONAL DEVELOPMENT AT PRESCHOOL CHILDREN

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**Abstract:** *The article "The Dynamics of Emotional Development at Preschool Children" presents, selectively, various scientific approaches related to the concept of "emotions" in general and, specifically, during the preschool period. It reviews some contemporary debates concerning the content characteristics of emotional development dynamics and the functional nature of emotions in preschool children. Exploring scientific approaches to the concept of "emotions" in psychopedagogy, in search of its practical essence, generates a perspective that encompasses as much of the relevant field as possible and determines the basis for emotional development in children. As a result, criteria for evaluating emotions were identified and examined: perception, understanding, recognition of emotional states, and social emotions. Analyzing the issue at hand is not intended to be polemical but aims to demonstrate why it is necessary to revisit this topic, which is not actually new.*

**Key words:** *emotion; emotional state; emotional regulation; intellectualization of emotions; emotional state; perception of emotions; understanding emotions; recognition of emotional states.*

### Introduction

*Emotions*, as a valuable source of information, have become a key reference point in analyzing a child's success. They are relevant and significant because they influence decision-making, boundary-setting, communication, and more. When shaping our decisions and actions, *emotions and feelings* matter equally—sometimes *even more than thoughts*. In this regard, an increasing number of researchers argue that understanding emotions greatly enhances social integration possibilities, thus ensuring the quality of a child's activities. According to D. Wechsler, an individual's adaptation to their living environment is achieved through both intellectual and non-intellectual elements, which include affective, personal, and social factors, and are essential for

success in life [Apud 14, p. 139].

Thus, the issue at hand addresses the *demands* of early education policies, especially since the process of emotional development in preschool children is forward-looking, fostering both immediate and long-term favorable growth.

In the context of new orientations in preschool education, the *development of emotions* at children complements the dimensions of preschool education from the perspective of the requirements outlined in the *Standards for Learning and Development of Children from Birth to 7 Years*. These standards specify that preschoolers should be able to perceive themselves positively as unique individuals with specific characteristics; adapt their feelings and control impulsive tendencies; recognize and appropriately express a variety of emotions; interact positively with children in their immediate environment; and demonstrate empathy, among other skills [3; 16]. In this context, it is crucial to emphasize that the preschool age represents a particularly favorable period for emotional development in children, which is reflected both in mandatory activities and in their daily experiences.

### **Concept and Methodology**

Reviewing the main paradigms, considerations, and opinions that have entered the sphere of psychology and pedagogy (such as G. W. Allport, D. Goleman, P. J. Lang, R. Vrsti, M. Arnold, P. Popescu-Neveanu, L. S. Vygotsky, S. L. Rubinstein, etc.), various approaches to the concept of "emotion" are evident. Emotion is defined as a short-lived affective state that reflects a particular quality of the relationship with an object or situation, thus having a situational character, and can be triggered by a real or imagined circumstance. The intensity of emotions can vary greatly: it may be vague, moderate, or very intense, shaking the entire organism [5, p. 56]. In the same context, it is noted that emotion refers to a feeling and the thoughts it engenders, to psychological and biological states, and to the extent to which we are inclined to act [6].

In this line of thought, it is also important to mention that *emotion* serves as a signal indicating the need for an adaptive response, guiding the subject within their natural and social environment. On the other hand, emotion provides the individual with information about the correlation between the immediate context and the anticipated goals. Simultaneously, emotions prepare immediate responses to important stimuli and the necessary physiological support [19]. This definition leads us to observe that *emotions* facilitate optimal decision-making, favoring important decisions and accelerating the individual's decision-making process. Additionally, emotions regulate social interactions, emotional expressions, and communicate a person's internal state to others.

On the same analytical line, emotion is also defined as a fundamental affective phenomenon that develops either as a *spontaneous and primary reaction*, in the form of primary emotions or affects, or as more complex processes related to secondary motivations that reflect the true emotions. In higher values, emotions are extremely varied and differentiated. As a result, we distinguish between emotions such as joy and sadness, love and hate, admiration and contempt, sympathy and antipathy, satisfaction and dissatisfaction, etc. [12]. In this regard, W. Gerrod notes that emotions are reactions to significant events for an individual. Here, the author refers to physiological, behavioral, cognitive reactions, and subjective experiences of pleasure or displeasure [Apud 1, p. 255].

To differentiate and manage emotions correctly, people associate them in contrasting pairs, such as joy-sadness, anger-relaxation, admiration-contempt, sympathy-antipathy. This leads to the classic division of emotions into: *sthenic emotions*, which enhance activity, increase the individual's strength and energy, and *asthenic emotions*, which diminish energy and activity. This polarity results from the correspondence, or discordance, between the individual's needs, beliefs, habits, and life situations or events [7, p. 40].

From the above, it follows that emotion depends not only on the nature of the emotional agent but also, more importantly, on the *individual*, their current *physical and psychological* state, their personality, and their past experiences. Therefore, *emotion* remains essentially *individual*; it generally manifests when the subject is surprised or when the situation exceeds their capabilities. Emotion reflects maladaptation and the organism's effort to restore the temporarily lost balance [Ibidem].

C. Rubinstein also discusses emotions, highlighting specific characteristics that distinguish them from other psychological processes and mental states. According to the author, these characteristics set emotions apart from perception (which reflects the content of the object). First, *emotions represent an expression of the subject's state and their relationship with the object*. This feature differentiates emotions from perception. Second, *emotions are characterized by polarity*, meaning they have either a positive or negative sign: pleasure versus displeasure, joy versus sadness, etc. However, Rubinstein notes that this polarity is not an immutable and oppositional characteristic [28, p. 571].

In this context, it is *relevant* to note that emotions are expressed through *expressive movements*. A specific emotional state corresponds to a particular *physiological reaction*. Nonetheless, an experiment by K. Herndon demonstrates that there is no direct link between *facial expressions and the experienced emotion* (such as disgust); thus, there is no absolute universality in facial expressions when experiencing an emotion [8, p. 642–663]



This perspective supports the idea that emotional experiences *correlate* with certain external *manifestations*. According to this approach, the manifestation of emotion is due to specific changes in the activity of internal organs and the motor sphere, meaning that emotion is considered an *external expression* of a physiological reaction to a significant event [9, pp. 211–221]. At the same time, W. Cannon holds a different view, stating that emotional and physiological reactions to any stimulus occur simultaneously. According to Cannon, *emotions* originate in *subcortical areas* [2, pp. 567–586].

Based on the results of the studies presented, it is evident that emotions are an integral part of human life and fulfill several important functions, including: shaping a person's attitude towards something, directing/regulating behavior, stimulating and suppressing human activity, and more.

At the same time, observing the dynamics of research in psychology, pedagogy, and physiology, we find that the development of emotions in preschool-aged children is addressed as one of the main characteristics of the child's psychological development. In this context, researchers argue that sensitive periods for the emergence of new emotional formations occur primarily during the preschool period. Furthermore, emotional structures retain their importance and value throughout all stages of the preschool period. Thus, emotions constitute an important dimension of the child's personality, a regulator of the most crucial functions of their life. From this perspective, the preschool age represents a critical period for the development of emotions in children; a stage of essential emotional acquisitions; emotions accompany all manifestations of the child's activity, exerting a strong influence on their behavior. Nevertheless, there is no consensus on several questions, such as emotional behavior manifestations, key directions, and significant particularities of emotional development in preschool-aged children, etc. In this regard, the basic coordinates of emotions in preschool children, as discovered in the works of researchers like M. Lewis, M. Sullivan, C. Stanger, M. Weiss, S. Tomkins, C. Saarni, R. Thompson, N. Eisenberg, A. Morris, V. Pavelcu, M. Roco, A. Leontiev, L. Vygotsky, G. Kravtsov, E. Kravtsova, Yu. A. Lapteva, etc., are of interest.

Given the complexity of this issue, some researchers examine various types of *emotional perception* by children, such as *preverbal, diffuse-amorphous, diffuse-local, analytical, synthetic, and analytical-synthetic*. From this perspective, the type of perception is determined not only by the child's age, although this is the most evident factor. Differences between types of emotional perception are determined to some extent by the nature of the emotion. For example, recognizing the emotion of *fear* by a child pertains to *preverbal perception*; *emotions of joy and sadness* are characteristic of *diffuse-amorphous perception* and manifest in

children aged 4-5 years, whereas *analytical-synthetic perception* is observed at the age of 6-7 years. On the other hand, the *perception of anger is diffuse-local*, becoming dominant in children aged 4-5 years, while *analytical* perception of emotions becomes dominant in children aged 6-7 years. At the same time, emotional states in the perception process are detected in children across all age groups, particularly when recognizing emotions like anger, fear, or sadness.

Concerned with the issue of the psychological development of preschoolers in ontogeny, L. Vygotsky notes that the basic characteristics of new formations during the crisis period (late preschool age) relate to “*generalization of emotions*” or “*intellectualization of emotions.*” In this sense, the author specifies the following: most emotions are intellectually mediated; there is a natural connection between the emotional process and the process of thinking; the development of emotions occurs alongside the development of thinking; emotions participate in regulating and motivating thinking. In other words, motivational and emotional regulation of thinking takes place. Thus, emotions are a component of children’s thinking.

Regarding the dynamics of emotional development in children, research provides certain considerations. Studies converge in defining three relative components of the emotional sphere: *cognitive, affective, and reactive*. At the same time, key invariants of emotional development at preschool age retain their meaning and remain unchanged in any social situation.

Some authors’ perspectives refer to the *interaction between emotional development, general psychological development of the child, and the structures of individual psychological development* (e.g., *self-awareness, motivation, and cognitive development of the child*). In this framework, S. Tomkins highlights the need for *sequential differentiation* of emotional states and the child’s *recognition* of emotional states. Both relational and communicative efficiency depend on whether participants (children) can understand another person’s emotional state and regulate their own emotions in relation to an adult or peer. Thus, the premises for emotional regulation, in accordance with establishing the connection between feelings and representations, condition the inclusion of “words” in the emotional process, which creates the basis for verbal regulation of behavior, guiding the child’s actions towards a specific goal.

In the same vein, R. A. Thompson develops the idea that *emotional regulation* is given by *intrinsic* and *extrinsic* processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensity and duration, through which an individual seeks to achieve their goal. From this perspective, the author also examines neurophysiological reactions in emotional regulation, such as: (a) attention processes; (b) encoding internal emotional signals; (c)

accessing “*coping*” resources; (d) regulating environmental demands; (e) choosing alternative emotional reactions, etc. The author also provides an acceptable explanation regarding the specificity and role of self-control, which, according to him, is part of emotional regulation, although regulation involves more than just inhibition (e.g., includes the ability to initiate behavior, shift attention, and plan actions). Adaptive regulation involves an optimal amount of self-control actions as well as the ability to initiate actions as needed. Therefore, regulation can be adaptive if self-control is adaptable or maladaptive, depending on the ability to voluntarily manage it.

Moreover, as the child learns to relate in the social environment, they also learn some self-control techniques, which evidently manifest in their expressive behavior and in the regulation of behavior during communication. In this sense, self-control in the development of emotions provides the child with certain forms of response, evidently determined by the social environment. From this perspective, even in the preschool period, the child begins to understand that adults may mask (negative) emotions (e.g., fear, anger), often using non-verbal techniques, such as a smile, to express opposite emotions.

Nevertheless, emotional regulation in preschool-aged children is most often achieved through the involvement of adults. With age, children accumulate experience in managing and manifesting emotions. Both management and manifestation are part of a broader process of emotional regulation, although distinctions between them are fundamental for understanding self-regulation. However, in cases where a child (or an adult) requests external intervention, the process of emotional regulation can be considered as part of external regulation as well as self-regulation.

According to other sources, the emergence of new interests and motives in children conditions their emotional development. On this basis, social emotions begin to develop intensively, thus eliminating the situational character of the emergence of emotions, making them deeper in content. As a result, the child starts to anticipate emotions in relation to a potential situation.

In light of the above reflections, other authors approach emotions through the lens of the *connection* between the *emotional framework and the cognitive framework*, with speech and psychological processes ensuring this connection. In this sense, the use of words, on the one hand, marks emotions, indicating intellectualization, awareness, and generalization of them, while, on the other hand, children use speech to manage their emotional state. It is also noteworthy that attempts by the child to regulate emotions appear already in the fourth year of life (e.g., the child makes an effort not to cry), but by late preschool age, the child actively uses words to manage emotions.

In the same area of ideas, we can also mention the findings of researchers who approach emotions in correlation with imagination, conditioning each other reciprocally. According to one author, an emotion is embodied in an image. For example, when confronted with the fear of something, a child may draw images of the consequences of threats posed by potential or real danger. In other words, an image created as a result of imagination can generate fear in the child.

In this realm of concerns, some authors' findings also address the significance of imagination at preschool age in a slightly different context. For the child, the special internal position represents the main component of imagination, making it possible to realize the structural components of imagination both in the objective environment and in the child's prior conscious experience. Furthermore, the internal supra-situational position allows the child to control their own imagination.

Therefore, preschool-aged children not only can feel but also can understand various emotional states. The levels of emotional awareness by children, understanding of other people's emotions vary: inadequate, situation-specific, verbal designation and description of expression, understanding in the form of description, and understanding in the form of interpretation and manifestation. Also, recognizing another person's emotional state is impossible without the ability to understand expressive signs of emotion.

Based on the arguments outlined above, despite their conceptual diversity, it must be noted that significant changes in indicators of *perception*, *understanding* (recognition), and *verbalization* of emotions by children occur between the ages of 4-7 years, and the age of 3-4 years can rightly be considered as preparatory, associated with the child's accumulation of emotional experience.

The examination of the child's ability to anticipate emotions, which arises in a context of new emotional formations and provides the child with the ability to anticipate the consequences of their actions and deeds, is also part of the analysis of emotional development. Thus, anticipating emotions (which emerges at the age of 4) becomes a mechanism of emotional regulation for the child, due to personal formations.

- Emergence of understanding of personal re-experiences: This correlates with affective and cognitive processes [22, pp. 5–25].
- Subordination of motives: This allows the child to overcome desires and transition to moral regulation characterized by “it is necessary” and “must” [27].
- Assimilation of prosocial behavior norms: The child learns the moral meaning of actions based on intellectual assessment of emotional attitudes towards themselves [34, pp. 127–134].
- Expansion of object content of needs and emotions: This includes the emergence of new feelings and forms of

motivational orientation in the child’s activities [29].

In summary, it is also noted that during late preschool age, significant transformations occur in social emotions, and the *anticipation of emotions* is examined as a crucial mechanism for socio-emotional development [13]. A prominent characteristic at this age is the dominance of their conduct by affective behavior, which serves as the energetic basis for the entire psychological system [11, p. 102]. Following the dynamics of research related to the specifics of emotional manifestations at preschool age, the most significant changes in the *emotional sphere* for children aged 6-7 years can be structured as follows:

- Increased capacity to understand complex emotions: such as *pride and shame*.
- Internalization and integration of these *emotions*: giving meaning to personal responsibilities.
- Increased ability to understand *emotions* experienced in specific situations.
- Tendency to judge the *emotional reactions* of others: especially adults, based on events.
- Progress in *suppressing* or *concealing* negative emotional reactions.

Regarding the evaluation of emotions in preschool-aged children, research provides certain considerations. From this perspective, some authors advocate for promoting specific criteria and indicators (Table 1) [26, pp. 84-88].

**Table 1. Criteria/Indicators for Evaluating Emotions in Preschool-Aged Children**

| Nr. | Criteria                                 | Indicators  |
|-----|--|---|
| 1.  | Perception and understanding of emotions | <ul style="list-style-type: none"> <li>• adequate orientation in perceived situations</li> <li>• ways of expressing emotions;</li> <li>• understanding and recognition of emotional states;</li> <li>• degree of response expression and verbal designation of emotion;</li> <li>• adequacy of actions in relation to emotional states</li> </ul> |
| 2.  | Development of emotional decentration    | <ul style="list-style-type: none"> <li>• the ability to identify oneself in relation to others.</li> </ul>  |

|    |                              |   |
|----|------------------------------|---|
| 3. | Formation of social emotions | <ul style="list-style-type: none"> <li>• the level of social mediation of emotions</li> <li>• the presence of prosocial motivation and the expansion of the content of basic needs</li> <li>• the level of situational anxiety</li> </ul> |
|----|------------------------------|---|

The synthesis of theoretical approaches has allowed us to outline the dynamics of emotional development in preschool children and to track how children's emotions evolve from one age period to another. In this regard, each age segment is characterized by specific possibilities that determine the content and manifestation of their emotional states, as presented in the table below.

**Table 2. Emotional development of preschool children**

| Criteria                               | Age  |   |  |  |   |
|--|--|---|--|--|---|
|  | 3-4 years  | 4 years   | 5 years  | 6 years  | 6-7 years   |
| Development of emotional understanding | Understands the specifics of certain emotions  | Understands the specifics of certain emotions   | Differentiates and identifies some emotional states  | Is able to show empathy  | Anticipates some emotional states   |
| Development of emotion regulation      | Perceives emotional states and means of expression; primary orientation to the emotional meaning of the situation (percept | Understands and recognizes verbal expressions of 3-4 basic emotions (cognitive component) | Orients within an emotional experience, evaluates actions relative to the appropriate emotional state (reflective component) | Shows active empathy, offers assistance to peers, identifies with others (behavioral component of empathy) | Exhibits prosocial motivation, understands the moral meaning of actions ("should," "ought to"), anticipates the consequences of emotional |

|  | ual<br>compon<br>ent)  |  | nt)   |  | actions  |
|--|--|--|---|--|--|
| Developm<br>ent of<br>social<br>emotions | Emotion<br>al and<br>cognitiv<br>e<br>compon<br>ents of<br>empathy.<br>Expansi<br>on of<br>needs<br>contents | Emotion<br>al and<br>cognitive<br>compon<br>ents of<br>empathy.<br>Emotion<br>al<br>decentrat<br>ion.<br>Expansio<br>n of<br>needs<br>contents | Emotiona<br>l<br>decentrati<br>on. Social<br>mediation<br>of<br>emotional<br>states | Social<br>mediati<br>on of<br>emotion<br>al states | Social<br>mediation<br>of<br>emotional<br>states |

As a result, the criteria and indicators for evaluating emotions provide us with the opportunity to track the evolution of children's general emotional states during the preschool age. However, the indicators require operationalization, and the comprehensive emotional development of children necessitates the structuring of a psychological and pedagogical framework.

Based on the ideas presented, it should be noted that preschool-aged children are characterized by emotional variability, vividness, and impulsiveness in the expression of their emotions, which is gradually replaced by a more pronounced adaptability. All of these factors determine the key aspects of the teacher's role with children—fostering the emotional enrichment of the child's life and organizing support for understanding and regulating emotions. Thus, the development of emotions as a trait of the child's personality is an important pedagogical task. From this perspective, there is no doubt that the main factor influencing a child's emotional development is the environment. At the same time, the environment involves a way of organizing space and utilizing equipment for safety, the child's psychological well-being, and their development.

### Conclusions

Summarizing the ideas presented in this paper, we can highlight the following:

- The preschool age is a period of essential emotional acquisitions, where emotions accompany the child's activities and influence their behavior.

- Emotions are a core component of the child's overall personality development, driving success in communication with peers and adults, determining the appropriateness of reactions to life events, and influencing the child's adaptation to new living conditions.
- Emotions facilitate optimal decision-making, promote important decisions, expedite the individual's decision-making process, regulate social interactions, emotional expressions, and communicate the child's internal state to others.
- The preschool institution faces a highly relevant issue that must be addressed both theoretically and methodologically.

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## **EXPLORING CLIMATE CHANGE IMPACT ON TEACHERS' EFFICIENCY AND STUDENTS' LEARNING OPTIMISATION IN LAGOS NIGERIA**

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**Abstract:** *Amidst the myriad challenges that threaten Nigeria's educational system is the declining learning outcomes of students across schools in Nigeria. Identifying and mitigating the challenges and deploying global innovative best practices into Nigeria's educational system may provide the needed solution. Therefore, the impact of climate change (CC) on teachers' efficiency, educational resources and students' learning optimization in Lagos State was examined. A mixed research method, involving quantitative and qualitative methods, was adopted for the study. CC learning optimizations (CCLO) questionnaire was used as an instrument for data collection. Random sampling technique was used to select 480 respondents for the study. Frequency counts with percentages and a t-test*

*statistical analysis were used to analyses the data. Result showed that CC effects like heat waves, high rainfall and flooding can threaten teachers' classroom efficiency, and learning resources and thus negatively influence students' learning outcomes. Excessive heat due to global warming could affect students' comprehension and retention. Extreme temperature and rainfall experienced in early school year can cause few years of schooling later in life. There was no significant difference in perception of impact of CC on student learning optimization based on gender (t-test). It was concluded that CC affects teachers' efficiency, learning resources, and students' learning optimization. Addressing the problem of CC can support teachers' efficiency and improve students' learning outcomes.*

**Key words:** *Climate Change; Learning Optimization; Teachers' Efficacy; Lagos Schools; Learning Resources.*

## **Introduction**

Lagos is a mega city with myriad challenges ranging from climate change (CC) to environmental pollution which have consequential effects on quality of life and education. The quality of education in the state has been a topic of discussion in recent years in meetings and conferences, with concerns about the factors that lower students' academic performances. Efficiency of teachers is fundamental to student academic achievement in schools. Many factors may influence teachers' level of effectiveness such factors include stress level, classroom management and workload. The level of teachers' efficiency influences teaching content and classroom effectiveness. A careful analysis of teachers' efficiency through various criteria has identified factors that enhance students' achievement. These factors include effective communication, engagement and clarification of tasks. An effective teacher makes an efficient school and creates an ideal environment for students to learn. Newsome et al., (2023) claimed that CC may impact teachers' efficiency leading to learning losses for the students. It also threatens the achievement of learning objectives and teachers' ability to teach their students very well. CC challenges may cause natural disasters like floods, increased temperature/global warming and wildfires. These disasters may affect the teaching ability of teachers.

Sometimes, due to the effects of natural disasters caused by CC that may affect schooling, teachers often shift from physical schooling to virtual schooling. This may seem effective in a short time however, studies have shown that in the long run, the frequent shifting between the learning environment may affect students' learning and teachers' efficiency. Teachers may face disruption of instructional time and may find it

difficult to make up for learning loss (Newsome et al., 2023). Rainfall, flood and excessive heat have been found by scholars like Ortsa and Ndidiamaka (2021) to affect teachers' performance. CC may also have negative impact on student learning and academic achievement. It could cause climate-related disasters that may lead to learning losses, reduced instructional days, damage to learning resources and extended closure of school (Newsome et al., 2023). Scholars like Onwumere, et al (2022) have identified CC issues that affect students' learning in senior secondary schools in Southeast Nigeria. They identified increased temperature, heat waves and extreme weather events as climate factors that affect student learning. This disaster could lead to the destruction of learning facilities, poor ICT learning facilities, and displacement of students and their parents. Hussaini (2023) noted that flooding and other extreme weather conditions could lead to disruption of learning, schooling, and students' attendance at school.

Cases of respiratory health issues due to poor air quality have been reported by scholars in research. Amanchukwu et al., (2015) reported that learners' poor attendance at school during climate-related disasters may be due to poor health issues leading to a decline in academic performance. Climate-related disasters may damage school infrastructure and learning resources. Many cases of school closure have also been reported due to flooding that makes schools inaccessible for students to learn. They may experience reduced attention span, compromised health and poor learning comprehension.

CC impact may further escalate gender gaps in education limiting opportunities for girls and cause psychological stress. Amanchukwu et al., (2015) express their concern about how girls are kept at home to perform domestic chores during extreme weather events, while boys are allowed to go to school. It can have adverse effects on human health, including an increased incidence of diseases such as malaria and diarrhea. The health effects of CC may affect learners' ability to learn effectively; it may decrease learners' levels of concentration, reduce comprehension ability and increase absenteeism. Interventions like climate awareness and literacy can build climate resilience among learners.

The impact of CC on students' learning in Nigeria is an area that has received little attention in research. While studies have been carried out on the effects of CC on various sectors of the Nigerian economy, including agriculture and health, there are only a few studies on the CC's effects on education, particularly on students' learning outcomes. This makes the impact of CC on education, learning and teaching difficult to understand in Nigeria. Therefore, there is a need to conduct further research to explore the relationship between CC and students' learning outcomes in Lagos, as well as to develop effective strategies to halt the

negative effects of CC on teachers' efficiency and students learning optimisation. Therefore, this study examined the impact of CC on teachers' efficiency, learning resources and students' learning optimisation. Also, the study analysed gender differences in the perception of individuals on the CC effects on students' learning optimisation. To achieve the overstated objectives, the study answers the following research question: What is the impact of CC on teacher efficiency? Does CC have any influence on the availability of learning resources? How does CC influence students' learning optimisation? One hypothesis was tested at  $p < 0.005$  significance level that there is no gender difference in the perception of the CC effects on students' learning optimisation.

### **Materials and Methods**

**Research Design:** The study adopted the descriptive survey research design. A descriptive survey research design was employed to gather data on teachers' perceptions and experiences related to CC and its impact on their learners' efficiency and learning optimisation. Creswell and Creswell (2018) opined that survey research methods are efficient and cost-effective for collecting and handling from a large sample survey, allowing for a generalisation of findings.

**Study Area:** This study was conducted in Lagos Nigeria. Lagos is an urban state in southwest Nigeria with the fastest-growing population and economy. Lagos is blessed with a large number of businesses and industries including the educational sector. It is one of the most populated cities in Nigeria. However, the state is faced with many challenges that usually plague a growing megacity. Some challenges currently facing Lagosians include but are not limited to air pollution, waste management, environmental degradation, and CC impact. The city is highly vulnerable to the impact of CC due to its geographical location and population. Studying the CC impacts on students' learning outcomes in Lagos is important for several reasons. Lagos is also vulnerable to extreme weather events, such as flooding and storms, which could be intensified by the effects of climate change.

**Population of the study:** Lagos State has 6 education districts for easy supervision and general administration of the schools. All the teachers in the six education districts formed the population for this study.

**Sample and Sampling Technique:** To select sample for this study, a multi-stage stratified random sampling technique was adopted. This was done to ensure that the results of this study were not biased but a true representation of the population (Mertens & Gere, 2016). This approach ensures that the findings from the study can be confidently generalised to the broader teacher population within the state (Sandelowski, 2012). The first stage involved stratification. Lagos State has six distinct education districts. This stratification acknowledged the potential for

variations in educational practices, environment, learners' peculiarity, ethnic background, socio-economic status or teacher demographics across different administrative divisions of Lagos State (Babbie, 2010). By including teachers from each district, the sample reflects this diversity. The second stage involved random selection within each stratum. Sixteen schools were randomly chosen from each of the six education districts. This randomised selection minimises bias and ensures that each school within a district has an equal opportunity to be included in the study (Israel, 1992).

A sample size of sixteen schools per district allows for a good representation of the schools within each region. The final stage involved further random selection within each chosen school. Five teachers from 96 selected schools were selected using random sampling technique (16 schools/district x 6 districts). The process of random selection of respondents helped to minimize bias towards certain teachers. Following these sampling techniques, a total of 480 teachers were selected for the study (5 teachers per school of 96 schools) (Cohen et al., 2013).

**Research Instruments:** The CC Effects on Teachers and Students (CCTS) questionnaire was used as an instrument for data for data collection.

**Validity:** The instrument was validated through face, content and construct validity testing.

**Reliability:** The reliability and internal consistency of the subscales were determined using Cronbach's alpha coefficient test.

**Data Collection:** Data was collected from teachers through a questionnaire. Interviews were conducted with teachers to supplement survey information.

**Data Analysis:** Quantitative data were analysed using frequency count with percentages and t-test statistical tools.

**Ethical Consideration:** consent was obtained from teachers and the school before participation in the study. Anonymity and confidentiality of participants' responses were ensured. The study was conducted following ethical research guidelines established by the university and the Lagos State authority.

## Results

### Climate Change and Teachers Efficiency:

The respondents' perceived effect of CC on teachers' efficiency is presented in Table 1 below. The influence of natural disasters; flooding, increased temperature and high rainfall as perceived by the respondents shows that climate-related disasters affect teachers' ability in achievement of learning outcomes and overall effectiveness in the

classroom.

**Table 1: Effect of CC on Teachers' Efficiency**

| S/N | Effect of CC on the efficiency of a teacher   | Strongly agree | Agree | Disagree | Strongly Disagree |
|-----|---|----------------|-------|----------|-------------------|
|     |   | %              | %     | %        | %                 |
| 1   | Natural disasters such as flooding can threaten teachers' ability to produce the learning outcomes promised to students | 7.8            | 67.7  | 20.9     | 3.6               |
| 2   | Heat waves due to global warming can lower teachers' effectiveness in school  | 35.4           | 52.1  | 10.4     | 2.1               |
| 3.  | High rainfall can lower teachers' teaching ability  | 25.5           | 29.8  | 31.9     | 1.8               |
| 4.  | Excessive heat (high temperature) can affect teachers' level of practical wisdom in the classroom.                      | 42.3           | 30    | 23.4     | 4.3               |

The majority of the respondents (75.5%) strongly agreed and agreed that climate-related disasters (flooding) can affect teachers' ability to deliver promised learning outcomes to the learners. A significant majority (87.5%) of the respondents also acknowledged the impact of heat waves on teachers' ability to be efficient in their jobs. This factor appears to be the most concerning factor for the teachers. The responses were more evenly distributed regarding high rainfall. Slightly less than half (55.3%) agree or strongly agree that high rainfall impacts their teaching ability, indicating a mixed perception of its influence.

A substantial portion (72.3%, combining 'Strongly Agree' and 'Agree') of teachers believed excessive heat affects their practical wisdom in the classroom. This suggests a concern about how extreme heat can hinder their ability to make effective teaching decisions in real time. The table suggests that teachers are generally concerned about the impact of CC on their ability to teach effectively (Table 1).

**Impact of CC on Learning Resources**

The perceived effects of CC on learning resources in Lagos schools were determined through descriptive statistical analysis tools of frequency count with percentage and measure of central tendency (mean and standard deviation). (Table 2).



**Table 2. CC and Learning Resources**

| S/N |  | Strongly Agree | Agree | Disagree | Strongly Disagree |
|-----|--|----------------|-------|----------|-------------------|
|     |  | %              | %     | %        | %                 |
| 1   | CC can damage learning materials in schools  | 29.2           | 52    | 14.6     | 4.2               |
| 2   | The use of schools for emergency shelters during climate-related disasters like flooding prevents the continuation of education in the school setting. | 25.4           | 45.4  | 27.5     | 1.7               |
| 3   | Livelihood losses as a result of CC is a major hindrance to educational enrolment  | 40.6           | 53    | 2.1      | 4.3               |
| 4   | Climate-displaced learners do face similar educational problems as refugees.   | 40.5           | 51.1  | 4.2      | 4.2               |
| 5   | Flooding as a result of CC can make school buildings inaccessible to students for learning   | 52.8           | 43.7  | 1.3      | 2.2               |
| 6.  | The impact of CC can make schooling expensive  | 34.1           | 53.2  | 10.6     | 2.1               |
| 7.  | Flooding as a result of CC can make school buildings   | 46             | 47.8  | 4.2      | 2                 |

unsuitable for  
learning

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Flooding as a result of CC can make school buildings inaccessible for students to learn was perceived to be the major impact of CC on the school learning resources (93.8%) (Table 2). The second most perceived impact of CC on school resources was the impact of CC on losses of sources of livelihood which present a major barrier to educational enrolment (93.6%). The third perceived impact was that Climate-displaced learners do face similar educational problems as refugees who do not have access to school and school resources to learn (91.6%). This was followed by the impact of CC on the cost of school. 87.3 % of the respondents perceived that as a result of CC schooling became expensive (87.35%). The respondents perceived that CC directly destroys learning materials (81.2%). Also, 70.8% of the respondents perceived that using schools as emergency shelters during environmental disasters like flooding prevents the continuation of children's education (70.8%)

### **CC and Student Learning Optimisation**

Table 3 presents respondents' opinions regarding the impact of CC on students' learning optimisation.

**Table 3. CC and Students' Learning**

| S/N |  | <b>Strongly Agree</b> | <b>Agree</b> | <b>Disagree</b> | <b>Strongly Disagree</b> |
|-----|--|-----------------------|--------------|-----------------|--------------------------|
|     |  | %                     | %            | %               | %                        |
| 1.  | The impact of CC can increase the rate at which students dropping out of school                          | 34.1                  | 53.2         | 10.6            | 2.1                      |
| 2.  | Excessive heat can cause student comprehension ability to decline  | 45.8                  | 48           | 2.1             | 4.1                      |
| 3.  | poor attendance at school later in life can be attributed to previous exposure to extreme temperature or | 10.4                  | 29           | 48.1            | 12.5                     |

|    |  |      |    |      |     |
|----|--|------|----|------|-----|
|    | rainfall in early life   |      |    |      |     |
| 4. | CC effects like excessive heat in the classroom and flooding can lower students' performance in school | 20.2 | 62 | 17.8 | 0   |
| 5. | Excessive heat in the classroom can cause students' retention to decline                               | 45.8 | 48 | 2.1  | 4.1 |

Respondents perceived the decline in comprehension ability of students as the major impact of CC on students (70%). This was followed closely by students' ability to retain what was learnt in class (94%) while the increase in the rate at which students are dropping out of school was rated third (85%). However, respondents considered the statement that poor attendance at school later in life can be attributed to previous exposure to extreme temperature or rainfall in early life has the lowest impact of CC on students (38%) (Table 3).

### Research Hypothesis

**Ho1. No significant difference in the perception of male and female respondents about the impact of CC on student learning optimisation.**

The outcome of the study is displayed in Tables 4 and 5

The findings in Tables 4 and 5 revealed no significant difference in the perception of male and female respondents about the impact of CC on students learning optimisation ( $p > 0.05$ ) (t-test). Therefore, the hypothesis was not rejected.

Table 4: Descriptive Statistics

|        | Mean   | Std. Deviation | N   |
|--------|--------|----------------|-----|
| Female | 3.1341 | 0.46369        | 241 |
| Male   | 3.1336 | 0.46502        | 239 |

Table 5: Gender Perception of CC Impact on Student Learning Optimisation

|                             | Levene's Test for Equality of Variances |       | t-test for Equality of Means |         |                 |                 |                       |
|-----------------------------|---|-------|------------------------------|---------|-----------------|-----------------|-----------------------|
|                             | F                                       | Sig.  | t                            | df      | Sig. (2-tailed) | Mean Difference | Std. Error Difference |
| Equal variances assumed     | 0.004                                   | 0.951 | 0.011                        | 478     | 0.991           | 0.00047         | 0.04239               |
| Equal variances not assumed |   |       | 0.011                        | 477.940 | 0.991           | 0.00047         | 0.04239               |

### Discussion of Findings

According to this study, CC has a direct impact on schools and learning materials and can prevent the continuation of education especially when schools are used as emergency shelters during environmental disasters like flooding. Furthermore, CC does not only impact the environment, but it can also affect the educational systems, from school closure, and curriculum changes to increased disruption in school buildings and properties (Hussaini, 2023). The consequences of climate change, such as flooding and extreme heat waves, pose risks not only to students' learning optimizations but also to learning resources. The consequences of climate-related disasters such as flooding and increased temperature or excessive heat can lead to curriculum changes and disruption of the smooth running of the school and affect students' learning and academic achievement. This result aligns with the findings of (Hussaini, 2023; Hall et al., 2023).

The result of this study also shows that CC significantly impacts teachers' efficiency in various ways. Natural disasters such as flooding can threaten teachers' ability to produce the learning outcomes promised to students while excessive heat due to global warming can affect teachers' level of practical wisdom in the classroom. This result aligns with the findings of Sharitt et al., (2023) and Newsome, et al., (2023). CC effects like excessive heat, high rainfall, and flooding were perceived to lower students' performance in school. CC may have far-reaching implications for student learning. CC may result in a lack of access to resources, and classrooms due to flooding. Many students are

worried about CC impact on them and their future careers. This fear of the unknown CC impact may reduce students' motivation to learn. Sometimes students may be afraid and not be sure whether another rain will fall in the morning of the next school day which may prevent them from going to school. This result was consistent with the findings of Hussaini, (2023).

Flooding due to CC can also make school buildings inaccessible and unsuitable for learning, and heat can reduce comprehension and retention, affecting the quality of education. Furthermore, the impact of CC can make schooling expensive and increase dropout rates. Climate-related disasters like sea level rise, increased temperature, flooding and global warming become more intense. The increase in temperature can lead to climate-related disasters such as high rainfall, flooding, and sea level rise. All these have direct and indirect effect on education. These results agree with Ortsa & Ndidiamaka, (2021) and Hussaini, et al., (2023).

### **Conclusion**

Following the findings of this study, it can be concluded that CC could significantly affect Lagos State teachers' efficiency, school learning resources and students' learning optimizations. Respondents perceived flooding as the most significant climate factor that affects teachers' efficiency and school learning resources in Lagos State. Moreover, respondents considered the decline in students' comprehension ability and retention of what was learnt in class as the major impact of CC on students. Following the t-test analysis, the hypothesis set was accepted. This implies that there was no significant difference in the perception of respondents based on gender on the impact of CC on students learning optimizations in Lagos State Nigeria.

### **Recommendations based on the Findings of the study**

Based on the findings of this study, it is recommended that

1. CC education should be integrated into the school curriculum
2. challenges of CC impact on teachers, learning resources and students' learning optimizations should be addressed.
3. teachers should be equipped with the needed skills and resources to adapt to climate change.
4. government agencies, parastatals and stakeholders in education should provide a framework for CC mitigation and adaptation in Lagos State and Nigeria as a country.
5. government should refrain from using school facilities as shelters for people displaced by climate hazards and victims of other disasters.

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## SPECIAL EDUCATORS ALS BRICOLEUR

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**Abstract:** *The purpose of this article is to investigate how special educators adapt to the diverse issue of children with disabilities. The concept of bricolage has been used to explain the ways in which teachers provide individualized support to these children with special needs. Using the key elements of bricolage: action, using available resources, combining resources, we have described the professional practices of special educators. Data for analysis come from semi-structured interviews with 16 teachers from the special school.*

**Key words:** *special educators; children with special education needs; bricolage.*

### Introduction

According to official European and national documents (EASNIE, 2021), children with disabilities have the right to education, in a special school or included in mainstream education. In practice, their education even in special schools is not without problems. Although the special educators have training in special psychopedagogy, work according to a special curriculum and with a smaller number of students in the class, they face an increased level of stress, and the consulted specialist literature proves those.

If in a previous article we analyzed how bricolage manifests itself in the education of children with autism spectrum disorders (Grasu, 2023), in this study we aimed to extinguish the researched problem for the entire range of special educational requirements. Thus, we will explore the experiences of special educators to better understand how they manage to adapt to the diversity of students with special educational needs (SEN). The concept of bricolage described by Claude Levi-Straus provides an explanatory model of the activities of special educators who are aware that they must respond to the needs of children.

First of all, the article presents the specialized literature related to the situation of special educators and the main sources of stress they face, then the concept of bricolage is described, followed by the presentation of the research and the results, and finally discussions and conclusions.

### **Special educators**

Special educators work with students with a wide variety of problems, from intellectual, sensory or physical disabilities to related impairments such as autism spectrum disorders. They carry out teaching-learning-assessment activities, but also therapy and recovery activities. The class size is reduced to 8-12 students, and in the case of severe and/or multiple deficiencies, to 4-8 students, so that teaching activities can be individualized and adapted to meet the needs of each student.

Several researches carried out internationally have highlighted the stress felt by teachers in special schools. The reason for this stress is explained by the multiple roles that a teacher must adopt, but also by the behavior of students (Cancio et al., 2018). In turn, researchers Park and Shin (2020), conducting a meta-analysis of studies on teacher burnout in special schools, found correlations between student problem behaviors and teacher burnout. White and Mason (2006) identified obtaining instructional materials (70%) and managing behavior (60%) as sources of stress for beginning special education teachers.

Haydon et al. (2018) grouped the sources of stress of special educators into four categories:

- 1) lack of administrative support (lack of effective support programs for teachers, presence of a negative school climate, legislation, educational policies);
- 2) individual student challenges (need for personal hygiene and physical care, transportation, behavioral and communication issues, caseload management);
- 3) peer interaction (co-teaching situations, finding time for meetings, communication blockages and experiencing the feeling of being unappreciated);
- 4) additional sources of stress, negative or challenging interactions with parents and families, meetings with other colleagues, completing the necessary documents outside the regular school day).

In Romania too, some researches have been carried out that highlight the problems of the special education system. In 2012, Folostină and Tudorache identified the following sources of disappointment, even frustration, that teachers in special schools have: insufficient staff related to the large volume of children with severe disabilities (67.10%), insufficient income (82.10%), the limited resources of schools (73.10%). Comăneanu (2021) compared the professional stress and burnout level of teachers in regular schools with those in special schools. As a result



of the research, it emerged that special education teachers perceive a higher level of stress, which is determined by a number of factors, such as: time pressure, inappropriate student behavior, low level of training, crowded classrooms, discipline problems, lack of resources, lack of learning materials in teaching activities, lack of well-designed curriculum, bureaucracy, social and political pressures on educational organizations, insufficient reward and lack of participation in decision-making.

A solution to adapting to these difficult situations could be the bricolage, which we will present next.

### **Bricolage**

Bricolage is a term that comes from the French language and means assembly of various structures and materials. In the scientific environment, it was used for the first time by the French anthropologist Claude Levi-Strauss (1970). The author contrasts the bricoleur, the "wild mind," who builds things using whatever materials are at hand, adopting practical solutions, with the engineer, the "scientific mind," who follows a plan and has a precise vision and relies on tools and specific resources. Although bricolage is based on intuition, it does not only produce banal and imperfect solutions, but can even achieve "unexpected brilliant results".

Later, the concept of bricolage extended to other disciplines or contexts. In education, bricolage is opposed to conservative teaching, limited creativity, the use of outdated or inadequate theories, and involves using existing skills and abilities to face all challenges (Hatton, 1997). For his part, Campbell (2019) describes the bricoleur teacher as active and individualistic in professional practice, having an eclectic range of methods. On the one hand, he is aware of the curriculum requirements and educational policies, but on the other hand, she/he follows his instincts and is guided by what she/he believes is best for his students. The core characteristics are creativity, flexibility and empowerment, rather than conformity and focus on repetitive strategies. According to Jenlick (2006), the principal as bricoleur has the task of balancing the daily challenges encountered in the school with the needs of students and teachers. For this, it does not turn to a single way, but to multiple perspectives and means of solving problems and making decisions. Bricolage is also a strategy used by families to overcome certain social boundaries encountered in the process of raising children (Gheorghiu and de Saint Martin, 2011). In the field of research, bricoleurs recognize that the boundaries of traditional research are pushed through the use of multiple methods (Rogers, 2012). In the organizational field, bricolage means "creating something from nothing", that is, the engine that leads to the implementation of some resources that are existing in the company

(Baker and Nelson, 2005) or "using the available resources to carry out tasks and fulfill objectives" (Duymedjian and Ruling, 2010).

Bricolage is defined as the ability to cope by applying combinations and available resources to new problems and opportunities (Baker and Nelson, 2005). According to these authors, bricolage presents three defining elements:

(1) to do, to be active, involved, focused on solving problems. It means seeking, trying solutions, refusing to be limited, which is different from passivity, indifference or avoidance. It also implies the idea of getting by, which means refusing to limit yourself, going beyond the boundaries of standards, insisting on trying different solutions and observing the results.

(2) using readily available resources, making do with "what is at hand." This involves creativity, improvisation, tolerance of ambiguity, overcoming the fear of failure.

(3) combining resources or giving them another meaning in order to apply them to new purposes, different from those for which they were originally intended or used.

Individuals act as bricoleurs by improvising from the resources they have available, borrowing and experimenting with new elements or modifying existing ones.

### **Research description**

To investigate the topic addressed, we used a qualitative research approach, using 16 semi-structured interviews with special educators. This article aims is to describe the professional practices of special educators that help them deal with the diversity of students with SEN.

### ***Objectives:***

- to explore the actions taken by special educators to succeed in responding to the diversity of students;
- to identify the resources used by the special educators;
- to describe how special educators combine the resources at their disposal to adapt to various problematic situations.

### ***Hypothesis and sample***

Are special teachers bricoleurs? How can the do-it-yourself actions of special teachers be described?

To answer these questions, we interviewed 16 female teachers from the "Constantin Păunescu" Special School in Iași, with a working experience between 20 and 5 years. We approached these teachers from the special school relatively easily as work colleagues.

### ***Methods***

We used the semi-structured interview and related observation. Interviews lasted between 45–90 minutes and we obtained consent from the subjects for their recording. The interview guide included 5 main themes:

- description of the circumstances in which they ended up working with children with SEN;
- strategies used for continuous professional training;
- organization of class work, choice of methods and procedures, teaching aids, etc.;
- the main professional challenges;
- the most relevant professional satisfactions.

The interviews were transcribed, then analyzed using the thematic analysis method.

### **Results**

Making a synthesis of the answers obtained, we identified how special educators act to meet the needs of students, which are the main categories of resources used and how they combine the resources at their disposal to adapt in challenging situations.

### ***Action***

In general, the teachers interviewed state that students with SEN cause them to be in a permanent state of action and alertness. These students have a low frustration tolerance, and they have to prevent crisis situations that can destabilize the entire collective. Sometimes the usual approaches are not effective, so teachers look for novel solutions.

Most special school children have severe language and communication problems and it takes persistence to find strategies to communicate with them. A teacher describes how he tested several methods until he was able to communicate with students through drawings. Searching for information on the Internet, he found a training course in the Picture Exchange Communication System Method (PECS) and by following it he was able to improve her communication with her students.

### ***Use of available resources***

One of the solutions used by most of the interviewed teachers in searching for professional resources is the Internet, which, most of the time, is accessed from home. The Internet helps them to expand the boundaries of their knowledge, to find news in the field, training courses, individual worksheets, activity ideas, but also to exchange opinions or materials with other specialists. Moreover, with the help of the Internet, information can be quickly transmitted to teammates or parents.

Another solution used by teachers is to enlist the help of other

colleagues. One teacher described asking permission from colleagues to attend their classes to observe how they react to certain problematic situations. In this way she also learned how to proceed in a similar situation.

Turning parents into collaborators is another solution presented by teachers. For example, a special school teacher reports that she can conduct her visual arts class much more easily when he proposes to paint with the students, when he receives help from a parent. Although it is a favorite activity, a student is unable to do it independently. If he is supervised by the mother, the teacher can take care of the other students in the class and the lesson can be conducted in good conditions.

### ***Combining resources***

Several teachers interviewed state that some of the methods and techniques of working with children with SEN that they learned during the training courses cannot be applied to the class of students for several reasons. First of all, unlike the individual office where the specialist works with only one child, the teacher has a class of students with diverse problems and must pay attention to all of them. She would need another person to be able to apply some of the methods as they were presented and she cannot do all the classes in partnership. Secondly, children have been trained in different styles and what works for one child may not work for another. That is why teachers consider it necessary to know several methods and techniques and to combine various working procedures, in order to adapt to different situations that may arise in the class. A significant problem that teachers raise is finding and preparing materials for lessons. Because there are no textbooks adapted for special schools, nor accessible materials, teachers spend a lot of time searching different sites for worksheets, which they simplify or adapt, since not all students are at the same level. Sometimes they design different teaching materials to help children better understand the concepts being taught. A teacher tells how she and her students made clock faces from recyclable materials to help them read the exact time.

### **Discussions**

This study aimed to identify the adaptation strategies of special educators to the diverse needs of students in a special school.

One of the strategies is to look for, to try different solutions, that is, not to be indifferent, passive or avoidant. Another strategy is to use readily available resources, being creative and improvisational. The third strategy is to combine resources, giving them a different meaning than the one for which they are usually used.

The strategy of being active, of looking for solutions to succeed in working in a special school is also found in other researches. For

example, in a study by Chao et al. (2017) it was shown that attending a training course in the education of children with SEN led to an increase in teachers' sense of self-efficacy in teaching and classroom management. Teachers with high self-efficacy tend to make a substantial effort to overcome their difficulty and treat this situation as a challenge rather than an obstacle. They are more willing to put substantial effort into organizing, planning, and teaching lessons and motivating their students to perform, identify effective classroom management systems, than teachers with low levels of efficacy.

The use of the Internet as a resource at hand is also mentioned in other studies. Thus Thanavathi (2020) showed that digital media is a vital tool used by teachers. The use of technology arouses the curiosity of students with SEN, stimulates them to get involved in school activities, helps them understand more easily and learn better.

Okhrimenko et. al. (2021) raises the issue of training special education graduates to use digital means of teaching. These researchers are of the opinion that only with a sufficient level of professional training in the digital field, the special education graduates will be competitive on the labor market.

Another author (Meyer, 2013) describes the socio-material bricolage that teachers resort to in order to adapt to the unpredictable and rapid changes that occur during the instructional-educational process. According to this author, teachers make do with what they have at hand and adapt different resources to their immediate needs and activities by combining different types of activities, technologies and other classroom resources.

## **Conclusions**

This article explores how special educators deal with the various challenges of educating children with SEN (lack of resources, student diversity, challenging behaviors). Bricolage behaviors were identified, such as the ability to act and adapt to students' needs, to prevent crisis situations, to use existing resources, to combine the resources they have at their disposal in a creative way, adapted to the circumstances, etc. which helps teachers to most effectively meet the needs of a complex and diverse school population. Bricolage is based on the fact that teachers build a repertoire of knowledge, methods, techniques, means and didactic materials and adapt their strategies to ensure equal educational opportunities for all children.

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## DEVELOPING SOFTWARE-BASED STATISTICAL MODELS FOR EDUCATIONAL INCENTIVES IN MIDDLE SCHOOL CLASSROOMS

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**Abstract:** *There is a need for more statistical, computerized representations in studies via fixed effects and mixed effects models. This article gives meta-analytic examples of (a) adequate literary, statistical, and conceptual coverage of token reinforcement as defined within educational interventions and (b) practical mixed-effects modeling that is relevant for determining how treatment effect size fits with other characteristics in literature on incentives. The findings from the meta-analytic modeling indicate that sample size, grouping options, timing, study type, and treatment effect size variation have significant influences on the practical significance (effectiveness) of incentives with middle school students. Accounting for these variables helps stakeholders in education develop supports that offer more standardization, versatility, and appeal to students as a whole. A variety of treatment effects for reinforcers may exist, but the overall effect of reinforcement can be positive. This article is recommended for those interested in developing better instructional practices for students, regardless of academic abilities.*

**Key words:** *modeling; reinforcement; instruction; education; supports.*

### Introduction

Numerous studies about educational incentives describe decision-making frameworks for reinforcement (Doll et al., 2013; Maggin et al., 2011; Schweyer, 2021; Simonsen et al., 2008). Practical strategies for incentivization must be evidence-based in order for teachers and administrators to know what works in the real world. The problem with many incentive-based studies is a lack of in-depth statistical models that generalize, synthesize, and corroborate stated findings. There is a lack of uniformity in terms of program implementation, even though past literature on incentives address the use of them. In education, incentives are frequently stereotyped as tools for struggling learners and individuals, which can influence perceptions and possibilities concerning their use (Author Citation). This creates alarming



inconsistencies between what educators say is effective and what the statistical data actually shows. More objective information needs to be available to discover what is actually happening in the classroom and provide a way to look at an incentive-based treatment plan in an unbiased way.

A statistical model is one way to objectively represent data while taking into account possible systemic variables and effects. Statistical models help to represent and determine key influences within environments and among participants. Statistical models are important because they can help to account for different factors in the environment, support research claims, explain important phenomena, summarize data trends, and apply STEM (Science, Technology, Engineering, and Mathematics) fields to real-world problems (Gordon, 2019; Winter, 2013). Statistical model construction is not comfortable for everyone, but it can be crucial in demonstrating actual treatment effects and outcomes.

Because of the current state of incentive-based strategies in research and practice, a meta-analytic study was created by the author to address the issues found. The purpose of this article is to determine how statistical, mixed-effects models of reinforcement can be used for meta-analytic research about student support systems. It answers the following questions: (a) To what extent do significant predictors exist for treatment effects pertaining to time and type-based reinforcement with middle school students? and (b) What data trends, if any, exist from meta-analytic, mixed-effects models about incentives for middle school students? The ultimate significance of this research is that it addresses the frequent lack of generalizability, standardization, rigor, and statistical corroboration in educational studies about incentives by demonstrating a system of analysis that reflects reinforcement environments as a whole.

### **Conceptual and Practical Frameworks**

This section provides the theoretical and conceptual foundations necessary for relating important study variables to one another. Empirical and practical frameworks help to make sense of the research questions and the data that are discovered as a result of the research process. Within educational environments, there need to be outcome-based supports in place that ease the burdens, pressures, and problematic situations placed on individuals in the workplace (Maggin et al., 2011; Schweyer, 2022). Incentive systems or any other consequence system must align with decision-making frameworks that are relevant within the school system. This alignment helps synthesize appropriate causes, effects, and goals. Figure 1 provides an illustration of support frameworks that are relevant to reinforcement.

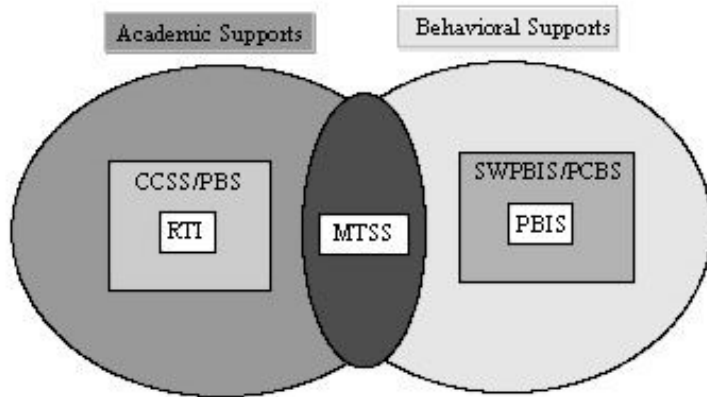


Figure 1. Venn Diagram outlining decision-making frameworks.

*Note.* CCSS = Common Core State Standards; PBS = Performance-Based Standards; RTI = Response to Intervention; MTSS = Multi-Tiered System of Support; SWPBIS = School-wide Positive Behavior Interventions and Supports; PCBS = Positive Classroom Behaviors and Supports; PBIS = Positive Behavior Interventions and Supports.

An example of an alignment tool that is used for schoolwide incentives with students is found with the National Technical Assistance Center on Positive Behavior Interventions and Support (2017) about Multi-tiered System of Support (MTSS). MTSS addresses tiered supports for achievement and behavior, and it is recommended for K-12 school systems. The systems that help to provide the environmental contexts modeled within the study are as follows: MTSS, Response to Intervention (RTI), Positive Behavior Interventions and Supports (PBIS), Positive Classroom Behaviors and Supports (PCBS), and token reinforcement systems.

### Historical Context for Instructional Support Systems

Initial developments for MTSS can be traced back as early as the 1980s because MTSS expands and extends the support systems created within Response to Intervention (RTI) and Positive Behavioral Interventions and Supports (PBIS) (Sugai & Horner, 1999; Sugai & Simonsen, 2012). RTI was a framework that became popular within the Individuals with Disabilities Education Improvement Act (IDEA) in 2004 as an alternative to basing placement decisions solely on intelligence tests and other psychometrics (Fuchs & Fuchs, 2006; Preston et al., 2015). Performance-Based Standards (PBS) were increased during this time to help provide objectives for what students should be able to do each school year. An example of performance-based standards that are used today to shape K-12 curricular needs are the Common Core State Standards (CCSS). RTI supports may be based on guidelines from

academic standards. Within RTI, instructional support occurs in three tiers: Tier 1 (general instructional supports), Tier 2 (intensive, small group supports), and Tier 3 (individualized supports). Struggling learners get additional academic supports, particularly with a focus on at-risk students, special needs students, and students with learning disabilities (Preston et al., 2015). PBIS uses a similar 3-tiered system, but the emphasis is on the behavioral needs of students. This is not just about students with disabilities and risks, but it pertains to school-wide, class-wide, and individual supports (Averill & Rinaldi, 2015). MTSS encompasses all supports needed for integrative student success, including academic, social, emotional, and behavioral supports (Averill & Rinaldi, 2015; Howley et al., 2023; Walker et al., 1996). Hill Walker originated the development of MTSS (Walker et al., 1996). Essential initiatives for the MTSS alignment and integration process are as follows: (a) Coordinate and lead alignment process with an executive level team; (b) Define the valued outcome(s) to be achieved; (c) Develop an inventory of the related initiatives that are currently implemented across the district; (d) Identify the core system features for initiatives targeted for alignment; (e) Analyze and make decisions for alignment of initiatives; and (f) Design the plan for effective alignment including implementation, evaluation, and professional development. According to the School Superintendents Association (2014), fidelity is crucial to the success and implementation of supports systems, particularly the Positive Behavioral Interventions and Supports (PBIS) framework. PBIS and similar support systems address intervention requirements that are in compliance with the Individuals with Disabilities Education Act (von Ravensberg & Blakely, 2017). These expectations are useful for RTI and MTSS frameworks as well.

### **Positive Classroom Behavior Support**

Furthermore, Swain-Bradway et al. (2017a, 2017b) identify Positive Classroom Behavior Support (PCBS), which is different from PBIS. PCBS is an umbrella term for positive practices in relation to behavior, whereas PBIS is a type of tiered system that is an example of PCBS. When PBIS is incorporated throughout schools, it is often known as SWPBIS. SWPBIS would be on the same level as PCBS because it meets similar requirements. This brings up the fact that PBIS is not always implemented for all districts, schools, or classrooms. The program breadth and depth can vary according to school system. MTSS would also be an example of a system that has PCBS. PCBS data can address the areas of fidelity, outcomes, and equity in system practices. Interventions may address various areas, including settings, routines, expectations, prevention strategies, responsive strategies, organizational funding, and data systems (Siegel, 2021; Swain-Bradway et al., 2017a,

2017b; U.S. Department of Education, 2021). A fully-functional PCBS system needs the following before and during implementation: (a) PCBS training, (b) School-wide positive behavioral support practices, (c) Policies and operating procedures for recruiting and hiring staff, (d) Clearly defined policies and procedures, (e) Ongoing professional development opportunities, (f) School investment in evidence-based curriculum, (g) Investment in district-wide data systems, (h) Collection and use of classroom data for decision-making, (i) Specific school-wide strategies for positivity, reinforcement, and expectations, (j) A formal process exists for requesting assistance, and (k) Policies and operating procedures for annual evaluation of personnel and systemic features. Based on the information in this list, it is observed that reinforcers are used within and alongside other types of systems.

### **Classroom Reinforcement**

Additionally, Simonsen et al. (2008) discovered essential characteristics of effective, evidence-based classroom management, which included reinforcement: (a) Maximize structure; (b) Post, teach, review, monitor, and reinforce expectations; (c) Actively engage students in observable ways; (d) Use a continuum of strategies for responding to appropriate behaviors; (e) Use a continuum of strategies to respond to inappropriate behaviors. They go further to say that reinforcement is used as a strategy for responding to both appropriate behaviors and inappropriate behaviors. Reinforcement refers to an event-based consequence that increases the likelihood for a behavior to occur again (Ferster & Skinner, 1957). It can improve engagement, social skills, motivation, behavior, and self-reflection during class activities. For instance, it is possible to have tokens address particular groups of students, such as those with autism (Whitney et al., 2018). A basic definition of tokens that is often used within research is provided by Skinner (1953). A token is a “generalized reinforcer distinguished by its physical specifications” (Skinner, 1953, p. 79). In other words, a token is an item with physical properties that is used as an exchange system for goods and services. Examples include money, points, tickets, badges, coins, coupons, stars, stickers, and checks. In a token system for the school setting, students accumulate items for appropriate behaviors, actions, and situations. These items are exchanged for more desirable items. Prize lists are developed for activities that require a token exchange. Token reinforcement systems can be schoolwide, classwide, and individuated. Token options “can depend on the setting, population, manager’s or teacher’s preference, cost, among other considerations” (Doll et al., 2013, p. 134). Tokens can be included with students of varying abilities, but the reinforcement used may not necessarily reflect what is preferred by all students. The amount of choice and the structure of token systems

would determine their feasibility. The idea of token reinforcement, however, does not imply mandatory ability grouping. Ability grouping is a concept required within merit systems, but it is optional within token systems.

### **Summary of System Connections**

A multi-tiered approach to educational intervention provides an alternative in decision-making that can be used separately from and simultaneously with standardized measures of intervention. MTSS instructional supports combine tiered supports found in RTI and PBIS. Effective MTSS in schools have PCBS as part of their implementation. Reinforcement is a requirement of PCBS, and an example of a reinforcement system is a token system. This means that MTSS, PBIS, and RTI can include token systems as an option for instructional support because token systems can address situations related to behavior, performance, social communication, emotional regulation, and motivation.

How do the intervention systems address the research questions? All of the data used for this study have forms of practical reinforcement for students. The first research question is asked to provide clarity on the types of factors that influence the effects of token reinforcement systems used for educational purposes. If significant predictors can be found, then those who implement and design support systems such as MTSS can be better informed about what consistently works for students. Teachers and administrators can help create more effective learning environments when they are aware of what is happening. Their decisions would be based on outcomes that are more representative of students as a whole. The second research question is asked in order to determine if there are any statistical trends in the data. Token systems are sometimes perceived as relevant only to struggling learners or traditional psychologists. It is important to know if this perception actually matches the factual results found from a variety of studies about different reinforcement systems.

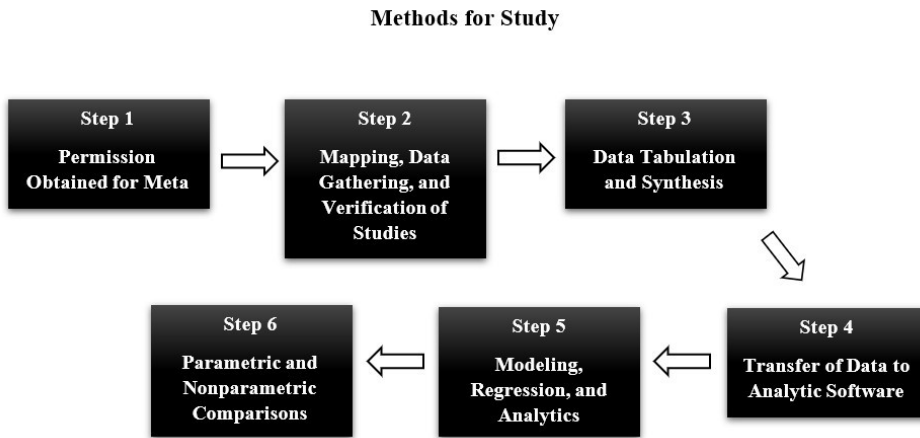
How is a meta-analytic study useful in this education context? A meta-analysis is a study of studies, encompassing a large body of research from multiple sources about a particular topic of interest (O'Rourke, 2007; Paul & Barari, 2022). It is more thorough than a literature review, and it includes statistical information to support literary and empirical claims. It can be used to further support claims in systematic reviews, research studies, and educational practice. It is specifically used to discover trends in data, increase statistical power of claims, and to determine more generalized, unbiased results. Token incentives are known as a strategy of differentiation, but there are other factors that can influence the results. For instance, results from a mixed methods study

in (Author Citation) indicated performance outcomes were influenced by ability grouping. A quasi-experiment, interviews, and focus groups were conducted for the study. The control group had higher math scores than those who received token interventions (i.e., points and coins). The control group contained more accelerated students than the treatment groups as well. This means that more struggling students received the token interventions from the teachers, which was not discovered until the interviews were conducted. Two out of the three math teachers directly interviewed about token interventions had the perception that struggling students needed the interventions more, which could have further influenced the administration of the treatment. The meta-analysis in this article was conducted to determine (a) if performance-based and ability-based influences extended to other studies in education and (b) if there were other influences that needed to be discovered. The two research questions address these areas of concern with modeling in mind. Because modeling and testing were conducted in R statistical software to answer the research questions, the tests generally assume that the null hypothesis is true. This is our hypothesis for the meta-analysis, which means we expect no significant differences between and among the groups analyzed.

## **Methods**

Permission was obtained to conduct a quantitative meta-analysis in 2018 as a follow-up to the results of Author Citation, which was supervised by the Institutional Review Board (IRB) at (University Listed). Figure 2 illustrates the process required to conduct this study. After approval was obtained, studies found to be relevant to reinforcement were summarized. The studies within this article pertain to token reinforcement use within middle grades as an instructional intervention. The focus on middle grades and token reinforcement was specifically done to build on previous mixed methods research, descriptive research, and analytic research by the author (Author Citations). Author Citation also address the same meta-analysis discussed in this article; however, this article expands on the previous discussion by providing conceptual and statistical information not covered within the previous article. Research databases within EBSCOhost, ProQuest, and PsycINFO were used to acquire past studies pertaining to token reinforcement and middle grades information. Search terms paired with the words reinforcement and middle grades included type (i.e., schedule, curriculum, students, design, teacher, classroom, environment, instructional strategies, and testing), student development, goals, socioeconomic status, culture, race, gender, attendance, attention, politics, location, parental involvement, and community partnerships.

Figure 2. General Methodology for Study



To document validity and reliability of each study, a checklist was created from recommendations made by Creswell (2009), Creswell and Plano Clark (2011), Maxwell (2012), and Ahn et al. (2012). Each of the studies were assessed according to items on the checklist (See Appendix A). The studies were given a grade based on the amount of items that existed within the given studies. There were 32 items on the checklist. A score of 23 or above was required in order for studies to have a passing score (i.e., at least 70%).

Out of the 129 studies reviewed, there were 31 studies from journal articles and dissertations that had enough satisfactory information for meta-analyses or effects-based modeling ( $n = 5,765$ ). Most of the studies contained the information necessary for basic procedures. The basic information required for data analysis are means and standard deviations for a particular dataset. These means and standard deviations were provided for the study by default within previous literature, or they were calculated from the raw data given within previous studies for this topic. In Table 1, important characteristics of each study (i.e., sample size, year, location, study type, outcome measured, and grouping variable) are summarized in chronological order.

Table 1  
Important Study Characteristics

| Study    | <i>n</i> | Year | Location | Type | Outcome     | PGV  |
|----------|----------|------|----------|------|-------------|------|
| Hoeltzel | 4        | 1973 | West     | EC   | Performance | Time |

|  |         |               |               |    |                         |               |
|--|---------|---------------|---------------|----|-------------------------|---------------|
| Cross  | 86      | 1981          | Other         | EC | Behavior<br>Performance | Time          |
| Miller   | 13<br>5 | 1981,19<br>85 | South         | EC | Performance             | Treatm<br>ent |
| Simon,<br>Ayllon, and<br>Milan                 | 7       | 1982          | South         | CA | Performance<br>Behavior | Treatm<br>ent |
| Novak and<br>Hammond                           | 28      | 1983,<br>2001 | West          | EC | Performance             | Treatm<br>ent |
| Gaughan  | 40      | 1985          | Northe<br>ast | CA | Performance             | Time          |
| Ames and<br>Archer                             | 17<br>6 | 1988          | Midwe<br>st   | SQ | Motivatio<br>n          | Time          |
| Devers,<br>Bradley-<br>Johnson, and<br>Johnson | 25      | 1994          | Midwe<br>st   | EC | Performance             | Treatm<br>ent |
| Truchlicka,<br>McLaughlin,<br>and Swain        | 3       | 1998          | West          | EC | Performance             | Time          |
| Swain and<br>McLaughlin                        | 4       | 1998          | West          | EC | Performance             | Time          |
| Baker and<br>Wigfield                          | 37<br>0 | 1999          | South         | SQ | Motivatio<br>n          | Time          |
| Taylor   | 60      | 2000          | West          | EC | Performance             | Treatm<br>ent |
| Wulfert  | 11<br>4 | 2002          | Northe<br>ast | EC | Behavior<br>Performance | Treatm<br>ent |
| Popkin and<br>Skinner                          | 5       | 2003          | South         | CA | Performance             | Time          |
| Urdan and                                      | 55      | 2003          | Midwe         | SQ | Performance             | Time          |



|                                       |         |      |               |    |                             |               |
|---------------------------------------|---------|------|---------------|----|-----------------------------|---------------|
| Midgley                               | 5       |      | st            |    | nce                         |               |
| Self-Brown and Mathews                | 71      | 2003 | South         | EC | Motivatio<br>n              | Treatm<br>ent |
| Hansen and Lignugaris/<br>Kraft       | 9       | 2005 | West          | EC | Behavior                    | Time          |
| Strahan and Layell                    | 47<br>9 | 2006 | South         | CA | Performa<br>nce             | Treatm<br>ent |
| Unrau and Schlackman                  | 47<br>0 | 2006 | West          | CA | Performa<br>nce             | Time          |
| Marinak and Gambrell                  | 75      | 2008 | Northe<br>ast | EC | Motivatio<br>n              | Treatm<br>ent |
| Young-<br>Welch                       | 40<br>0 | 2008 | Midwe<br>st   | EC | Behavior<br>Performa<br>nce | Treatm<br>ent |
| Mucherah and Yoder                    | 38<br>8 | 2008 | Midwe<br>st   | CA | Performa<br>nce             | Time          |
| Yager                                 | 60      | 2008 | South         | SQ | Behavior                    | Treatm<br>ent |
| Lynch et al.                          | 6       | 2009 | Northe<br>ast | EC | Performa<br>nce             | Time          |
| Borrero et al.                        | 3       | 2010 | Other         | EC | Behavior                    | Time          |
| Hayenga and Corpus                    | 34<br>3 | 2010 | West          | CA | Performa<br>nce             | Time          |
| Abramovich,<br>Schunn,<br>and Higashi | 51      | 2013 | Northe<br>ast | SQ | Motivatio<br>n              | Time          |
| McClintic-<br>Gilbert et al.          | 90      | 2013 | West          | SQ | Motivatio<br>n              | Time          |
| Habaibeh-<br>Sayegh                   | 60      | 2014 | Midwe<br>st   | EC | Behavior<br>Performa<br>nce | Time          |
| McDonald et<br>al.                    | 3       | 2014 | South         | EC | Behavior                    | Time          |
| Author<br>Citation                    | 20<br>5 | 2017 | South         | EC | Performa<br>nce             | Treatm<br>ent |

*Note.* EC = Experimental/Causal; CA = Correlation/Ambiguous Methods; SQ = Survey/Questionnaire; PGV = Primary Grouping Variable.

Microsoft Excel spreadsheets were made to transfer key information into data tables. Data tables with appropriate formatting for statistical analysis were transferred to R Statistical Language (Base Software),

RStudio, and R Commander to start and complete the data analysis stage of the information gathered. The tabular data were used to create meta-analytic models of the 31 studies. Figure 3 summarizes all of the parametric and non-parametric models necessary for the study.

Model Diagram for Testing and Analysis (3 Levels)

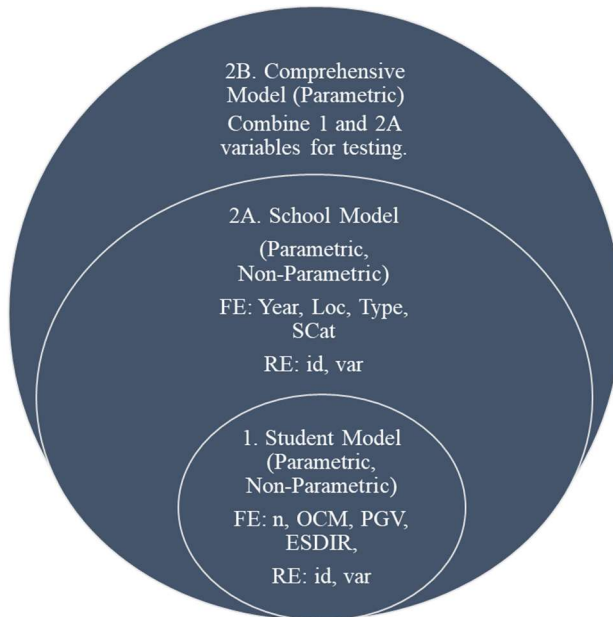


Figure 3. Diagram of parametric and non-parametric modeling for this study, where FE = Fixed Effects, RE = Random Effects, Year = Study Year; Location = Study Location; Type = Study Type; SCat = Number of Sessions; id = Study id; var = Variance; n = Sample size; OCM = Study Outcome; PGV = Primary Grouping Variable; ESDIR = Effect Size Direction.

The Level 1 Model is the individual, student level. The Level 2 Model A equation is the school level, general study characteristics. Level 2 Model B is a comprehensive model that includes all relevant variables from both levels. All models have effect size as the dependent response variable. The specific procedures that were necessary to complete the modeling were as follows: Gather Data, Create the Model(s), Test Assumptions, Test the Model(s), and Interpret the Data. A checklist was developed in order to keep track of the strategies needed to complete each step (See Appendix B). Due to the fact that the school environment contains both expected and unexpected occurrences that may affect treatment effects, mixed effects modeling was the most appropriate method of modeling for this investigation. Mixed effects modeling is

similar to basic regression in that there are predictors, response variables, and one or more equations based on specific effects; however, there are key differences in terms of accountability and complexity (Gordon, 2019; Author Citation). In this instance, there are multiple levels of modeling that reflect the multiple tiers of supports (i.e., individual and group) that are necessary in such systems as MTSS, PBIS, and RTI. Variables necessary for modeling were the following:

- Effect Size (es) – It “refers to the magnitude of the relation between the independent and dependent variables, and it is separable from statistical significance, as a highly significant finding could correspond to a small effect , and vice versa, depending on the study’s sample size” (Funder & Ozer, 2019, p. 156). Factor-based thresholds of Small, Medium, Large, and Trivial were created during rank-based analysis. Hedges’ *g* was used to calculate effect size.
- Sample Size (*n*) – The number of participants in a study sample, symbolized as *n*. Like effect size, initial testing involved a continuous variable until rank-based modeling had to be performed. Factor-based thresholds of Small, Medium, Large, and Trivial were created during rank-based analysis.
  - Outcome (OCM) – Continuous, numerical results for performance, behavior, and motivation that were the basis for a study. For instance, performance scores would be an outcome for a study about student performance differences. This is symbolized as OCM.
  - Primary Grouping Variable (PGV) – Pertains to how study treatments were organized. In terms of reinforcement, there are type-based and time-based studies. Coded as 1 (time) and 2 (type).
  - Effect Size Direction (ESDIR) – The sign of an effect size number that tells the direction of the effects (positive or negative). Coded as 1 (positive) and 2 (negative).
  - Identification number (id) – The number assigned to each study to keep track of what was read. The first work of literature read received the first id number.
  - Variance (var) – Effect size variability and dispersion, represented as a number. This

was used as a continuous variable until ranked-based analysis, where explained variance was categorized into Trivial, Small, Medium, and Large.

- Study Year (Year) – The year in which the study was completed, sorted according to important literary periods found from the literature review: (a) 70s to 80s, (b) 90s to 00s, and (c) 00s to 10s.
- Location (Loc) – Where the study took place and/or the affiliated areas pertaining to study implementation. Categories used were Northeast, Midwest, South, West, and Other. The defined categories pertain to studies located in the United States. Other refers to ambiguous locations and combinations of locations that do not specify a particular region in the United States.
- Study Type (Type) – The design of the study (i.e. experimental, ambiguous yet correlational, survey/questionnaire).
- Number of Sessions (SCat) – The number of sessions required to complete the study, sorted according to frequency (At Most Two, Multiple Sessions, Weeks to Months, Year at Least).
- Error ( $e$ ) – Representative of anything not accounted for within the study that would be of concern, including programming errors, unknown confounding, reporting bias, technical glitches and statistical mistakes. In mixed-effects modeling, this would not be numerically calculated.

After general models were chosen that fit the data, specific procedures for model fitting and analysis could start. The modeling procedures in R were recommended by Christensen (2016, 2019), Del Re (2015), Koller (2016), Kuznetsova et al. (2017), McNeish and Kelley (2018), Lawson (1983), Mertler and Vannatta (2013), Tabachnick & Fidell (2007), and Winter (2013). There were six essential assumptions that were tested within the data variables: linearity, collinearity, independence, influential weights, equal variances, and normality. Then, the actual models were tested from this point. Initial testing involved the parametric, untransformed WB-MEM models in Figure 2. They were

named Model Level 1, Model Level 2A, and Model Level 2B. They were stored in R as follows:

- Level 1 Model:  $es \sim n + OCM + PGV + ESDIR + (1|id) + (1|var) + e$
- Level 2 Model A:  $es \sim Year + Loc + Type + SCat + (1|id) + (1|var) + e$
- Level 2 Model B:  $es \sim Year + Loc + Type + SCat + n + OCM + PGV + ESDIR + (1|id) + (1|var) + e$ , where  $es$  = effect size,  $Year$  = study year,  $Loc$  = location,  $SCat$  = number of sessions,  $n$  = sample size,  $OCM$  = outcomes,  $PGV$  = primary grouping variable,  $ESDIR$  = effect size direction,  $(1|id)$  = id number in random effects form,  $(1|var)$  = effect size variance in random effects form,  $e$  = error

After transformations and initial testing, the models were labeled non-parametric and non-linear due to violations within the results. Once non-linearity was fully established, supplemental models were needed to explain additional violations within the untransformed models. The WB-MEM Models were transformed into ordinal models in Clmm2:

- Level 1, Model 1:  $es \sim n + OCM + PGV + ESDIR + (1 | id) + e$
- Level 1, Model 2:  $es \sim n + OCM + PGV + ESDIR + (1 | var) + e$
- Level 2, Model 1:  $es \sim Year + Loc + Type + SCat + (1 | id) + e$
- Level 2, Model 2:  $es \sim Year + Loc + Type + SCat + (1 | var) + e$

Ordinal procedures are appropriate when parametric assumptions are violated or there are bivariate/ordinal data that exists in the dataset (Cangur et al., 2018). ANOVA-based likelihood ratio tests and ranked ANOVAs (RANCOVAs) with smoothing functions were completed using the four Clmm2 ordinal models. The packages `car`, `compute.es`, `effects`, `ggplot2`, `multcomp`, and `WRS2` were used to analyze the data. The RANCOVA procedures were recommended by McSweeney and Porter (1971). Olejnik and Algina (1984, 1985) point out that these procedures are modeled after and have similar results to the Quade (1967) method.

## Results

Statistical results for the 31 studies are explained individually and in aggregate. Relevant subgroups and percentages are presented in Table 2. The random effects `id` (id number) and `var` (effect size variance) did not have subgroups, so they were not included in Table 2.

*Table 2*  
Counts and Percentages for response and fixed effects

| Variable | Subgroup Variable            | for Study Count | Study Percentage |
|----------|------------------------------|-----------------|------------------|
| ES       | Trivial                      | 9               | 29.03            |
| ES       | Small                        | 6               | 19.35            |
| ES       | Medium                       | 4               | 12.90            |
| ES       | Large                        | 12              | 38.71            |
| <i>n</i> | Trivial                      | 9               | 29.03            |
| <i>n</i> | Small                        | 8               | 25.81            |
| <i>n</i> | Medium                       | 12              | 38.71            |
| <i>n</i> | Large                        | 2               | 6.45             |
| OCM      | Performance                  | 15              | 48.39            |
| OCM      | Behavior                     | 4               | 12.90            |
| OCM      | Motivation                   | 5               | 16.13            |
| OCM      | Combination                  | 7               | 22.58            |
| PGV      | Time                         | 18              | 58.06            |
| PGV      | Treatment                    | 13              | 41.94            |
| ESDIR    | Positive                     | 19              | 61.29            |
| ESDIR    | Negative                     | 12              | 38.71            |
| Year     | 70s-80s                      | 7               | 22.58            |
| Year     | 90s-00s                      | 17              | 54.84            |
| Year     | 00s-10s                      | 7               | 22.58            |
| Loc      | Northeast                    | 5               | 16.13            |
| Loc      | Midwest                      | 6               | 19.35            |
| Loc      | South                        | 9               | 29.03            |
| Loc      | West                         | 9               | 29.03            |
| Loc      | Other                        | 2               | 6.45             |
| Type     | Experimental/Causal          | 18              | 58.06            |
| Type     | Correlation/Any Relationship | 7               | 22.58            |
| Type     | Survey/Questionnaire         | 6               | 19.35            |
| SCat     | At Most Two                  | 6               | 19.35            |
| SCat     | Multiple Sessions            | 8               | 25.81            |
| SCat     | Weeks to Months              | 12              | 38.71            |
| SCat     | Year at Least                | 5               | 16.13            |

*Note.* Relevant counts and percentages for analyzed variables. ES = Effect size; *n* = sample size; OCM = Outcome Type; PGV = Primary grouping variable; ESDIR = Effect size direction; Year = Study Year; Loc = Location; Type = Study Type; SCat = Categories for Number of Sessions.

Based on the statistical information found from the models, did significant predictors exist within the models? Significant predictors did exist within the models. There were a total of 48 influential points during linear model testing for beta weights. Values from Yager (2008), Unrau and Schlackman (2006), Baker and Wigfield (1999), and Devers et al. (1994), were frequently found within the influential points. The Clmm2 models produced significant results as well. For the first model in Level 1, there were significant results found in terms of sample size and effect size within the large category ( $p < .001$ ). For the second model, significant effects were shown within sample size, but this time the trend was found among all ranks ( $p < .001$ ). The Level 2 models showed no significant estimates of effects within their results ( $p > .05$ ).

From the results within Level 1 RANCOVA modeling, it was determined that time had an influence on effect size when paired with sample size as a covariate ( $p = .042$ ). The variables of time and type of groups (independent or dependent) had an influence on effect size when accounting for direction as a covariate ( $p < .001$ ). This was also true when accounting for variation ( $p = .004$  for group;  $p = .002$  for time). Through principal component analysis with the raw data as recommended by Hayden (2018) and Winter (2013), it was determined that sample size accounted for 72.2% of the variation and effect size variance accounted for 27.8% of the variation.

Were there data trends that stood out within the data? There were unique data trends and unique inconsistencies. The assumption of linearity was not met for the mixed-effects models before or after transformations. Residual results and plots from the R packages indicated patterns inconsistent with normal and linear distributions. For non-parametric  $y \sim x$  correlation testing, the results of both Spearman Rho and Kendall Tau showed significant correlations between pairs: a) sample size and study type, b) id and study type, c) sample size and time sessions, d) sample size and effect size variance, e) id and sample size, f) effect size direction and id, g) effect size direction and variance, and h) id and effect size variance. Significant correlations are shown in Table 3.

*Table 3*  
Significant correlations between fixed and random effects

| x<br>(Variable 1) | y<br>(Variable 2) | Spearman<br>Rho<br>(coefficient) | Spearman<br>Rho<br>( $p$ -<br>value) | Kendal Tau<br>(coefficient) | Kendal<br>Tau<br>( $p$ -<br>value) |
|-------------------|-------------------|----------------------------------|--------------------------------------|-----------------------------|------------------------------------|
| <i>n</i>          | Type              | -.419                            | .019                                 | -.332                       | .023                               |
| id                | Type              | -.795                            | <.001                                | -.698                       | <.001                              |
| <i>n</i>          | SCat              | .376                             | .037                                 | .296                        | .035                               |

|          |          |      |        |      |       |
|----------|----------|------|--------|------|-------|
| <i>n</i> | var      | .767 | < .001 | .581 | <.001 |
| id       | <i>n</i> | .553 | .001   | .399 | .002  |
| ESDIR    | id       | .400 | .026   | .332 | .029  |
| ESDIR    | var      | .429 | .016   | .356 | .019  |
| id       | var      | .421 | .019   | .308 | .015  |

Note. *n* = sample size (fixed effect); Type = study type (fixed effect); id = identification number (random effect); SCat = time sessions (fixed effect); var = effect size variance (random effect); ESDIR = effect size direction (fixed effect).

Out of the eight correlations found, four correlations involved sample size. Four involved id number as well, which was given after studies were reread for sorting purposes. The lowest significance values were found between a) id and study type and b) sample size and variance. Bivariate normality was tested using Shapiro-Wilk (SW) and Kolmogorov-Smirnov (KS) within the EZR package and RCommander. Residual structures for each variable indicated non-normality and nonlinearity except in the case of the id variable, which had a *p* = .247 on the initial SW test for normality. The *p* value increased to *p* = .996 using the KS test.

Multivariate normality was tested using the MVN package. Royston and Mardia were the recommended tests. The testing had three sections: multivariate normality, bivariate normality, and descriptives. For Mardia, only partial requirements were met for some of the pairs. Overall, many of the pairs did not show normality (*p* < .05). Royston’s tests indicated that no pair had multivariate normality (*p* < .05). Both tests did conclude that id had normality by itself (*p* > .05), which was also found within the bivariate tests already performed on the variable. For the effect size (Hedges’ *g*), the top nine studies had an effect size over one. This result is statistically possible but rare in terms of effects size. Table 4 shows the top 11 effect sizes, including the previous study done by Author Citation.

Table 4

Top 11 Means, Standard Deviations, and Effect Sizes from Effects Modeling, Sorted by Effect Size Magnitude (High to Low)

| Study                       | CM   | CSD | EM    | ESD   | <i>g</i> | V <i>g</i> |
|-----------------------------|------|-----|-------|-------|----------|------------|
| Yager (2008)                | .16  | .27 | .50   | .16   | 18.505   | 1.038      |
| Baker and Wigfield (1999)   | 2.85 | .26 | 25.94 | 28.61 | 11.491   | .166       |
| Unrau and Schlackman (2006) | 2.82 | .01 | 2.71  | .01   | -7.419   | .034       |
| Novak and Hammond (1983)    | 2.34 | .00 | 7.33  | 1.44  | 3.619    | .549       |



|   |              |              |               |              |               |             |
|---|--------------|--------------|---------------|--------------|---------------|-------------|
| <b>McDonald et al. (2014)</b>             | <b>23.80</b> | <b>4.50</b>  | <b>11.93</b>  | <b>5.46</b>  | <b>-1.897</b> | <b>.727</b> |
| <b>Popkin and Skinner (2003)</b>          | <b>46.76</b> | <b>31.13</b> | <b>54.12</b>  | <b>37.66</b> | <b>1.796</b>  | <b>.306</b> |
| <b>Hansen and Lignugaris/Kraft (2005)</b> | <b>.12</b>   | <b>.14</b>   | <b>.31</b>    | <b>.03</b>   | <b>1.772</b>  | <b>.289</b> |
| <b>Lynch et al. (2009)</b>                | <b>73.67</b> | <b>.00</b>   | <b>91.75</b>  | <b>1.90</b>  | <b>1.671</b>  | <b>.254</b> |
| <b>Swain and McLaughlin (1998)</b>        | <b>54.50</b> | <b>22.52</b> | <b>83.00</b>  | <b>2.16</b>  | <b>1.549</b>  | <b>.528</b> |
| <b>Devers and Bradley-Johnson (1994)</b>  | <b>94.03</b> | <b>5.30</b>  | <b>103.10</b> | <b>6.87</b>  | <b>.856</b>   | <b>.105</b> |
| <b>Author Citation</b>                    | <b>79.76</b> | <b>2.07</b>  | <b>65.94</b>  | <b>3.71</b>  | <b>-.843</b>  | <b>.017</b> |

*Note.* *CM* = Control Group Mean; *CSD* = Control Group Standard Deviation; *EM* = Experimental Group Mean; *ESD* = Experimental Group Standard Deviation; *g* = Hedges' *g* (Effect size); *Vg* = Effect Size Variation.

Treatment effects and traits found in (a) Yager (2008), (b) Unrau and Schlackman (2006), (c) Baker and Wigfield (1999), and (d) Devers et al. (1994) carried more weight than the other 27 studies. Three out of the four studies had performance-based reinforcement as a focus. When adding all the 31 effect sizes together, the sum of the effects is 33.28, and most of that can be found within Yager (2008) and Baker and Wigfield (1999) alone. Just adding those two effect sizes together gives a total of 29.996. What both of the studies had in common were the location and the study type.

## Discussion

Based on the information found in the first research question, the researcher found that the amount of influence depended on sample size and approach. A high, positive treatment effect was found as a whole; however, what works for students in individual classrooms may not show up as having much effect in the general sense. To get a better idea of what can work, more details have to be given about specific studies. The literature from Yager (2008), Baker and Wigfield (1999), Unrau and Schlackman (2006) and others such as Schweyer (2022) and Swain-Bradway (2017a, 2017b) indicate that positive effects from token reinforcement are possible, especially when they are based on the needs and goals of students. Having goals, standards, and objectives that are academic in nature, whether they are used for short-term performance or long-term mastery of skills, not only are an important focus for educators, but they also are reasonable components to include when developing instructional interventions about reinforcement. Not all studies had positive effect sizes, but the ones that did often cited

generalizability as a limitation. The top two effect sizes were found with Yager (2008) and Baker and Wigfield (1999), but both had issues with generalizing the results beyond their participant pools (Author Citation). Both were major influences in the study model, but they were not true experiments or quasi-experiments. Yager (2008) contained survey research for middle school students in Mississippi. Baker and Wigfield (1999) included a variety of case-based assessments in their analyses as well as the administration of the Motivation for Reading Questionnaire. Both were studies that involved surveys or questionnaires. They did not focus on the same outcomes. Yager (2008) focused on school-wide behavioral reinforcement ( $n = 60$ ), and Baker and Wigfield (1999) encouraged the use of performance-based incentives and motivation-based incentives for groups of students ( $n = 370$ ). Out of the 31 studies, there were 18 (58.06%) that were experimental, quasi-experimental, or causal-comparative in nature. Only six (19.35%) used surveys or questionnaires.

The results from the second research question indicated that accurate models based on MTSS, PBIS, RTI and similar frameworks did not follow what is typically expected of the general population. Parametric modeling assumes a bell-curve, also known as a normal distribution. In practical terms, it is unrealistic to expect this when dealing with student support systems. If the goal is for all students to meet or exceed the standards and expectations that are placed on them, then the model for that would have to be non-parametric on one or more levels, with allowances for both fixed and random occurrences. Some support systems, such as the ones found in Gaughan (1985), Hansen and Lignugaris/Kraft (2005), Lynch et al. (2009), McDonald et al. (2014), and Popkin and Skinner (2003), only address students with atypical behaviors and needs. All had positive treatment effects except for McDonald et al. (2014), which focused on behavior-based incentives. Hansen and Lignugaris/Kraft (2005) also focused on behavior, but the remaining three studies encouraged the use of performance-based incentives that were based on the participants' needs and preferences. Performance-based incentives tended to show more positive effects overall than other incentive types (i.e., behavior, motivation, and combination). The findings revealed that token use was not automatically detrimental to targeted outcomes. The drawback is that when looking at results from an overall standpoint, it is hard to determine what should be kept and what should be discarded in order for token reinforcement to have long-lasting, game-changing effects that work for middle school students. When it comes to model selection and model fitting, being able to determine non-normal distributions, specific non-parametric variables, and statistical software for handling such data helps to show how practical studies are and how they actually differ from

ideal expectations of what researchers would like to see (Foldnes & Olsson, 2016; Gu & Ma, 2005; Noguchi, Gel, Brunner, & Konietschke, 2012; Tremblay & Newman, 2015; Tsangari & Akritas, 2001; Zuur, Ieno, Walker, Saveliev, & Smith, 2009).

In terms of the hypothesis, the results did not show what was expected by the researcher. All levels showed non-normal results with high heterogeneity, and they had to be transformed in order to be properly fitted with the appropriate models. Upon further inspection within the transformed models, significant predictors existed with student-level variables (Level 1) and not with school-level variables (Level 2). Therefore, all models showed that the token systems were mostly influenced by students' needs and the classroom environment at the time of instruction. There were 22 studies that had performance as an outcome, but outcome was not found to be a significant influence on effect size for the studies on either level. What was a major influence was time, specifically whether or not groups were time-based in nature. The top 11 studies, when sorted by magnitude, mostly had time-based designs. This means that treatment strength tended to show up higher with time-based designs. Time-based designs in this circumstance usually have dependent grouping, where the same group of participants are observed before and after a specific type of reinforcement. This differs from treatment-based designs, where independent groups receive different treatments over a similar period of time. Within the study data, time-based designs tended to have small groups. It is important to note that in this study, larger sample sizes tended to have higher positive effects, but smaller sample sizes tended to have higher magnitude. How is this possible? There are two explanations for this: (a) Some studies carry more statistical weight and influence than others in the calculations, and (b) Effect size direction is not the same as magnitude. Based on the data, the most appropriate reinforcement design that is likely to produce strong results is one with a time-based design. Although Yager (2008) is a treatment based design, there are seven studies in the top 11 that are time-based. Treatment-based designs and time-based designs with medium or large sample sizes are likely to have strong influence and positive effects. Baker and Wigfield (1999), Devers et al. (1994), Unrau and Schlackman (2006), and Yager (2008) had the most influence within the calculations. Two had time-based designs and two had treatment-based designs. Out of these four, sample size ranged from 25 participants for Devers et al. (1994) to 470 participants for Unrau and Schlackman (2006). The study year and length of sessions are separate variables with no significant predictive power. Therefore, educators and researchers need to pay more attention to treatment timing according to instructional groups and activity changes within those groups. This supports the ability group influence found within Author

Citation since teachers design their lessons in ways that take into account the amount of time they want to spend on instructional activities and how students need to be grouped for instructional support. The meta-analysis also supports the idea that different systems can produce different results, and reinforcement systems can be successful with students who have different learning needs, behaviors, and personalities. Teachers' perceptions and expectations may not always align with statistical results.

There are various implications that exist because of the modeling procedures completed within this article. Firstly, it is possible to model incentive effects and probable influencers in a way that is relevant to the school system today. Similar to the structure of the meta-analytic models discussed, teachers and researchers can propose one overarching intervention support system that works with different incentive systems. Each incentive-based subsystem can be implemented simultaneously within the one system. MTSS can be utilized for this arrangement because it facilitates the use of a tiered support system with a variety of supports in place for students. Secondly, it is possible to have positive treatment effects for token interventions as a representative whole, even if not all studies support the positive finding. The supports included in a reinforcement system could be arranged or changed according to actual evidence-based results; however, it is important to allow for diverse systems without compromising practical integrity. Thirdly, decision-making about intervention use can be more tailored to students' needs since it is known statistically where strengths and weaknesses exist within the educational studies discussed. Heterogeneity, sample size, variation, and instructional timing are all important factors to consider during implementation of token-based incentives. Future meta-analytic models can and should be created with these and other variables in mind.

### **Recommendations**

The reason mixed-effects modeling is important in research and practice is because it represents situations that have clear influencers (fixed effects) and situations that have unpredictable influencers (random effects). This is needed if educators, researchers, and individuals want to determine possible explanations for outcomes in a way that is actually supported by factual statistics. When explaining an evidence-based treatment that could be adopted into schools and businesses, there needs to be a determination of why it is important on a larger scale or how it would need to be modified to work with different types of people who come from diverse backgrounds.

With this in mind, one recommendation is to use sampling techniques that reflect the typical classroom setting in the region of the study. Instead of using reinforcers just for struggling students, educators can

identify a subset of students that are representative of different types of learners. There are too many studies within reinforcement that have limitations in terms of generalizability. Using frameworks such as RTI, PBIS, and MTSS to inform decisions would help to make supports more accessible for different learners. Encouraging more social, electronic, and network-based reinforcement in studies in addition to what is available out there helps modernize the practice of reinforcement for all those involved. Having participant groups primarily based on treatment and not age or ability helps to mitigate undue influences seen with time-based scheduling. There will be elements of time present during schooling, but the amount of focus given to time is something that needs to be planned in advance when discussing instructional supports.

Reinforcement systems are usually developed as a way to regulate past behavior, but they are also used in order to encourage future behavior. Reinforcement systems, in other words, are not just feedback systems. They are feed-forward systems as well. According to Andreas (2012), feed-forward systems are known as 'strategic planning' or 'backward planning' (p. 41). Systems that are goal based and outcome based would be feed-forward in nature. More research and instructional supports should include the concept of feed-forward systems so that future studies on reinforcement can determine essential differences in the feedback and feed-forward processes.

Future research also needs to be available that gives more statistical depth to projects on motivation. Many traditional studies have been experiments or surveys with simple behavior tracking. More complex and mixed methodologies that involve parametric modeling, non-parametric modeling, observations, interobserver agreement, member checking, reliability statistics, triangulation, and interviews are strongly encouraged. Researchers who use modeling effectively can generate descriptives for central tendency, descriptives for dispersion, fixed effects modeling, mixed effects modeling, random effects modeling, or some combination of models.

### **Conclusion**

Mixed-effects modeling can represent outcomes and possible influencers in a practical way because it takes into account not only the expected, but also the unexpected. The predictive, statistical modeling within this article helped to determine important reinforcement effects as well as a more generalized treatment effect size that could apply to middle school students as a whole. Essential conclusions can be reached from the data: (a) the number of participants can impact treatment practicality and (b) group structure and variation can influence treatment results. Participants and the treatment variation are major factors in whether or not a treatment has practical significance. Statistically

speaking, small sample sizes are not ideal for calculations. The more unique the group characteristics are, the less likely the treatment effects would have the same effects on a generalized sample. The actual group selection and treatment group determination can influence treatment effect size, and enough standardization in research methods should be in place so that statistical results are more likely to align accurately with previous results.

The example models shown in this article help represent concepts beyond words or emotional appeal. A model can be generated which yields results that educators and researchers can use. Determining the appropriate supports based on students' needs is essential to do, and creating better standards that give instructional flexibility is a step in the right direction. The results of this article provide more complexity to the issue of incentive use in schools. It ultimately provides strong encouragement for practical modeling of causes and effects, which is of interest to those who like to utilize rigorous, credible strategies for meeting and exceeding expectations.

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## IDENTIFYING SPATIAL, FUNCTIONAL AND TECHNOLOGICAL MODIFICATIONS AND GUIDELINES TO COPE WITH EDUCATIONAL CHANGE AND CONTEMPORARY CHALLENGES

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**Abstract:** *The study identified spatial, functional, and technological modifications and guidelines to cope with educational change and contemporary challenges. The study adopted survey research design in which (600) secondary school teachers were purposively selected from thirty (30) secondary schools in south-west, Nigeria. The instrument for data collection was a self-developed questionnaire divided into four sections with 28 items based on the research topic. Four research questions were raised and two hypotheses were generated and answered. The study revealed that majority of the respondents agreed that learning spaces influence teaching and learning process in the educational change of twenty-first century. The study also revealed that majority of the respondents agreed that technology modification of twenty-first century influence change and continuity in educational planning, The study further showed that the issues and challenges to effective implementation of educational planning in educational changes of twenty-first century includes, blindness to the existing educational culture and teaching learning conditions, insufficient understanding of what change is like, lack of adequate planning skills, misappropriation of development funds, lack of in-service training on educational manager and failure to involve the key stakeholders among others. The result also indicated that there is strong significant influence of learning spaces on teaching and learning process in the educational change of twenty-first century and there is a significant influence of technology modification of twenty-first century on change and continuity in educational planning. Based on these findings, the following recommendation among others was made: effective and efficient educational planning should be built on sound decision in order to strengthen educational change of twenty-first century.*

**Key words:** *technological modifications, educational change, contemporary challenges, educational culture.*

## **Introduction**

Technological advances are seen to have given rise to upsurge in information hunt which has made students of tertiary institutions to be in a great pursuit for information; they are very much willing to learn new things, ideas, technologies and new ways of acquiring information (Kyari, Adiuku-Brown, Abechi, Pyochi & Adelokun, 2018). Humans have used technology in various spheres of life to harness the natural resources. It is obvious that the use of technology creates challenges, but has benefits as well. One of the benefits of its ability to make the world become a global village. This it has done through its ability to facilitate the sharing of information globally. This phenomenon is facilitated by the use of Information and Communication Technology (ICT). Information communication and technology has made tremendous impact in the education industry by enhancing learning and global changes in education. Technology is one of the vital tools for learning.

Education plays a vital role in the modern, complex industrialized societies. It is commonly considered tool for poverty alleviation, increasing economic growth, people empowerment, cherishing personal earnings, encouraging a friendly and flexible environment paving way for a competitive economy. Furthermore, it provides for the new generations' strategies coping the complexities of economies in future Afzal, M., Farooq, M. S., Ahmad, H. K., Begum, I., & Quddus, M. A. (2010). In the development of schools, educational change is unavoidable, as it encourages flexibility in learning and teaching process. Change is inevitable in any organization with no exception to educational system changes (Chakraborty, Chakraborty, Dahiya, & Timajo, 2018). This change is brought about through the introduction of noble inventions and embrace of contemporary ideas, skills and practices required for modern growth and development. The other positive social impacts of education though not directly related to poverty but equally important, including improvement in functioning and continuity of democracy and reeducation in crime rate (Berg, 2010). Oluwalola (2015) describes change as aims at school improvement in one way or another. He opines that effective change does not come without adequate planning, vision, professional development, education measures and new institutional structures. Therefore, school improvement is closely linked to the professional development of principals and teachers (Postholm, 2012; Timperley, 2008). The improvement of student learning, learning environment, instructional support and/or learning processes, are ultimate goals for school improvement.

Planning could be said to be looking into the future and preparing for it. Planning involves the determination in advance of what is to be done



including clarification of goals, the establishment of policies, mapping out programmes and campaigns and defining specific methods or procedures and fixing day-to-day schedules. Educational planning is a continuous process of obtaining, analyzing, and providing data to make projections of future development in terms of human and material estimates necessary to accomplish the goals and purposes of education. Okwori (2011) states that educational planning is the exercise of foresight in determining the policy, priorities and cost of educational system having due regards for economic and political realities for the system potentials, for growth and for the needs of the country and of the pupils served by the system. This implies that educational planning is a scientific study of the future with regard to a nation's educational development. Educational planning is a strategic process for the improvement of teaching and learning, that first appeared in the educational literature aftermath of World War I era (Ornstein & Hunkins, 1988 cited in Dan, 2013). Educational planning is the key function of educational resource management. The need for planning stems from the fact that a system must operate in changing environments. Changes in technological, economic, political and social climate can have radical effects on any system. Planning channels efforts towards desired results, and by providing a sequence of efforts, minimizes unproductive behaviours and waste of resources.

Planning for change should be done in a collaborative manner as a group work and not by individuals. This is necessary in order to develop implementation projects that the more people are involved in the problem analysis, the better, and more sustainable the solution. The planning process itself needs to be "comprehensive" and consider a vast array of real and potential intervening variables that is (people, things, and ideas) that may impact on the implementation of change (Krug, cited in Polka, 2015). It is imperative that contemporary educational leaders or those aspiring to become one need to keep this twentieth century four C planning model (cooperative, comprehensive, continuous, and concrete) in mind to meet the ever-changing educational landscape of the twenty-first century. (Fullan, 2005, cited in Polka, 2015) describes that the sustainability of school reform efforts, as being related to, "continuous improvement, adaptation, and collective problem solving in the face of complex challenges that keep rising."

It is observed that since the 1960s, educational change has undergone several phases of development. This has led to the creation of a unique and innovative design for teaching and learning process. However, much more is known about change strategies that typically lead to successful educational reforms in the early twenty-first century to implement flexible learning classroom and provide guidelines for stakeholders in education on how the space ought to be. According to

Lackney (2019), an effective school-built facility is aimed at changing programs of educational delivery, and at a minimum should provide quality school physical environment for effective teaching-learning process. The school-built facility also includes furnishings, materials and supplies, equipment and information technology, building grounds, athletic fields, and playgrounds that is very important in contributing to healthy academic exercise (Lackney, 2019).

School-built facility is an essential component of the conditions of learning. The layout and design of a school-built facility contributes to the place experience of students, educators, and community members (Lackney, 2019). The quality of school design and its management can contribute to a sense of ownership, school safety and security, personalization and control as well as sociality, and spaciousness or crowdedness. (Lackney 2019) suggested that when planning, designing, or managing the school-built facility, these facets of place experience should be taken into consideration.

The twenty-first century school building is visualized to support academic success for all students, engage school communities to inform the creation of excellent school buildings for students and create school buildings on the cutting edge of technology and environmental sustainability (Price & Burley, 2016). The school-built facility planning process at its best involves an assessment of functional needs in light of the educational program developed during educational planning. Facility planning includes feasibility studies, master planning, site selection, needs assessment, and project cost analysis. Spatial requirements and relationships between various programme elements also needs to be established (Lackney, 2019). He stressed further that several school environmental issues have emerged over the past few decades, such as classroom acoustics, lighting, temperature, recreational equipment's, water quality, and abatement of asbestos, radon, and other hazardous materials to provide a safe and comfortable internal atmosphere for students and teachers.

The situation is that many schools built in the past do not provide adequate space resources for the way schools educate children in the early twenty-first century. Efforts to scale back class size across the nation along with growth in the number of students have placed a burden on school facilities and increased the demand for more classroom space (Picus & Lackney, 2019). Over time, it has also been observed that teachers' efforts to use classrooms in different ways to maximize learning often require additional square footage in each classroom (Lackney, 2019). In earlier periods, schools were built to meet the requirements of educational methods that are no longer in favour since the world does not occur in a vacuum. Many schools built in the 1970s have become obsolete because it is an "open classroom" model where

there were no walls between classrooms. As teaching moved away from this model, schools had to spend substantial sums of money to reconfigure their facilities (Picus & Lackney, 2019). However, due to significant improvement in technology, changes are also important part of a continuous modernization process because installation of white boards have been used to replace traditional chalk boards to make it easier to hang and display teaching aids and make a tremendous difference in the appearance of a classroom. Yet even these simple things can be expensive, and planning for such upgrades is important (Picus & Lackney, 2019).

(Zhao, 2011) opined that due to vast changes in education, the classical self-contained classroom can no longer provide the variety of learning settings necessary to successfully support project-based, real-world authentic learning. Education has to meet the needs of the globalized classroom. He stressed further that advancement in technology lead to new ways of doing things and learning, and to new types of knowledge. It becomes increasingly difficult to predict what type of businesses will emerge in the job market of the future. Thus, what is required are unique talents, skills and knowledge, the ability to adapt to changes and creativity so that school leaders must approach their work in radically new ways. Lackney (2019) stated that technology has enriched a variety of changes in the organizational and physical form of schools. With regards to instructional processes, technology integration is facilitating the movement toward project-based, self-directed learning and individualized instruction. As learning in twenty-first century becomes increasingly virtual, web-based, and wireless, it must physically take place somewhere. Technology is becoming ubiquitous; more schools are decentralizing technology throughout the school building and across the community.

The major challenge of educational change is how to understand and cope with rapid development in an unpredictably changing world. In the view of [Hayward \(2010\)](#), one of the main challenges of change is to sustain change on a broader scale, which is beyond that of individual teachers. Emerging new theories of educational change are beginning to employ concepts and ideas derived from the sciences and its development. The main characteristics of these new theories are nonlinearity of processes, which will make education as an open system, the interdependency of the various components of the system, and the change process itself. Consequently, educational planning projects that address the four contemporary cultural forces of accountability, technology, diversity, and constructivism, as well as others that may emerge, must be introduced to educators using Krug's 4 C model of cooperative, comprehensive, concrete, and continuous as a valuable strategic planning framework because change is ongoing process of

delivering an innovation. Thus, the changes in educational system related to people, things, and ideas will be more successfully implemented and will be more sustainable because the leaders managed in the “effective change zone”. There is no doubt that proper educational planning is a necessity in this twenty-first century to address educational change and contemporary challenges.

To carry out effective planning, educational planners need to familiarize themselves with the theories of educational system. The study therefore is based on the Bereday theory of planning. Bereday (1977) cited in Asuquo (2018) maintains that a set of decision and the process of preparing the decisions are elements which are evident in educational system planning. This implies that planning in education involves preparing a set of decisions to be approved and executed by other organs or persons as the case may be. This theory maintains that the overall planning in education is continuous and systematic process from one generation to another which involves the application and co-ordination of social research methods, principles and techniques of education, administration, economics and finance. It takes into consideration the participation and support of general public and other stakeholders in education, with the opportunity of developing their potentialities and making the most effective contribution to the social, cultural and economic development of the nation.

It is necessary to understand what is meant by planning and what a plan is for better understanding of educational planning. An adage says; “to fail to plan is to plan to fail”. This adage is loaded with meanings and full of warnings. According to (Newman as cited in Yawe, 2010) “planning is the process of determining in advance, what is to be done, including classification of goals, establishment of policies, mapping out of programme and campaigns and determining specific methods or procedures and fixing day-to-day schedules”.

In line with the above definition of planning, Coombs, 1974 cited in Akpan (2018) opined that educational planning “is the application of rational systematic analysis to the process of educational development, with the aim of making education more effective and efficient in responding to the needs and goals of its student and society. In the same vein Okwori, (2011) sees educational planning as: “Involving the application of rational methods; systematic analysis or explanations, through the process of educational development with the aim of making education more effective and efficient in terms of responding to the needs of the students and the society as a whole. Therefore, Educational planning can be approached in four different perspectives, social demand, manpower requirement, rate of return and the synthesis (John & Abdus 1981, cited in Abdulrahman, Abdulkarim, Ibrahim & Abdulrahman, 2017). Whatever angle educational planning is viewed

from, the primary aim is to achieve quality.

Educational sectors are increasingly building or remodeling classrooms to be flexible spaces that support learner-centered instruction. However, the actual impact of these spaces on student learning outcomes cannot be overemphasized. Hence, learning space, whether digital or physical, is the most vital contemporary infrastructure requirement for learning in the twenty-first century (Uduku, 2015). Aside mastering the curriculum, twenty-first century learners have specific needs that need to be attended to by educators. Also, there is a need for students to acquire lots of skills necessary for digital innovation and partnerships. In the course of doing this, students should be sure to diligently be creative, while being adaptable to any contemporary situation they find themselves, with informed flexibility and critical reasoning. This is what knowledge could be defined as, in the twenty-first century, twenty-first century, twenty-first century contrary to the obsolete perception of knowledge as the ability to acquire a set of streamlined contents of a school syllabus so rigidly structured. All these could be better achieved if educators imbibe more productive modern methods of imparting knowledge.

Unlike twentieth century that focused on building more learning spaces, the twenty-first century allows the students to take up various positions in a variety of places, in various seating arrangements making them capable of continuously reconfiguring themselves (Uduku, 2015; Pearlman, 2010). The Joint Information Systems Committee (JISC, 2009) also described several attributes of twenty-first century learning spaces which includes flexibility that are able to accommodate both current and evolving pedagogies, future proofed that can be re-allocated and reconfigured, bold that looks beyond tried and tested technologies and pedagogies. Moreover, it also includes creativity that can energize and inspire students and teachers, and support development potential of all students. However, twenty-first century learning spaces offer students access to instructional and learning technologies that may include computers and connection to the internet. This adoption of learning technologies does not necessarily require more physical space, but more flexible space (Uduku 2015).

The emergency of technology into design is also an important part of planning for today's learning environments. A twenty-first century learning environment blends physical and digital infrastructure seamlessly support learning, melding face-to-face with blended and online learning. Technology modification in twenty-first century has allowed us to rethink the way schools are designed to promote physical learning spaces that accommodate new and expanded relationships among teachers and the students (U.S. Department of Education, 2017). These learning spaces allow equitable access to quality learning tools and technologies, and include space for group, team and individual

learning. Some of the most notable ways that technology can enhance student learning and promote twenty-first century skills are;

- Promoting greater student achievement
- Increasing student engagement
- Assessing student performance
- Facilitating communication and collaboration
- Maximizing administrative effectiveness
- Building student proficiencies in twenty-first century skills

These are factors that seem to strengthen the implementation and sustainability of educational change and contemporary challenges. Fullan asserted that ‘the interface between individual and collective meaning and action in everyday situations is where change stands or falls.’ (Fullan, 2007). Thus, we need to understand that educational change is highly complex and it involves various stakeholders. Darling-Hammond’s (2009) reported an ongoing professional development for teachers and leaders of teachers that is collaborative and incorporated into teachers’ schedules is one factor. Some countries are better than others at integrating the professional development of teachers into their teaching schedule. However, time for reflection on changes is a crucial factor for embedding and sustaining developments (Harlen & Hayward, 2010).

Inquiry-based approaches focused on classrooms and classroom practice, for example, action research and action learning can be effective ways of bringing about educational change (Pedder & James, 2012; Timperley, 2008). Therefore, educational change can become more effective, in order for education to better meet the needs of the world outside school, and allowing policy, practice and research to become better aligned. Nelson Mandela’s famous words, reminding us of the power education has on its surroundings, makes it clear why educational change is so important and needs further research to develop and become even more effective: ‘Education is the most powerful weapon which you can use to change the world.’

### **Statement of the Problem**

Over the years, massive financial, material and human resources are devoted to trying to improve education worldwide. However, the costs of managing and maintaining school-built facilities have received much less attention than facility planning. In addition, many schools built in the past do not provide adequate space resources for the way schools educate children in the early twenty-first century. Efforts to scale back class size across the nation along with growth in the number of students have placed a burden on school facilities and increased the demand for more classroom space. Teacher’s efforts to use classrooms in different ways to maximize learning often require additional square footage in

each classroom.

Moreover, a high budget has been placed in order to provide the technology equipment needed in twenty-first century by teachers to improve the education system. Regardless of all the effort by the government to integrate technology due to educational changes, most developing countries are facing problem whereby the teachers are not maximizing the usage of the technology provided. The incorporation of learning space and technology into school environments in the twenty-first century necessitates additional modifications to both the built environment and the pedagogical approach to capitalize on the affordances of technology. This therefore investigated spatial, functional and technological modifications, and guidelines to cope with educational change and contemporary challenges.

### **Purpose of the Study**

The general purpose of the study is to identify spatial functional and technological modifications and guidelines to cope with educational change and contemporary challenges specifically the study:

1. examined the influence of learning spaces on teaching and learning process in the educational change of the twenty-first century
2. ascertained how technology modification of the twenty-first century influence change and continuity in educational planning.
3. investigated the issues and challenges to effective implementation of educational plan in educational changes of the twenty-first century.
4. proffered possible measures to cope with educational change and contemporary challenges in the twenty-first century to ensure effective educational planning and implementation.

### **Research Questions**

1. What are the influences of learning spaces on teaching and learning process in the educational change of the twenty-first century?
2. How does technology modification of the twenty-first century influence change and continuity in educational planning?
3. What are the issues and challenges to effective implementation of educational plan in educational changes of the twenty-first century?
4. What are the measures to cope with educational change and contemporary challenges in the twenty-first century to ensure effective educational planning and implementation?

### **Research Hypotheses**

**H<sub>01</sub>:** There is no significant influence of learning spaces on teaching and learning process in the educational change of the twenty-first century.

**H<sub>02</sub>:** There is no significant influence of technology modification of the twenty-first century on change and continuity in educational planning.

### **Significance of the Study**

The findings of this study will be of immense benefit to teachers to maximize the available school-built facility provided in the school to enhance teaching and learning process. The findings of the study would help Ministry of education in all over the world to provide a lot of facilities and training in order to enhance the use of advanced technologies in the twenty-first century teaching and learning process. The finding of the study will help educational planners/policy makers to be aware of the importance of spatial requirements and technological modification in building of school facilities in the twenty-first century. This will enable them to make policies that can stand the test of time to meet the educational changes. The outcome of this study will be an additional reference material to other stakeholders in education such as the ministry of education and government in identifying the key issues and challenges of effective implementation of educational plan in educational changes. More so, the findings of the study would help government both at state and national level to be aware of the need to provide adequate learning spaces and modern technology facilities that can accommodate and facilitate learning modes such as collaboration, explicit instruction, independent work, feedback and reflection as well as experiential learning, which are believed to lead to improvements in students' engagement and motivation.

## **METHODOLOGY**

### **Research Design**

The study adopted a survey research design which only requires the gathering of information from the population sample without manipulating any variable. The choice is also premised on the fact that the study involved investigating a sample of the population and generalizing the result.

### **Population of the Study**

The population of the study is made up of all secondary school teachers in south-west Nigeria.

### **Sample and Sampling Technique**

Six hundred (600) secondary school teachers were purposively selected



from thirty (30) secondary schools in south-west Nigeria. Among the thirty schools, six (6) secondary schools were randomly selected from five (5) states in south-west Nigeria. Twenty (20) teachers each were randomly selected from each of the thirty (30) secondary schools in south-west Nigeria.

**Instrument for Data Collection**

The instrument used for data collection is a self-developed questionnaire titled ‘Educational Change and Contemporary Challenges Questionnaire (ECCCQ).’ The instrument is made up of five sections consisting twenty-seven (27) items designed in line with the title of this study. Section A of the questionnaire was on bio-data information such as, respondent’s gender, age, academic qualification and years of experience. Responses was based four-point scale, of “Strongly Agree” (SA = 4), “Agree” (A = 3), “Disagree” (D = 2) and “Strongly Disagree” (D = 1). The instrument was given to three experienced secondary school teachers to assess the validity before it was administered to twenty teachers of the population sample who were not involved in the real study. Their responses were analyzed and a reliability coefficient of 0.85 was obtained.

**Method for Data Collection**

The instrument for the study was distributed to the respondents. The instrument was retrieved immediately after they have been correctly filled by the respondents.

**Method of Data Analyses**

Data were analyzed using frequency count, percentages mean standard deviations and Pearson’s product moment correlation. The percentages aspect of descriptive statistics was used to answer research questions one (1), two (2), three (3) and four (4) while Pearson’s product moment correlation was used for research hypotheses one (1) and two (2).

**RESULTS**

**Table 1: Analysis of the influence of learning spaces on teaching and learning process in the educational change of twenty-first century**

| S/<br>N | Items   | SA               | A                | D               | SD             | Mea<br>n | XD   |
|---------|---|------------------|------------------|-----------------|----------------|----------|------|
| 1.      | Classroom design helps students spent more time collaborating | 319<br>53.2<br>% | 195<br>32.5<br>% | 60<br>10.0<br>% | 26<br>4.3<br>% | 3.35     | .829 |

|    |   |                  |                  |                 |                |      |          |
|----|---|------------------|------------------|-----------------|----------------|------|----------|
|    | and interacting with their peers  |                  |                  |                 |                |      |          |
| 2. | Students are actively engaged with the lesson due to their adequate learning space                                    | 211<br>35.2<br>% | 304<br>50.7<br>% | 63<br>10.5<br>% | 22<br>3.7<br>% | 3.17 | .75<br>8 |
| 3. | Classroom design also facilitate ample opportunities to enhance student creativity and innovation                     | 228<br>38.0<br>% | 260<br>43.3<br>% | 99<br>16.5<br>% | 13<br>2.2<br>% | 3.17 | .77<br>7 |
| 4. | Renovation and redesign of classroom enable students' communication and problem-solving skills                        | 221<br>36.8<br>% | 283<br>47.2<br>% | 71<br>11.8<br>% | 25<br>4.2<br>% | 3.17 | .79<br>2 |
| 5. | Learning spaces helps to promote students' interest towards learning  | 249<br>41.5<br>% | 250<br>41.7<br>% | 78<br>13.0<br>% | 23<br>3.8<br>% | 3.21 | .81<br>0 |
| 6  | Classroom design encourages students to learn and have easy access to a range of educational technologies designed to | 317<br>52.8<br>% | 185<br>30.8<br>% | 80<br>13.3<br>% | 18<br>3.0<br>% | 3.34 | .81<br>9 |

|  |                     |  |  |  |  |  |  |
|--|---------------------|--|--|--|--|--|--|
|  | facilitate learning |  |  |  |  |  |  |
|--|---------------------|--|--|--|--|--|--|

Table 1 shows the analysis of influence of learning spaces on teaching and learning process in the educational change of twenty-first century. Majority of the respondents agreed that: classroom design helps students spent more time collaborating and interacting with their peers (85.7%); students are actively engaged with the lesson due to their adequate learning space (85.9%); classroom design also facilitate ample opportunities to enhance student creativity and innovation (81.3%); renovation and redesign of classroom enable students communication and problem solving skills (84.0%); learning spaces helps to promote students’ interest towards learning (83.2%); classroom design encourages students to learn and have easy access to a range of educational technologies designed to facilitate learning (83.6%); The above table shows that majority 83.9% of the respondents agreed that learning spaces influence teaching and learning process in the educational change of twenty-first century .

**Table 2: Analysis of how technology modification of twenty-first century influence change and continuity in educational planning**

| S/ N | Items   | SA            | A             | D             | SD         | Mea n | XD   |
|------|---|---------------|---------------|---------------|------------|-------|------|
| 1.   | Emergence of technology will make it possible to work with large data sets, e.g., to record statistics of student results | 152<br>25.3 % | 258<br>43.0 % | 140<br>23.3 % | 50<br>8.3% | 2.85  | .894 |
| 2.   | Technology provides the help and complementary supports for both teachers and students                                    | 228<br>38.0 % | 234<br>39.0 % | 98<br>16.3 %  | 40<br>6.7% | 3.08  | .897 |

|    |   |                  |                  |                  |                 |      |          |
|----|---|------------------|------------------|------------------|-----------------|------|----------|
| 3. | Technology help teachers and students for effective learning with the help of the computers to serve the purpose of learning aids | 167<br>27.8<br>% | 258<br>43.0<br>% | 138<br>23.0<br>% | 37<br>6.2%      | 2.93 | .86<br>6 |
| 4. | With the development of learning technologies in the twenty-first century, education system has changed rapidly                   | 214<br>35.7<br>% | 209<br>34.8<br>% | 113<br>18.8<br>% | 64<br>10.7<br>% | 2.96 | .98<br>6 |
| 5. | Technologies enable easy access and comprehensive teaching and learning environment.  | 213<br>35.5<br>% | 251<br>41.8<br>% | 101<br>16.8<br>% | 35<br>5.8%      | 3.07 | .86<br>8 |
| 6  | Usage of technologies in teaching and learning process could improve students' achievement  | 183<br>30.5<br>% | 269<br>44.8<br>% | 110<br>18.3<br>% | 38<br>6.3%      | 2.99 | .86<br>2 |
| 7  | Usage of ICT in pedagogy could increase students' creativity and thinking skills  | 188<br>31.3<br>% | 249<br>41.5<br>% | 117<br>19.5<br>% | 46<br>7.7%      | 2.97 | .90<br>3 |

Table 2 shows the analysis of how technology modification of twenty-first century influence change and continuity in educational

planning. Majority of the respondents agreed that: emergence of technology makes it possible to work with large data sets, for example, to record statistics of student results (68.3%); technology provides the help and complementary supports for both teachers and students (77.0%); technology help teachers and students for effective learning with the help of the computers to serve the purpose of learning aids (70.8%); with the development of learning technologies in the twenty-first century, education system has changed rapidly (70.5%); technologies enable easy access and comprehensive teaching and learning environment (77.3%); usage of technologies in teaching and learning process could improve students’ achievement (75.3%); usage of ICT in pedagogy could increase students’ creativity and thinking skills (72.8%); The above table revealed that majority of the respondents agreed technology modification of twenty-first century influence change and continuity in educational planning.

**Table 3: Analysis on the Issues and challenges to effective implementation of educational plan in educational changes of twenty-first century**

| S/ N | Items  | SA            | A             | D             | SD          | Mea n | XD   |
|------|--|---------------|---------------|---------------|-------------|-------|------|
| 1.   | Lack of care at the initiation stage.  | 215<br>35.8 % | 247<br>41.2 % | 101<br>16.8 % | 37<br>6.2 % | 3.07  | .878 |
| 2.   | Lack of adequate planning skills   | 193<br>32.2 % | 256<br>42.7 % | 106<br>17.7 % | 45<br>7.5 % | 2.99  | .894 |
| 3.   | Insufficient understanding of what change is like                              | 245<br>40.8 % | 264<br>44.0 % | 56<br>9.3%    | 35<br>5.8 % | 3.20  | .834 |
| 4.   | Blindness to the existing educational culture and teaching learning conditions | 162<br>27.0 % | 324<br>54.0 % | 82<br>13.7 %  | 32<br>5.3 % | 3.03  | .788 |
| 5.   | Inadequate funds/ financial constraints  | 187<br>31.2 % | 259<br>43.2 % | 98<br>16.3 %  | 56<br>9.3 % | 2.96  | .921 |

|   |   |       |       |       |      |      |      |
|---|---|-------|-------|-------|------|------|------|
| 6 | Lack of in-service training on educational management | 199   | 295   | 89    | 17   | 3.13 | .760 |
|   |   | 33.2% | 49.2% | 14.8% | 2.8% |      |      |
| 7 | Misappropriation of development funds                 | 144   | 332   | 102   | 22   | 2.99 | .747 |
|   |   | 24.0% | 55.3% | 17.0% | 3.7% |      |      |
| 8 | Emerging issues /new challenges                       | 144   | 292   | 126   | 38   | 2.90 | .834 |
|   |   | 24.0% | 48.7% | 21.0% | 6.3% |      |      |
| 9 | Failure to involve the key stakeholders               | 179   | 280   | 103   | 38   | 3.00 | .851 |
|   |   | 29.8% | 46.7% | 17.2% | 6.3% |      |      |

Table 3 shows the analysis on the Issues and challenges to effective implementation of educational plan in educational changes of twenty-first century. Majority of the respondents agreed that; lack of care at the initiation stage (77%); lack of adequate planning skills (74.9%); insufficient understanding of what change is like (84.8%); blindness to the existing educational culture and teaching learning conditions (81.0%), inadequate funds/ financial constraints (74.4%); lack of in-service training on educational management (82.4%); misappropriation of development funds (79.3%); emerging issues /new challenges (72.7%); failure to involve the key stakeholders (76.5%); The above table showed majority of the respondents agreed that issues and challenges to effective implementation of educational plan in educational changes of twenty-first century includes, blindness to the existing educational culture and teaching learning conditions, insufficient understanding of what change is like, lack of adequate planning skills, misappropriation of development funds, lack of in-service training on educational management and failure to involve the key stakeholders.

**Table 4: Analysis on the measures to cope with educational change and contemporary challenges in twenty-first century to ensure effective educational planning and implementation**

| S/N | Items   | SA    | A     | D     | SD   | Mean | XD   |
|-----|---|-------|-------|-------|------|------|------|
| 1.  | Schools should carry out strengths, weaknesses, | 162   | 304   | 103   | 31   | 2.99 | .806 |
|     |   | 27.0% | 50.7% | 17.2% | 5.2% |      |      |

|    |   |              |              |              |            |      |      |
|----|---|--------------|--------------|--------------|------------|------|------|
|    | opportunities and threats analysis/needs assessment   |              |              |              |            |      |      |
| 2. | Schools should have clear vision/mission and objectives   | 155<br>25.8% | 313<br>52.2% | 101<br>16.8% | 31<br>5.2% | 2.99 | .796 |
| 3. | Educators and principals should undergo educational administration and planning course  | 147<br>24.5% | 310<br>51.7% | 91<br>15.2%  | 52<br>8.7% | 2.92 | .859 |
| 4. | School policies regarding development planning needs to have a clearly defined framework and strategies to achieve its goals.   | 216<br>36.0% | 263<br>43.8% | 97<br>16.2%  | 24<br>4.0% | 3.12 | .818 |
| 5. | There is need to actively involve all key stakeholders in development planning since school level change will be supported by all stakeholders to shared ideas, mechanisms, | 194<br>32.3% | 303<br>46.0% | 89<br>18.2%  | 14<br>3.8% | 3.13 | .741 |

|   |   |              |              |              |            |      |      |
|---|---|--------------|--------------|--------------|------------|------|------|
|   | and processes that appeared to be promising for promoting systemic change and quality improvement             |              |              |              |            |      |      |
| 6 | Educational policies need to work towards strengthening of local participation in education service delivery. | 192<br>32.0% | 276<br>46.0% | 109<br>18.2% | 23<br>3.8% | 3.06 | .808 |

Table 4 shows the analysis on the measures to cope with educational change and contemporary challenges in twenty-first century to ensure effective educational planning and implementation. Majority of the respondents agreed that: schools should carry out strengths, weaknesses, opportunities and threats analysis/needs assessment (77.7%); schools should have clear vision, mission and objectives (78.0%); educators and principals should undergo educational administration and planning course (76.2%); school policies regarding development planning needs to have a clearly defined framework and strategies to achieve its goals (79.8%); there is need to actively involve all key stakeholders in development planning since school level change will be supported by all stakeholders to shared ideas, mechanisms, and processes that appeared to be promising for promoting systemic change and quality improvement (78.3%); educational policies need to work towards strengthening of local participation in education service delivery (78.0%). Table 4 showed majority of the responses of the respondents agreed that measures to cope with educational change and contemporary challenges in twenty-first century to ensure effective educational planning and implementation includes the need to actively involve all key stakeholders in development planning, there is need for school policies regarding development planning to have a clear defined framework and strategies to achieve its goals, schools should also have clear vision/ mission and objectives. More so, there is need for educators and principals to undergo educational administration and planning



course. Respondents also reported that they considered that the school should carry out strengths, weaknesses, opportunities and threats analysis/needs assessment for the schools and educational policies need to work towards strengthening of local participation in education service delivery.

**Table 5: Summary of Pearson Product Moment correlation on how learning spaces influence teaching and learning process in the educational change of twenty-first century**

| Variable              | N   | Mean  | SD    | Df  | R      | Sig (2-tailed) | Remark      |
|-----------------------|-----|-------|-------|-----|--------|----------------|-------------|
| Learning space        | 600 | 1.463 | .4995 | 198 | 0.113* | 0.051          | Significant |
| Teaching and learning | 600 | 2.827 | .9449 |     |        |                |             |

\*\*Correlation is significant at the 0.001 level (2-tailed)

A Pearson product-moment correlation analysis was used to provide answer to the first research hypothesis. As shown in Table 5. The result revealed that there is a strong influence of learning spaces on educational change of twenty-first century ( $r=0.113$ ,  $df=198$ ,  $p<0.05$ ). This implied that there is a strong significant influence of learning spaces on teaching and learning process in the educational change of twenty-first century.

**Table 6: Summary of Pearson Product Moment Correlation on the influence of Technology**

**Modification of twenty-first century on Change and Continuity in Educational Planning**

| Variable                | N   | Mean  | SD    | DF  | R      | Sig (2-tailed) | Remark      |
|-------------------------|-----|-------|-------|-----|--------|----------------|-------------|
| Educational planning    | 600 | 1.463 | .4994 | 198 | 0.196* | 0.001          | Significant |
| Technology modification | 600 | 2.833 | .9671 |     |        |                |             |

\*Correlation is significant at the 0.001 level (2-tailed)

The result shows that there is a significant influence of technology

modification of twenty-first century on change and continuity in educational planning ( $r=0.196$ ,  $df=198$ ,  $p<0.05$ ). This implies that technology modification of twenty-first century plays a pivotal role on change and continuity in educational planning.

### **Discussions**

The study revealed that majority of the respondents agreed that learning spaces influence teaching and learning process in the educational change of twenty-first century. This finding is in conformity with Uduku, (2015) who posited that learning space, whether digital or physical, is the most vital contemporary infrastructure requirement for learning in the twenty-first century. This is also in line with the findings of Marx, et al., cited in Adedokun, Parker, Henke and Burgess (2017) which confirmed that seating arrangement in semi-circles or similar configurations could facilitate interactive behaviours in teaching/learning process such as asking questions or collaborative learning. Therefore, the influence of learning spaces in twenty-first century teaching/learning process cannot be overemphasized; hence there is need for proper educational planning that incorporate adequate spatial requirement.

The study also revealed that majority of the respondents agreed that technology modification of twenty-first century influences change and continuity in educational planning thereby supporting U.S. Department of Education (2017) that the emergence of technology into design is also an important part of planning for today's learning environments. Therefore, technology modification in twenty-first century has allowed us to rethink the way schools are designed to promote physical learning spaces that accommodate new and expanded relationships among teachers and the students.

The study also showed that majority of the respondents agreed that issues and challenges to effective implementation of educational plan in educational changes of twenty-first century includes, blindness to the existing educational culture and teaching learning conditions, insufficient understanding of what change is like, lack of adequate planning skills, misappropriation of development funds, lack of in-service training on educational management and failure to involve the key stakeholders. This finding is in tandem with Ngunju (2009) who posited that there are several challenges to effective implementation of educational plan, which may include lack of planning skills among head teachers, failure to involve key stakeholders, high turnover of head teachers, lack of finances, poorly made development plans, and lack of support from stakeholders. However, these factors affect the effective implementation of educational plan in educational changes of twenty-first century.

The study further revealed that majority of the respondents opined that

measures to cope with educational change and contemporary challenges in twenty-first century to ensure effective educational planning and implementation includes the need to actively involve all key stakeholders in the development planning, there is need for school policies regarding development planning to have a clear defined framework and strategies to achieve its goals, schools should also have clear vision mission and objectives. Moreso, there is need for educators and principals to undergo educational administration and planning course. Respondents also reported that they considered that the school should carry out strengths, weaknesses, opportunities and threats analysis/needs assessment for the schools and educational policies need to work towards strengthening of local participation in education service delivery. Similar result was reported by Darling-Hammond's (2009) that one of the factors to cope with educational change and contemporary challenges is professional development for teachers and stakeholders in education. Further, Harlen and Hayward, (2010) opined that time for reflection on changes is a crucial factor for embedding and sustaining developments. However, Hargreaves & Fullan, (2012) posited that core ingredients in pulling change, as found in good examples from Canada, Finland and Queensland, Australia, are: collective responsibility, testing a bit but not too much and trust.

The result also indicated that there is strong significant influence of learning spaces on teaching and learning process in the educational change of twenty-first century. However, learning space whether digital or physical is recognized as socially constructed, and the most important contemporary infrastructure requirement for learning in the twenty-first century that could foster effective teaching and learning process because education has to meet the needs of the globalized classroom In this view, educational change has undergone several phases of development. This is in tandem with agreement of Cleveland (2016); Neill and Etheridge (2008) posited that effective design of leaning spaces has been found to facilitate constructivist pedagogy and student engagement.

The result further shows that there is a significant influence of technology modification of twenty-first century on change and continuity in educational planning. This implies that technology modification of twenty-first century plays a pivotal role on change and continuity in educational planning. It also observed that the incorporation of technology modification in twenty-first century improves teaching and learning processes across all subjects and ages. This could be translated to mean that incorporation of technology modification in twenty-first century increases the motivation of children and enhances the process of addressing their individual learning needs and also improves the enjoyment and interest in learning and augments self-directed learning. The assertion made above also agreed with

Chandra and Mills (2015) which revealed that the incorporation of virtual space into learning environments necessitates additional modifications to both the built environment and the pedagogical approach to capitalize on the affordances of technology.

### **Conclusion**

The study identified spatial, functional, and technological modifications and guidelines to cope with educational change and contemporary challenges. The study revealed that majority of the respondents agreed that learning spaces influence teaching and learning process in the educational change of twenty-first century. The study also revealed majority of the respondents agreed that technology modification of twenty-first century influence change and continuity in educational planning. The study further showed that the issues and challenges to effective implementation of educational planning in educational changes of twenty-first century includes, blindness to the existing educational culture and teaching learning conditions, insufficient understanding of what change is like, lack of adequate planning skills, misappropriation of development funds, lack of in-service training on educational management and failure to involve the key stakeholders. More so, the study revealed that measures to cope with educational change and contemporary challenges in twenty-first century to ensure effective educational planning and implementation includes the need to actively involve all key stakeholders in development planning, there is need for school policies regarding development planning to have a clear defined framework and strategies to achieve its goals, schools should also have clear vision mission and objectives. In addition, there is need for educators and principals to undergo educational administration and planning course. Respondents also reported that they considered the school to carry out strengths, weaknesses, opportunities and threats analysis/needs assessment; educational policies need to work towards strengthening of local participation in education service delivery. The result also indicated that there is strong significant influence of learning spaces on teaching and learning process in the educational change of twenty-first century and there is a significant influence of technology modification of twenty-first century on change and continuity in educational planning. This implied that technology modification of twenty-first century plays a pivotal role on change and continuity in educational planning.

### **Recommendations**

1. Effective and efficient educational planning should be built on sound decision and decision-making process in order to

- strengthen educational change of twenty-first century.
2. There is also need for active-learning classroom environment in order to facilitate the changing pedagogical practices needed to support educational change of twenty-first century.
  3. Efforts should be made to conduct evaluations that provide guidelines for learning benefit, associated financial and other costs of new-style learning spaces.
  4. There is a need for stakeholders in education to frequently organize in service training for teachers on technology issues and emerging trends
  5. Flexible learning space should be incorporated in school design to enhance health safety in teaching and learning process.

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## DEVELOPING THE CREATIVE POTENTIAL OF YOUNG SCHOOLCHILDREN

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**Abstract:** *At early school age, school work should fully demand the student's creative forces. Once they enter school, children are trained in an intellectual activity, largely unknown to them. In such situations, life experience and previously acquired knowledge prove to be insufficient for obtaining a positive result and children have the opportunity to activate and capitalize on their creative potential. It is about one of the sensitive periods in the child's life, when certain mental qualities, with minimal effort, can be exploited with maximum efficiency and oriented towards the development of creativity. Developing children's creativity should be a permanent concern for teachers. To respond to these needs, a creative, ingenious, imaginative, well-trained teacher is needed who is always discovering new strategies that go beyond templates and contribute to the development of creativity. Thus, the child challenged to create will become the man capable of finding solutions and adapting in a society in permanent change. The presented research aims to bring attention to the need for school intervention for the development of creativity, methods of intervention and the results obtained within an experiment oriented towards this goal: the development of creative potential in young schoolchildren.*

**Key words:** *creativity; predictive reading; free text writing; interactivity.*

### **Conceptual boundaries**

The term creativity was introduced by G.W. Allport (1938) following the understanding of the fact that "the psychic substrate of creation is irreducible to skills and presupposes a general disposition of the personality towards the new, an organization of psychic processes in the personality system" (Burdus, Caprarescu, p.282).

Creativity is defined as "representing the highest human behavioral level, capable of training and focusing all other levels of biological and logical conduct (instincts, skills, intelligence), as well as all the attributes of an individual (thinking, memory, attention, will, affectivity) in the direction for which he is prepared and concerns him, in order to create products that are characterized by originality, novelty, value and social

utility"(V. Feier, 1995, p. 50-53).

Creativity is a process by which the human spirit transcends the present reality and discovers new truths and realities.

V. Oprescu considered creativity as "the ability to make new combinations between two or more concepts already existing in the mind, combinations resulting in products that correspond to individual or social needs; the more independent the elements of the new combination are, the more creative the solution" (Oprescu, 1989, pp. 38-41).

According to P. Popescu-Neveanu "creativity **implies** a general disposition of the personality towards the new, a certain (stylistic) organization of psychic processes in the personality system" (Popescu-Neveanu, 1987, p.52).

Al. Roșca is of the opinion that, due to the complexity of the phenomenon of creation, it is unlikely to be unanimously recognized, since each author emphasizes different dimensions. Thus, it is shown that according to some authors "creativity is the aptitude or ability to produce something new and of value", and according to others it "constitutes a process through which a product is made" (Roșca, 1981, p.16).

"Creativity is a superior human faculty, a psychic process of identifying new possibilities, of ensuring disparate elements, more or less distant, consisting of knowledge accumulated through studies or experience, the combination achieved representing a scientific, technical or artistic, which constitutes a material or spiritual good, useful to society" (Manolescu, 1997, p. 87-98).

In general, in the specialized literature, the dimensions of creativity are considered to be: the creative process, the created product, the creative personality, the environment or the social climate of creation.

### **Creativity in the educational process**

Cultivating creativity has become an important task of schools.

A first step must be taken in the formulation of the instructional-educational objectives, so that the cultivation of creativity stands alongside the education of thinking, by combating the cultural conformity manifested in many of the teachers. Thus, the very progress of thinking in solving problems depends on the creativity factor.

Educating creativity in children of all ages involves achieving the following general objectives (Ionescu, 2000, p.129):

- the formation of a positive attitude towards progress, towards new elements and towards their introduction in one's own actions;
- their readiness to accept the new as an indication of progress, innovations and human creativity;

- encouraging student manifestations characterized by character and original results;
- training and development of skills and capacities to create, rethink work strategies and integrate them into dynamic, flexible and efficient systems;
- the formation and development of capacities to achieve something new: connections, ideas, theories, ideal or material models, material products, etc.

Very important is the attitude of the teacher, his relationship with the students. The authoritarian attitude can create emotional blockages in students. A democratic, relaxed, friendly atmosphere is preferable. The teacher must be close to the students, lenient (within reason) and encourage imagination (Cury, 2005, p. 53).

For the development of students' creativity, there are non-specific means, which are not related to any educational object, and specific methods for a certain subject, depending on its content.

The first category includes imaginative-inventive activities.

The role of these non-specific methods is to develop creative attitudes.

The progress of creativity is also achieved through specific methods.

### **Methods of developing creativity**

During the research, in the experimental stage, the following methods were used: Free text writing, Predictive reading, Research hypotheses, Philips 6-6, Thinking hat method, Snowballs, Quintet.

In this paper we present in detail only two methods: Free text writing and Predictive reading, which are less known and used in school practice. They can be used in particular within the Romanian language and literature discipline.

#### ***Free text writing***

The Free Text Writing method is a method that increases the student's interest in written composition. The method develops creative expression and encourages the person to write without constraints or strict rules. This is a great way to free your imagination and explore new ideas without being limited by formal structures or grammar rules. This method can be used to develop creativity, to clarify thoughts or to discharge yourself emotionally. There are no rigid rules. It's about *letting your releasing the creative spirit* and enjoying the writing process.

Here are some steps to go through this method:

1. Students are divided into groups of 4.
2. Each student writes on a piece of paper the titles of three texts they would like to write for 20 minutes.
3. Everyone communicates to their colleagues in the group the titles of the texts, which they are willing to write.

4. They choose the text they would like to listen to.
5. Each student creates a first form, in which he writes ideas, feelings, thoughts, without a logical, chronological order. Spelling problems can be ignored.
6. It is written on one line, so that corrections and additions can be made, individually or through consultation with a colleague or the teacher.
7. Reread and correct the text, by everyone, together with a colleague.
8. The text for the presentation is created: calligraphic rewriting, completing with drawings, writing on the computer, putting it on the page, being another element of creativity that the student should be aware of. This activity can be homework.
9. Read each text in the small group.
10. Some texts are read to the whole group.
11. It is recommended that the teacher works at the same time. This is how the motivational state is formed: WE LEARN together!
12. A booklet or part of a booklet is made (Popa, 2009, p.113)

*Recommendations!*

1. One hour is not enough for such an activity.
2. Allowing the necessary time is recommended.
3. The teacher must teach his students how to present their creation: tone of voice, non-verbal language, eye contact.
4. The booklet will be presented to students in the school and will be taken to the library or a place where peers can browse it.

***Predictive reading***

It is a way to increase students' interest in reading and to exercise creativity, critical thinking and written expression of ideas (Popa, 2009, p.114).

Steps:

1. Divide the class into groups of 4 and distribute the worksheets.
2. The teacher dictates the predictive terms, words from the supporting text.
3. Students create a text using all the words for 3 minutes.
4. Students read the texts in pairs and choose the one they find more interesting.
5. The chosen text is read from each group. The main idea is extracted from each text.
6. The teacher notes on the flipchart the basic idea of each read text.

7. The first fragment of the given text is read. It is recommended that the text has the points that divide it into fragments marked.
8. **It is formulated** The students write it down on the cards and the teacher on the flipchart.
9. The whole class looks at the predictions and compares them with the idea of the text. It is decided which of the predictions is most similar to the idea of the text.
10. The teacher equally appreciates the originality and similarity of the texts created by the students.
11. 7. Each student, for 3 minutes, completes the table with a new prediction.
12. **8. The second fragment is read and the table is completed again.**
13. 9. Do the same with the third fragment, the fourth and so on until the entire text is covered.
14. The discussion network in which the binary-question is passed is completed.
15. Students find at least 2 arguments for and 2 against the idea expressed in the binary question.
16. The teacher places posters in the classroom: PROS, CONS, UNDECISED, in such a way that three groups of students can be formed.
17. Each student positions himself in front of a poster according to his personal opinion.
18. Each group discusses to find the most consistent arguments to support their point of view.
19. In turn, through a representative, each group brings a single argument.
20. It comes back with a new argument, as time allows.
21. 16 Everyone writes their own conclusion. The conclusions are read in the group.
22. Some conclusions are read, including the one made by the teacher, for the whole class.

### *Recommendations!*

The teacher will draw his own conclusions, together with the students, which he will read at the end of the activity. This is how the motivational state is formed: WE LEARN together! (Popa, 2009, p. 114)

### *Research hypothesis*

In carrying out the experimental study, we started from the premise that the development of creativity in young schoolchildren can be stimulated by the use of specific strategies, which demand their interest, respect the particularities of age, and the activities are carried out in a relaxed

atmosphere.

Research hypothesis: If the teacher frequently uses strategies to develop creativity in learning activities, then the children's ability to be creative will increase.

Conducting research

In order to fulfill the objectives and validate the hypothesis, the research was carried out throughout the school year 2022-2023, in the third grade, on an experimental batch comprising 15 students.

There was an experimental intervention in the discipline of Romanian language and literature.

The research was carried out in three stages:

The pre-experimental stage in which the students' creative potential was evaluated, before the start of the experimental research. An initial assessment test was administered.

The test was designed starting from 3 competencies, mentioned in the program. The evaluation of creativity was done on a scale of 10 levels, 1 being the minimum level and 10 being the maximum level.

The experimental stage, the stage of introducing the progress factor, represented by the creativity development methods mentioned, and specific activities were carried out for this purpose, activities with a pronounced interactive character.

Among them we mention:

- creating stories starting from supporting words;
- formulating hypotheses regarding the possibilities of continuation of an event;
- group conversations, based on an overheard text or an image;
- games for changing the stories heard: changing the sequence of events, changing the ending, introducing some characters, etc.;
- making up statements and/or creating stories based on ideas/images, data or drawings created by children;
- games of the type: "Say further", "Continue the verse/stanza", "What would happen if...", "If I were...", "Continue the story";
- creating stories in the group;
- dialogues in real or simulated contexts, on various topics;
- formulating a personal opinion regarding a character/a person's conduct/an event, etc.;
- role-playing games;
- writing stories, diaries, poems, through which the child can express his joy, sadness, delight, pride, following

different experiences;

- the presentation, in writing, of pleasant, funny, surprising experiences, of good deeds.

There was also an intermediate evaluation.

At this stage, the students were often grouped according to the performances achieved, forming groups by performance level. For students who recorded low levels of creativity, from the perspective of the targeted skills, remedial activities were carried out, in order to stimulate spontaneity and the development of creativity.

Students who achieved the minimum level of the specific skills evaluated or those who have already formed them, were included in development groups or were tutors in the remedial groups, depending on the wishes and needs expressed by them.

The post-experimental stage, the comparison stage, of the performances from the initial level, with the intermediate and final level. A final assessment test was applied.

### **Analysis and interpretation of research results**

The tests were designed based on three competencies.

Following the analysis of the initial assessment, the following were found:

At competence 3.1. Extracting some detailed information from informative or literary texts, the students identified the meaning of the message conveyed in the text, 5 formulated hypotheses regarding the possibilities of continuation of events and 10 students encountered difficulties in formulating hypotheses regarding the possibilities of creative continuation of events. Also, expression is cumbersome, entwined with verbal stereotypes. Little creativity was noticed in the hypotheses formulated.

To competence 3.2. Formulating an emotional response to the literary text read, 5 students encountered difficulties in formulating creative sentences with visual support, and 7 students formulated less creative sentences. 2 students managed to formulate creative answers.

Competence 4.4. Briefly recounting an imagined/lived event, 8 students have difficulties in expressing their own opinion, when writing stories, dialogues. The lack of creativity and originality is shown by 5 students when writing a surprising experience. 2 students managed to answer creatively.

Following the analysis of the intermediate evaluations, the following were found:

At competence 3.1. Extracting some detailed information from informative or literary texts, the students identified the meaning of the message conveyed in the text, 8 formulated hypotheses regarding the possibilities of creative continuation of events and 7 students

encountered difficulties in formulating hypotheses regarding the possibilities of creative continuation of events. Also, expression is cumbersome, entwined with verbal stereotypes.

To competence 3.2. Formulating an emotional response to the literary text read, 4 students encountered difficulties in formulating creative sentences with visual support, and 6 students formulated less creative sentences. 4 students managed to formulate creative answers.

Competence 4.4. Briefly recounting an imagined/experienced event, 6 students have difficulties in expressing their own opinion, when writing stories, dialogues. The lack of creativity and originality is shown by 6 students when writing a surprising experience. 3 students managed to answer creatively.

Following the analysis of the final evaluations, the following were found:

At competence 3.1. Extracting some detailed information from informative or literary texts, the students identified the meaning of the message conveyed in the text; 5 students encountered difficulties in formulating some hypotheses and 10 formulated hypotheses regarding the possibilities of creative continuation of the events. The expression became more nuanced.

To competence 3.2. Formulating an emotional response to the literary text read, 2 students encountered difficulties in formulating creative sentences with visual support, and 4 students formulated less creative sentences. 9 students managed to formulate creative answers.

Competence 4.4. Briefly recounting an imagined/experienced event, 2 students have difficulties in expressing their own opinion, when writing stories, dialogues. The lack of creativity and originality is shown by 3 students when writing a surprising experience. 10 students managed to answer creatively.

## **Conclusions**

The purpose of this work was to introduce into the classroom teaching activity interactive strategies that require the mechanisms of imagination and creativity, that activate the students to make a greater effort, to undertake a mental action of search, research and rediscovery of truths. Creative capabilities have been developed, demonstrated in a linear ascending line following the application of interactive methods such as: (Research hypotheses, Philips 6-6, Thinking Hats Method, Snowballs, Quintet, Free Text Writing, Predictive Reading);

Following the analysis and interpretation of the results obtained at the initial, intermediate and final assessments, it was found that the students' results increased.

The graph below shows the individual evolution of the students, through a comparative analysis of the three evaluations (initial evaluation,



intermediate evaluation, final evaluation) regarding the discipline Romanian Language and Literature.

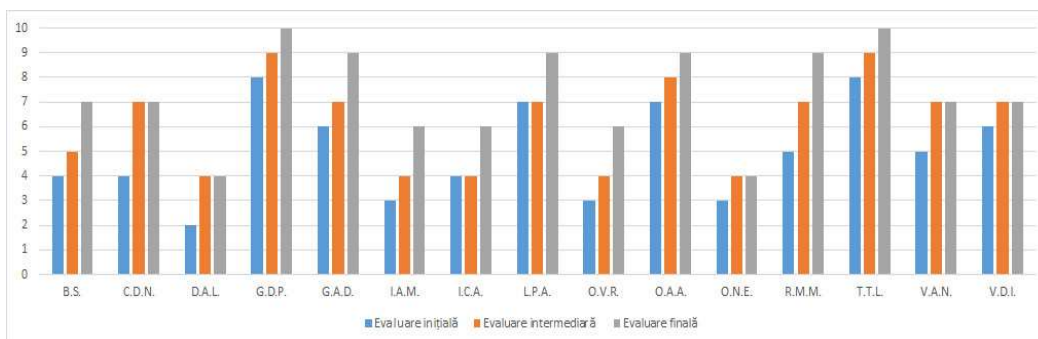


Figure 1. Individual comparative results obtained in Romanian language and literature

Two students with a score of 4 and 7 did not make progress in the intermediate stage. In the final stage, two students did not make progress compared to the intermediate assessment.

During the experiment all students made progress. The highest progress was achieved by 4 points by 2 students from 5 to 9 and the lowest progress by 1 point from 3 to 4. Most of the students, 7, achieved a progress of 2 points and 5 students a progress of 3 points.

The evolution of students by class, through a comparative analysis, in the form of the average, in the discipline Romanian language and literature (initial evaluation, intermediate evaluation, final evaluation) confirmed the progress, in a linear form; from 5, in the initial assessment, to 6 in the intermediate assessment and 7 in the final assessment.

Following the analysis of the research results, we formulated conclusions regarding the influence of the application of some interactive strategies, for the development of creativity.

The use of interactive didactic strategies stimulated the students' creativity, each making progress of at least 1 point.

Following the use of the stated methods and the differentiated activities with an interactive character, the collaboration and communication relationships between the children improved. All students engaged both cognitively and creatively and were more responsible. Even the less sociable participated in discussions and debates.

The working climate in the classroom was relaxed. During the activities they communicated and asked questions, were interested, persistent, motivated, which led to increased creativity. Students gained confidence in themselves, that they can deduce and have the ability to create something original from their creativity, thinking and imagination.

Creativity is not something that some have and others don't, all children

have it and it is imperative that teachers create the environment **worthwhile** to the manifestation of creativity, offering them work assignments and topics of interest, adapted to their age and level of development .

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## STUDENTS' PERCEPTION OF DIDACTIC FEEDBACK IN UNIVERSITY EDUCATION

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**Abstract:** *This article is based on the study of students and master's students' perception of didactic feedback in university education. Effective feedback is designed to determine the level of understanding and development of a learner's skills, as well as to plan the next steps in order to achieve learning intentions or objectives. In order to identify the way in which the students and master's students perceive the feedback provided by the teaching staff in university courses and seminars, we applied an online questionnaire to a number of 160 subjects. The answers received to the 10 questions of the questionnaire were statistically processed and presented in the paper, in order to provide an overview of the following aspects of the didactic feedback: the degree of satisfaction of students, on the way in which the teaching staff provides feedback in the courses and university seminars; the extent to which students and master's students are encouraged by the teaching staff to provide feedback during courses and seminars; the advantages and disadvantages of giving and receiving didactic feedback on those who learn; the way in which students and master's students would prefer feedback to be provided by teaching staff; the perceived influence of didactic feedback on the motivation for learning; the extent to which teachers' feedback influences the academic performance of students and master's students; the feedback collection methods frequently used by teachers; the type of didactic feedback preferred by students and master's students; proposing ways to provide feedback, which will make students and master's students more motivated to learn.*

**Key words:** *didactic feedback; students' motivation; academic performance; academic satisfaction; students' perception.*

### 1. Introduction

In higher education, new theories of didactic feedback focus on developing a culture of feedback that emphasizes the needs and active

participation of students, promoting a learning environment in which they are directly involved in their own educational process. According to Carless and Boud (2018), this “feedback culture” involves not only teachers’ provision of corrective comments or assessments, but also an open and ongoing dialogue between teachers and students, as well as between students themselves. The aim of this model is to turn feedback into an essential tool for developing reflexivity and self-regulation of learning.

## 2. Theoretical foundation

Clarifying the concept of feedback at the educational micro-level is carefully analyzed in the pedagogical literature. In particular, in the **Dictionary of Pedagogy**, feedback is defined as a mechanism for regulating the educational process, at this level, through which feedback can be given and received by both educators and learners. It includes both the action by which educators obtain information about the effects of their pedagogical efforts, and the action by which learners receive information about the results of their learning efforts. It emphasizes that feedback is a fundamental principle of didactic communication activities, facilitating effective teaching and learning processes.

A concrete example of this mechanism is described as follows: "Feedback involves ambivalence, it manifests itself during the direct or mediated interaction between the teacher and the student/pupil, and can be given and received by both. (...) The more complex and in greater quantity the feedback is, the higher the quality of didactic communication. (...) The feedback collected and constantly offered by teachers allows the negotiation of the didactic act, so that it responds to a greater extent to the specific training needs" (Bocoş et al., 2021).

The functions of feedback that reflect on both the teaching and learning activities are emphasized, contributing to the growth of the repertoires of knowledge, skills, language and common behaviors between those who are educated and those who educate them. (...) The means of obtaining feedback differ according to the lesson category, but there are also some that are universal (non-verbal indicators of conscious participation, the degree of active involvement, independent work). (...) Feedback in education does not only aim at the relationship between the agents of educational action, but also at that between teaching, learning and evaluation, as elements of the instructive-educational process." (S.-E. Bernat, 2003).

Without aiming to detail the conceptual elements, we present the current meanings that highlight the active role of students in the **feedback process**, shifting the emphasis from a traditional approach, where students are mere receivers, to one where they become active participants. Thus, we identify:

- **feedback as a collaborative process:** One of the new models in development is the relational approach to feedback, where the discussion between teacher and student is seen as an open collaboration. This type of feedback is intended to encourage reflection and continuous learning, providing support for the development of students' critical skills (Heron et al., 2023).
- **feedback literacy:** Modern theory promotes the concept of "feedback literacy," which involves both students' ability to understand and use feedback, and teachers' ability to provide it in an accessible and constructive way. This is based on student-centred learning, with the aim of encouraging active engagement and self-assessment (Molloy et al., 2020).
- **online feedback and peer feedback:** Another relevant dimension is online feedback, especially peer feedback, which is becoming increasingly popular in virtual learning environments. It has been shown to be effective in developing critical skills and stimulating reflective thinking among university students (Theelen et al., 2023). The conditions of the online environment also have an important impact on how feedback is given and received.

From the perspective of effective feedback, it is essential to assess the level of understanding and development of a learner's skills, but also to guide his future learning path. This type of feedback is based on several modern educational theories that emphasize both the evaluative and formative components of the educational process.

- **Constructivist learning theory (Piaget, 1967; Vygotsky, 1978)** emphasizes that students actively construct their knowledge through interaction with the environment and with others. In this context, effective feedback must support the development of autonomy and facilitate self-regulation of learning (Piaget, 1967; Vygotsky, 1978). An example of effective feedback is formative feedback, which not only evaluates performance, but provides concrete suggestions for improving it, helping students plan next steps and achieve educational goals. Thus, feedback plays a crucial role in adjusting cognitive and strategic processes for deep and continuous learning.
- **The student-centered feedback model (Nicol and Macfarlane-Dick, 2006)** emphasizes the active involvement of students in the feedback process, which contributes to the development of self-reflection skills. Effective feedback should be clear, specific and provide guidance on how performance can be improved. In addition, this model emphasizes the importance of supporting self-regulated learning by giving students the

opportunity to evaluate and adjust their own learning methods, enabling them to become autonomous learners.

- **Feedback literacy (Molloy and Boud, 2020)** implies that students must develop skills not only to receive feedback, but also to understand and use it effectively. Feedback is not only an assessment tool, but also a process of training metacognitive skills essential for educational progress. Effective feedback, according to this theory, should teach students to critically analyze feedback, internalize it, and apply suggestions to improve future performance.
- **The zone of proximal development theory (Vygotsky, 1978)** suggests that learning is maximized when learners receive adequate support to push beyond the current limits of their competence, in an area known as the "zone of proximal development." Effective feedback, in this context, identifies this area and provides clear guidance for progress. Feedback should be challenging yet accessible, thus supporting students in moving to the next level of competence, ensuring sustained skill development.
- **Assessment for Learning (Assessment for Learning - AfL, Black & Wiliam, 1998)**, according to this approach, assessment and feedback are not just marking mechanisms, but essential tools for the continuous improvement of learning. Feedback provided in AfL (Black & Wiliam, 1998) provides students with useful information about their current performance and guides them on the steps needed to achieve educational goals. This type of feedback involves clear communication and is geared towards developing deeper understanding, facilitating autonomy and self-regulation of learning.

At the same time, in order to provide feedback that motivates students and master's students to learn, it is essential to adopt a personalized approach, clear and focused on the continuous improvement of learning processes. **Ways to provide motivating feedback** are: **specific and constructive feedback**, i.e. the feedback must be clear and specific so that students understand what they did well and what aspects they can improve. Constructive feedback, which outlines steps to take to correct errors, is essential for increasing motivation (Nicol & Macfarlane-Dick, 2006). **Positive and progress-oriented feedback**, as focusing on the positive aspects of the student's work can improve self-confidence and intrinsic motivation. Giving genuine praise and highlighting progress helps maintain a growth mindset (Dweck, 2006). **Continuous and in-process feedback**, providing feedback regularly and throughout the activities, not just at the end, allows students to correct mistakes and adjust their learning strategies, leading to greater engagement in the

proposed activities (Sadler, 1989). **Feedback that encourages self-reflection and autonomy**, such that encouraging students to reflect on their own progress and identify solutions for improvement increases their engagement and motivation. This type of feedback stimulates self-regulation of learning (Nicol, 2010). **Peer-to-peer feedback** assumes that peer feedback can create a collaborative learning environment and motivate students to improve their reflection and critical thinking skills (Theelen et al., 2023). An important aspect is also given by the **use of technology for feedback**, digital feedback, provided through online platforms, that allows quick access and more frequent interactions. Students value prompt and flexible feedback provided through digital media (Gikandi et al., 2011).

From the perspective of the **disadvantages in giving and receiving feedback**, we list the following theories and models that present characteristics necessary to be analyzed by teachers and students:

- **Poor school performance**, as feedback given in a negative, vague or non-specific way can lead to lower school performance. The “low expectations” theory (Rosenthal & Jacobson, 1968), also known as the “Pygmalion effect,” suggests that low expectations of teachers, expressed through feedback, can lead to poorer student performance.
- **Reducing the frequency of attending classes and seminars**, because negative or inadequate feedback can cause students to avoid attending classes. According to deterrence theory (Deci & Ryan, 2000), lack of autonomy and feedback support can reduce intrinsic motivation, which can lead to decreased participation frequency.
- **Decreased self-esteem**, caused by critical or unstructured feedback that can affect students' self-esteem. According to self-efficacy theory (Bandura, 1997), negative perception of one's own competences can lead to decreased self-esteem and confidence in learning abilities.
- **Deterioration of the teacher-student and student-student educational relationship** is given by unfavorable feedback that can damage interpersonal relationships, either between teacher and student or between colleagues. Attachment theory (Bowlby, 1988) applied in education argues that positive relationships are fundamental to social and academic development, and negative feedback can affect these relationships, leading to an atmosphere of tension and mistrust.
- **Conflicts** that arise when feedback is unclear, ambiguous or perceived as critical can lead to conflicts between teacher and student or between peers. According to conflict management theory (Deutsch, 1973), feedback that is perceived as personal

criticism or that does not offer constructive solutions can escalate into open conflict.

### 3. Research objectives

Through this confirmatory research, we set out to identify:

- a. Students' satisfaction degree, about didactic feedback during courses and university seminars.
- b. Students' and master's students' perception about advantages and disadvantages of giving and receiving didactic feedback.
- c. Students' and master's students' preferences about receiving the didactic feedback from teachers.
- d. The perceived influence of didactic feedback on learning motivation and students' academic performance.
- e. Feedback collection methods frequently used by teachers and the didactic feedback types, preferred by students and master's students.

### 4. Research methodology

In order to achieve the research objectives, we carried out a survey based on a questionnaire, by building an online questionnaire, applied in Google docs, which totaled 10 questions, of which the first 9 with multiple choice answers and the last question requested the construction an own answer. This questionnaire was applied to a number of 160 students and master's students, from the "1 December 1918" University in Alba-Iulia.

### 5. Research results

Following, we present the results of the confirmatory research carried out by us, based on the questionnaire applied to a number of 160 subjects. The first question of the questionnaire considers the degree of satisfaction regarding the way teachers provide feedback in courses and seminars.

| Variants of answer     | N   | f  | %      |
|------------------------|-----|----|--------|
| 1 (unsatisfied)        | 160 | 2  | 1.30%  |
| 2 (slightly satisfied) | 160 | 1  | 0.60%  |
| 3 (neutral)            | 160 | 19 | 11.90% |
| 4 (satisfied)          | 160 | 53 | 33.10% |
| 5 (very satisfied)     | 160 | 85 | 53.10% |

*Table no. 1. The degree of satisfaction regarding the way in which teachers provide feedback in courses and seminars*

As can be seen from Table no. 1. most of the surveyed students and master's students declare themselves satisfied and very satisfied with the way in which the teachers give feedback in the didactic activities of the



university. Among the 160 subjects of the research, 53.10% state that they are very satisfied with the way the teachers provide feedback in courses and seminars, while 33.10% state that they are satisfied. Only 11.90% indicate a neutral answer to this question of the questionnaire, and the degree of dissatisfaction of the subjects is very low, 0.60% slightly satisfied and 1.30% dissatisfied.

The second question of the questionnaire concerns the degree to which students and master's students are encouraged to provide feedback during courses and seminars.

| Variants of answer         | N   | f  | %      |
|----------------------------|-----|----|--------|
| 1 (to a very small extent) | 160 | 1  | 0.60%  |
| 2 (to a small extent)      | 160 | 5  | 3.10%  |
| 3 (neutral)                | 160 | 18 | 11.30% |
| 4 (mostly)                 | 160 | 46 | 28.70% |
| 5 (to a very large extent) | 160 | 90 | 56.30% |

*Table no. 2. The degree to which students and master's students are encouraged to provide feedback during courses and seminars*

From Table no. 2. it can be observed that the students and master's students declare to a very large extent 56.30% and mostly 28.70%, that they are encouraged by the university teaching staff to provide feedback in the courses and seminars. Also, 11.30% of the subjects do not have a clear opinion and choose the neutral answer, while 3.10% are somewhat satisfied, and 0.60% are somewhat dissatisfied. Thus, it can be interpreted that this aspect of the university teaching activity is well fulfilled by the teaching staff.

The following question aimed to identify the advantages of teachers' feedback, on students and master's students.

| Variants of answer   | N   | f  | %      |
|--|-----|----|--------|
| Increases motivation   | 160 | 96 | 60.00% |
| It supports student-centered learning and collaborative learning | 160 | 84 | 52.50% |
| Increases self-esteem  | 160 | 57 | 35.60% |
| It contributes to obtaining high performance in learning         | 160 | 63 | 39.40% |
| It optimizes the educational process                             | 160 | 66 | 41.30% |
| It improves educational relations                                | 160 | 58 | 36.30% |
| Increases the frequency of participation in courses and seminars | 160 | 64 | 40.00% |

*Table no. 3. The advantages of teachers' feedback on students and master's students*

Thus, from Table no. 3. it turns out that the majority of 60% of the subjects of our research indicated the increase in student motivation as the main advantage of providing feedback by teachers, followed by 52.50% of supporting student-centered learning and collaborative learning. Then with very close percentages, the following statements are chosen as advantages of the feedback of university teachers, in the following order: optimization of the educational process 41.30%, increased frequency of participation in courses and seminars 40%, obtaining high performance in learning 39.40%. With fewer choices, but not to be neglected, the surveyed students and master's students indicate as advantages the positivity of educational relations 36.30% and the increase of self-esteem by 35.60%.

Regarding the students' and master's students' perception of the disadvantages in giving and receiving feedback, offered by teachers, Table no. 4. offers the following perspective.

| <b>Variants of answer</b>   | <b>N</b> | <b>f</b> | <b>%</b> |
|---|----------|----------|----------|
| Demotivation  | 160      | 61       | 38.10%   |
| Low school results  | 160      | 22       | 13.80%   |
| Decrease in the frequency of participation in courses and seminars                  | 160      | 40       | 25.00%   |
| Decreased self-esteem   | 160      | 37       | 23.10%   |
| Deterioration of the professor-student and student-student educational relationship | 160      | 39       | 24.40%   |
| Conflicts   | 160      | 40       | 25.00%   |

*Table no. 4. Students' and master's students' perception of the disadvantages in giving and receiving feedback, offered by teachers*

The most frequently indicated disadvantage, as shown in Table no. 4., is demotivation, chosen by 38.10%, followed by the same proportion of 25% by decreasing the frequency of participation in courses and seminars as well as by conflicts. Very close, with 24.40% of the choices, the deterioration of the professor-student and student-student educational relationship is indicated as a disadvantage, and with 23.10%, the decrease in self-esteem of students and master's students is chosen as a disadvantage. With the fewest choices, only 13.80% indicates the drop in school results, as being a disadvantage in giving and receiving feedback, offered by teachers. Probably the subjects of the research considered the feedback negative, as having these disadvantages, mentioned above.

The next question of our questionnaire aimed to identify students and master's students' preferences regarding teacher's feedback. The

obtained results are presented in Table no. 5.

| <b>Varianta of answer</b>                       | <b>N</b> | <b>f</b> | <b>%</b> |
|---|----------|----------|----------|
| Focused on the result                           | 160      | 51       | 31.90%   |
| Process focused                                 | 160      | 40       | 25.00%   |
| Workload focused                                | 160      | 69       | 43.10%   |
| Focused on the learning strategies used         | 160      | 46       | 28.70%   |
| Focused on self-assessment                      | 160      | 37       | 23.10%   |
| Focused on accepting and following instructions | 160      | 24       | 15.00%   |
| Using praise                                    | 160      | 12       | 7.50%    |

*Table no. 5. The preferences of students and master's students regarding teachers' feedback*

It can thus be observed that the majority of respondents, 43.10% prefer the feedback centered on the work task, followed by 31.90% by the feedback centered on the result, and then by 28.70% of the choices by the feedback centered on the learning strategies. Also, 25% of the students' preferences are towards process focused feedback and 23.10% indicate the focus on self-assessment feedback. The fewest options of the research subjects, 15% were for feedback oriented towards accepting and following indications, and 7.50% considered praise as a preferred way to receive feedback from university teaching staff.

The sixth question concerns the perception of students and master's students on the relationship between didactic feedback and learning motivation. The subjects were asked to answer, using a Likert scale from 1 to 5, where 1 means to a very small extent, and 5 means to a very large extent.

| <b>Variants of answer</b>  | <b>N</b> | <b>f</b> | <b>%</b> |
|----------------------------|----------|----------|----------|
| 1 (to a very small extent) | 160      | 1        | 0.60%    |
| 2 (to a small extent)      | 160      | 2        | 1.30%    |
| 3 (neutral)                | 160      | 13       | 8.10%    |
| 4 (mostly)                 | 160      | 51       | 31.90%   |
| 5 (to a very large extent) | 160      | 93       | 58.10%   |

*Table no. 6. Students' and master's students' perception of the relationship between didactic feedback and learning motivation*

From Table no. 6. it emerges that 58.10% of the research subjects consider that there is to a large extent a relationship between the didactic feedback and the learning motivation, while 31.90% consider that there

is to a large extent such a relationship. 8.10% of students do not have a clear opinion about the relationship between didactic feedback and learning motivation, and 1.30% and 0.60%, consider that there is a small and very small relationship between didactic feedback and learning motivation.

The following question explores students and master's students' perception on the relationship between the teacher's feedback and students and master's students' academic performance.

| Variants of answer         | N   | f  | %      |
|----------------------------|-----|----|--------|
| 1 (to a very small extent) | 160 | 1  | 0.60%  |
| 2 (to a small extent)      | 160 | 1  | 0.60%  |
| 3 (neutral)                | 160 | 15 | 9.40%  |
| 4 (mostly)                 | 160 | 58 | 36.30% |
| 5 (to a very large extent) | 160 | 85 | 53.10% |

*Table no. 7. Relationship between the teacher's feedback and students and master's students' academic performance*

Table no. 7. exposes the subjects' perception on the relationship between teacher's feedback and students and master's students' academic performance, so that we can observe the fact that 53.10% consider to a very large extent, that this relationship exists, and 36.30% believe that it is present in to a large extent. Then, 9.40% do not have a clear opinion about the relationship between the teacher's feedback and students and master's students' academic performance and thus chose the neutral answer option, while 0.60% perceive this relationship as existing to a small or very small extent.

The eighth question of our questionnaire concerned the feedback collection options, frequently used by university teaching staff. The answers obtained from the surveyed students and master's students are presented in Table no. 8.

| Variants of answer                               | N   | f  | %      |
|--|-----|----|--------|
| Questionnaire per minute                         | 160 | 30 | 18.80% |
| The centered question                            | 160 | 90 | 56.30% |
| Summary phrase                                   | 160 | 31 | 19.40% |
| The five minutes essay                           | 160 | 13 | 8.10%  |
| Application sheet                                | 160 | 40 | 25.00% |
| Completing some sentences with a given beginning | 160 | 8  | 5.00%  |
| Identifying the strengths and weaknesses of the  | 160 | 24 | 15.00% |

|                                   |  |  |  |
|-----------------------------------|--|--|--|
| teacher and the<br>course/seminar |  |  |  |
|-----------------------------------|--|--|--|

*Table no. 8. Variants of feedback collection, frequently used by university teachers*

According to the answers provided by the surveyed students and master's students, among the options for collecting feedback, frequently used by university teaching staff, the most indicated option with 56.30% was the centered question, followed with 25% by application sheet. Other options for collecting feedback, used in the opinion of students, by their teachers are: with 19.40% the summary phrase, with 18.80% the minute questionnaire, with 15% the identification of the strengths and weaknesses of the teacher and of the course/seminar, followed by 8.10% of the 5-minutes essay and finally with only 5% the completion of some sentences with a given beginning.

The penultimate question of the questionnaire, aimed to identify the feedback types, preferred by students and master's students in courses and seminars. The results are presented in Table no. 9.

| <b>Variants of answers</b> | <b>N</b> | <b>f</b> | <b>%</b> |
|----------------------------|----------|----------|----------|
| Positive                   | 160      | 62       | 38.80%   |
| Negative                   | 160      | 2        | 1.30%    |
| Specific                   | 160      | 43       | 26.90%   |
| Generic                    | 160      | 15       | 9.40%    |
| Constructive               | 160      | 118      | 73.80%   |
| Corrective                 | 160      | 39       | 24.40%   |
| Immediate                  | 160      | 49       | 30.60%   |
| Delayed                    | 160      | 1        | 0.60%    |

*Table no. 9. Students and master's students preferred feedback type, in courses and seminars*

Thus, as can be seen in Table no. 9., 73.80%, i.e. most of the surveyed subjects, prefer constructive feedback, followed by 38.80% preference for positive feedback and with 30.60% by immediate feedback. Also, a smaller part of the respondents, i.e. 26.90%, claim that they prefer specific feedback, and 24.40% prefer corrective feedback, while only 9.40% indicate that they want to receive general feedback from the teacher. Only 1.30% declare that negative feedback is the preferred one, and 0.60% want delayed feedback.

The last open question of the questionnaire aimed to identify, among the research subjects, the ways of providing didactic feedback, in order to stimulate the learning motivation of students and master's students. It was an open question, so the students' answers were grouped and they are listed below.

| Answers given by the research subjects                                 | N   | f  | %     |
|--|-----|----|-------|
| They did not offer any answer  | 160 | 13 | 8.12% |
| Evaluative feedback  | 160 | 4  | 2.50% |
| Descriptive feedback   | 160 | 6  | 3.75% |
| Oral feedback, immediate, formulated to stimulate students' confidence | 160 | 4  | 2.50% |
| Any form of feedback is welcome  | 160 | 2  | 1.25% |
| Constructive and positive feedback                                     | 160 | 12 | 7.50% |
| Feedback based on questionnaire  | 160 | 5  | 3.12% |
| Encouragement  | 160 | 8  | 5.00% |
| Feedback offered gently even for mistakes                              | 160 | 1  | 0.62% |
| Detailed explanation   | 160 | 1  | 0.62% |
| Any type of feedback can motivate the student/master's student         | 160 | 2  | 1.25% |
| Active participation should be rewarded in the final grade             | 160 | 2  | 1.25% |
| Immediate feedback   | 160 | 9  | 5.62% |
| Individual feedback with a focus on results                            | 160 | 6  | 3.75% |
| Negative feedback  | 160 | 2  | 1.25% |
| Praise   | 160 | 1  | 0.62% |
| By email   | 160 | 1  | 0.62% |
| The focused question   | 160 | 2  | 1.25% |
| General feedback   | 160 | 2  | 1.25% |
| I don't know   | 160 | 2  | 1.25% |
| Workload focused   | 160 | 1  | 0.62% |
| High marks   | 160 | 1  | 0.62% |

*Table no. 10. Feedback giving methods, which stimulate the students and master's students learning motivation*

Regarding the methods of giving feedback, which stimulate students and master's students learning motivation, from the variety of received answers, we want to highlight only those with higher frequencies. Thus, as it appears from Table no. 10., the following answers were indicated in a relatively large proportion: constructive and positive feedback, indicated by 7.50% of the subjects, followed by immediate feedback,

mentioned by 5.62% of the subjects. Then another preferred form of feedback is encouragement, mentioned by 5.00% of the students and master's students, and individual feedback with an emphasis on the result, indicated by only 3.75% of the subjects. Among the 160 subjects of our study, 8.12% did not provide any answer.

## 6. Conclusions

Effective instructional feedback plays a key role in developing skills and guiding learners towards learning objectives. By integrating contemporary educational theories such as constructivism, feedback literacy, and Assessment for Learning, feedback becomes an essential formative tool that helps students actively construct knowledge and improve long-term performance. In order to provide feedback that motivates students and master's students to learn, it is essential to adopt a personalized, clear and focused approach to the continuous improvement of learning processes. In conclusion, the new theories emphasize the importance of an integrated, student-centered approach that includes active collaboration, development of feedback skills, and the use of modern technologies in the teaching and assessment process. According to this confirmatory research, the majority of students and master's students questioned, declare themselves satisfied and very satisfied with the way in which teachers give feedback in the didactic activities of the university. Students and master's students are encouraged to a great extent, by university teaching staff, to provide feedback during courses and seminars. The subjects of our research indicated, the increase in student motivation as the main advantage of didactic feedback, followed by support for a student-centered learning and collaborative learning. The most frequently indicated disadvantage in the way in which didactic feedback is offered, is represented by the demotivation experienced by students and master's students, followed by the decrease in the frequency of participation in courses and seminars, as well as the generation of possible conflicts. We also found out, that the majority of respondents prefer a feedback focused on the work task, followed by a result feedback, and also a feedback focused on learning strategies. Almost 60% of the subjects of the research believe that there is to a great extent a relationship between didactic feedback and motivation for learning. More than half of the subjects of our research indicate, that they perceive to a great extent, a relationship between the teacher's feedback and the academic performance of students and master's students. Among the options for collecting feedback, frequently used by university teachers, the most indicated option was the centered question, followed by the application sheet. Among the types of feedback preferred by the majority of subjects surveyed, it is constructive feedback, followed by positive feedback and immediate

feedback. And with regard to the methods of providing feedback, which stimulate the motivation for learning of students and master's students, we mention constructive, positive and immediate feedback, as the answers most frequently indicated by the subjects of our research.

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## PRE-SERVICE TEACHERS' AWARENESS OF INNOVATIVE TOOLS IN CHEMISTRY TEACHING

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**Abstract:** *The best way to pave way for usage of effective tools for teaching of chemistry called for awareness of the tools by the prospective users which are the pre-service teachers. This study was carried out to investigate pre-service chemistry teachers' awareness of innovative tools in teaching chemistry. One hundred and eighty-two pre-service chemistry teachers from both university and colleges of education were involved in the study. The sample size which was randomly selected consisted of 82 male and 100 female. A researcher designed questionnaire known as Pre-service Teachers Awareness of Innovative Tools in Chemistry Questionnaire tagged PTAITCQ was the instrument used to collect data for the study. Two experts in the field of Chemistry Education carried out the face and content validity of the instrument while the reliability of the instrument was determined using Cronbach alpha in which reliability coefficient of 0.75 was arrived at. The data analysis was carried out with mean and standard deviation while the four null hypotheses formulated were tested using t-test at 0.05 level of significance. Findings revealed that pre-service chemistry teachers were aware of four out of the 10 innovative tools. The respondents have positive views about the roles of innovative tools. It was also reported that gender influenced the respondents' awareness of innovative tools for teaching chemistry while pre-service institution of learning did not. It is therefore recommended that there is the need for creation of awareness of all the necessary innovative tools used in teaching of chemistry.*

**Key words:** *awareness; chemistry; innovative; pre-service; teachers.*

### **Introduction**

In the 21<sup>st</sup> Century, nations' economical, educational and social structures have been greatly affected by scientific and technological development of these countries. Hence, there is need to fashion out new approaches to teach science (Tekerek & Karakaya, 2018). Science in the 21<sup>st</sup> Century should be productive, open to innovations and able to solve problems. Citizens in this era are expected to be entrepreneurs and lifelong learners, and need to be trained in order to live in the complex environment that he finds himself (Erdogan & Ciftci, 2017). The scientific knowledge should be such that will cater for needs of human beings in order to meet up the 21<sup>st</sup> century requirements. This can be achieved when the teachers of chemistry are trained with and utilize innovative tools for learning. Innovative tools are those tools that are used to engage students in learning so as to make it effective Whitman (2018). Such tools are expected to ease teaching and learning processes for both teachers and students.

Wagner (2008) opined that educational environment in the present generation should provide avenue for the development of necessary learning skills which are otherwise known as 21<sup>st</sup> century skills. Some of these skills are as follows: critical thinking and problem-solving, collaboration across network and leading by influence, agility and adaptability, initiative and entrepreneurialism, accessing and analyzing information, effective oral and written communication, curiosity and imagination. All these skills are necessary to meet up with standard of learning in the 21<sup>st</sup> century. The best way to achieve this is by making use of innovative approaches which require use of innovative tools especially those that has to do with information communication Technology ICT. Ulah, Khan and Khan (2017) observed that majority of the innovative tools are rooted in ICT. Hence, the use of ICT for teaching and learning has been seen as internationally accepted occurrence which is used to aid conventional way of teaching so as to promote effective teaching.

In recent years, there is a lot of focus on use of innovative tools around the world. Countries that wish to have a say on the international platform and accord with knowledge of technological development should prioritize the use of innovative tools for teaching and learning. The current reform in science education requires a considerable change in how science is taught, as well as change in professional development and practices at all levels. Science can be described as acquisition of knowledge about nature phenomenon in the environment which is of different categories depending on the nature of investigation e. g. Chemistry, biology, physics etc. Omorogbe and Ewansiha (2013)

described it as organized set of knowledge which exists in form of concepts, laws, principle etc. It deals with getting update knowledge about what takes place in the surroundings. The importance of science in the development of any nation cannot be overemphasized since science is the foundation of technology, agriculture, industrial and economic advancement (Hornby, 2010).

The development of nations depends basically on the level of scientific and technological literacy possessed by the citizenry. Science and its application have become important for sustainable development in all nations' economy. Science is a discipline which comprises of many branches such as biology, physics and chemistry etc. Chemistry is a branch of science that is important in the technological development of a nation. Chemistry has aided the advancement of technology via its principle in modern discoveries (Asiyai, 2005), therefore, chemistry, as a science subject taught at secondary school level, plays an important role in scientific and technological development of a nation through its modern inventions. Chemistry is a science subject which has to do with provision of adequate knowledge about matter, which is everything surrounding us. It is a scientific knowledge required by technologists to provide human needs such as food, cloth, shelter etc. Hence, chemistry can be seen as scientific knowledge which has direct impact on human sustainability as a result acquisition of the knowledge should be of great concern to all. However, researches have revealed that the causes of dwindle in academic performance of senior school chemistry students in Nigeria include the abstract nature of chemistry (Samba & Eriba, 2012), ineffective methods of teaching, and lack of teaching aids (Ojukwu, 2016). Hence, there is the need to design innovative tools to teach chemistry in order to make the concepts real.

Innovative tools are learning tools that assist teachers in implementing effective and efficient learning. A great number of innovations emerge day to day within the educational system. Recent innovative tools include Videogames, Online Chemistry Drills, Simulation, Virtual Laboratories, Animation, Web Quest, Edmodo, Kahoot, Google classroom, ClassMarker (Whitman, 2018; Ryan, 2019). The introduction of innovative tools to teaching and learning of science would assist learners to benefit more from content of instruction. In a like manner, Udu (2018) observed that using innovation in science education results to productive teaching and learning that will improve students' performance in science subjects. The role of innovative tools in chemistry teaching cannot be overemphasized. Innovative tools have helped in transforming the abstractness of chemistry into reality, and also helped the students to become creative, problem-solvers, and equipped them with scientific process skills. Innovative tools also make science learning interesting as they provide hands-on experience which

makes students develop positive attitudes and curiosity towards science concepts, especially chemistry.

Teachers play a key role in the effectiveness of learning activities. They are the bedrock of the society, and must be well-trained and embrace technological education. It is therefore important that pre-service science teachers, who are the practitioners of reform movements in science education, are trained to use innovative tools for classroom practices (Lee, & Nason 2012; Ingec & Erdemir, 2016). In order to prepare them for task ahead in the teaching and learning enterprises there is need for them to be aware of innovations in the field of science such as innovative tools used in teaching and learning of chemistry. Pre-service teachers are those who are still undergoing training in the teaching profession courses, or individuals without a prior teaching qualification who enrolled in a pre-service teacher education program (TEP). Pre-service science teachers who are future science teachers need to be aware of, and trained on, the use of innovative tools in teaching of chemistry.

In order to reduce the abstractness in teaching and learning of chemistry concepts, there is the need to make use of innovative tools in the teaching and learning of the subject. This is because there is general belief by experts in the field of chemistry education that chemistry is a science subject that is difficult and abstract in nature Samba and Eriba (2012), in which the difficulty and abstractness have been attributed to different factors. For instance, Johnstone (2000) submitted that difficulty experienced by students can be traced to two major reasons which are nature of the subject and the approaches employed by the teachers in teaching the subject. Nature of chemistry is such that the concepts can be represented in three different ways which are macro, submicroscopic and symbolic (Johnstone, 2000).

The macro form of representation is seen as the experimental stage which can be experienced using the sense organs. The submicroscopic is the use of atoms, ions and molecules to describe what happen at the micro level of representation while the use of symbols to describe the two other levels is regarded as symbolic representation. Students do find it difficult to comprehend the use of the three levels but chemistry experts navigate easily while using the three forms of representation. In order to cater for the difficulty and abstractness experience by students in learning chemistry concepts in term of both the nature of the subject and ways of teaching it, there is the need to make use of innovational tools which will encourage student-centered learning as the best form of learning recognized by constructivists such as Vygotsky (1978).

Hence, the use of innovative tools for teaching of chemistry by chemistry teachers especially those that has to do with ICT will not only solve the difficulty experienced in learning of chemistry due to nature of

chemistry it will also go a long way in encouraging the students to study on their own otherwise known as student-centered learning. Therefore, pre-service chemistry teachers' awareness of these innovative tools is as important as chemistry concepts they need to teach in future. Several studies have been conducted as regard innovative approach in teaching and learning of science. Such studies include Oyelekan, Igbokwe and Olorundare (2017) who investigated science teachers' utilization of innovative strategies for teaching school science in Ilorin, Nigeria. The study reported that out of the 36 innovative teaching strategies the teachers majorly used two and the rest were rarely used but both experience and qualification did not influence the teachers' utilization of the strategies.

Saudale, Lerrick, Parikesit and Mariti (2019) who carried out study on chemistry teachers' awareness, understanding and confidence toward computational tools for molecular visualization, the study showed that the teachers were aware of some of the computational tools but they were not aware of some. Another study was carried out by Samuel (2020) who investigated chemistry teachers' awareness and application of innovative instructional strategy, findings from the study revealed that the chemistry teachers were aware of innovative teaching strategies and they also apply them in their daily teaching.

However, there are limited studies on pre-service teachers' awareness of innovative tools in teaching of chemistry concepts. Thus, the present study investigated the pre-service teachers' awareness of innovative tools in chemistry teaching, which is an important aspect of using innovative approach in the teaching and learning of chemistry. The study also put into consideration the gender and institution of pre-service training of the chemistry teachers. This is because both male and female undergo pre-service training as chemistry teachers likewise the pre-service training mostly takes place in colleges of education and universities in Nigeria, since the institution of training is quite different the pre-service chemistry teachers may also differ in their awareness of the innovative tools for teaching chemistry, hence, the need for investigation of the two variables in the study.

#### Research Questions

1. Are pre-service chemistry teachers aware of innovative tools in chemistry teaching?
2. What are the views of pre-service chemistry teachers on roles of innovative tools in chemistry teaching?
3. Does gender influence the pre-service teachers' awareness of innovative tools in teaching chemistry?
4. Does institution influence the pre-service teachers' awareness of innovative tools?

5. Does the views of respondents on roles of innovative tools in teaching chemistry

Influenced by gender of the pre-service teachers

6. does the views of respondents on roles of innovative tools in teaching chemistry influenced by gender of the pre-service teachers

Research Hypotheses

The following research hypotheses were tested in the study:

1. There is no significant difference in the awareness of innovative tools in teaching chemistry by pre-service teachers based on gender
2. there is no significant difference in the awareness of innovative tools in teaching chemistry based on the institution of pre-service teachers
3. there is no significant difference in the roles of innovative tools in teaching chemistry based on the gender of pre-service teachers
4. there is no significant difference on pre-service teachers' views of the roles of innovative tools in teaching chemistry based on the institution attended

### **Materials and Methods**

This study is a descriptive researcher of the survey type. Since descriptive research majorly describe how things are and this is what is expected of the study, this is thought to be appropriate. The study involved two colleges of education and two universities students in Kwara State, Nigeria. Total of 200 students were randomly selected from the four institutions but only 182 of the respondents appropriately answered the questionnaire items. The sample consisted of 106 and 76 from the Universities and Colleges of Education respectively, while 82 were male and 100 were female. The instrument used to collect data from the respondents was a researcher designed questionnaire known as Pre-service Teachers Awareness of Innovative Tools in Chemistry Questionnaire tagged PTAITCQ. The questionnaire comprises of three sections. Section A has to do with demographic data of the respondents that is, their gender and institution of pre-service training. Section B is a three point likert scale of Not Aware, Moderately Aware and Fully Aware, asking the students to rate their level of awareness of 10 innovative tools in chemistry presented to them. Section C is a four-point likert scale of Strongly Disagree, Disagree, Agree and Strongly Agree. Two experts in the field of Chemistry Education carried out the face and content validity of the instrument while the reliability of the instrument was determined by administering the instrument to 20 students that did not take part in the study. The response of the students to the questionnaire items was analysed using Cronbach alpha in which reliability coefficient of 0.75 was arrived at for section B and C of the instrument which shows that the instrument is reliable.

The data analysis was carried out using mean and standard deviation while the four null hypotheses formulated were tested using t-test at 0.05 level of significance. This is thought to be appropriate since the four hypotheses consist of independent variables which occur at two levels that is gender with male and female levels and institution of pre-service training which consists Universities and Colleges of Education, while the dependent variables are the responses of the pre-service teachers to the questionnaire items.

## Result

**Research Question 1:** Are pre-service chemistry teachers aware of innovative tools in teaching chemistry

The pre-service chemistry teachers were aware of only four innovative tools out of the ten presented to them as shown in Table 1. These four are online chemistry drill, simulations, animations and virtual laboratories. The awareness of innovative tools by the pre-service chemistry teachers were determined by comparing the mean value of their responses to each of the tool to the average mean of their response which is 2.0. Those means that are less than 2.0 means the students are Not Aware (NA) of the tools and those mean values which are equal to 2.0 or greater than means the students are Aware (A) of the tool as an innovational one in teaching of chemistry.

Table 1

Descriptive Analysis of Pre-service Teachers Awareness of Innovative Tools in Teaching Chemistry

| S/N | Items                       | Mean | Std. Deviation | Decision |
|-----|-----------------------------|------|----------------|----------|
| 1   | Google Classroom            | 1.52 | .749           | NA       |
| 2   | Chem bingo super value game | 1.37 | .597           | NA       |
| 3   | Online chemistry drill      | 2.47 | .592           | A        |
| 4   | Simulations                 | 2.26 | .754           | A        |
| 5   | The chemical Touch          | 1.75 | .802           | NA       |
| 6   | Animations                  | 2.29 | .785           | A        |
| 7   | WebQuest                    | 1.88 | .748           | NA       |
| 8   | Project Noah                | 1.55 | .776           | NA       |
| 9   | Virtual Laboratories        | 2.14 | .815           | A        |
| 10  | Mosa Mack Science           | 1.30 | .558           | NA       |

**Research Question 2:** what are the views of pre-service chemistry teachers on the roles of innovative tools in teaching chemistry?

The chemistry teachers have positive views about role of innovative tools in teaching chemistry presented to them. They agreed with all the questionnaire items. This is because the mean of each of the item is greater than the average mean of their response which is 2.5. Any mean value less than 2.5 means disagreement and the mean value equals to or



greater than 2.5 is regarded as agreement with the role. Since, all the roles have mean values greater than 2.5 this means the respondents agreed with all the roles of innovative tools

Table 2

Descriptive Analysis of Pre-service Teachers Roles of Innovative Tools in Teaching Chemistry

| S/N | Items  | Mean | Std. Deviation | Decision |
|-----|--|------|----------------|----------|
| 1.  | Effective teaching and learning of chemistry concepts is enhanced when innovative tools are utilized by teachers                 | 3.32 | .968           | A        |
| 2.  | Students interest and motivation towards chemistry can be improved when teacher utilizes innovative tools in teaching            | 3.40 | .846           | A        |
| 3.  | Using innovative tools to teach chemistry reduces abstractness of some chemistry concepts  | 2.98 | .817           | A        |
| 4.  | The use of innovative tools in teaching and learning of chemistry promote students critical thinking ability                     | 3.24 | .756           | A        |
| 5.  | Using innovative tools in learning chemistry equips students with skills to cope with 21 <sup>st</sup> century requirements      | 3.15 | .724           | A        |
| 6.  | Creative problem solving skills of students can be enhanced through the use of innovative tools in teaching chemistry            | 3.13 | .708           | A        |
| 7.  | Hands on and minds on skills are improved or developed when innovative tools are adopted for teaching chemistry                  | 2.79 | .869           | A        |
| 8.  | Self-confidence and technologically inclined students are produced when teachers use innovative tools to teach chemistry lessons | 3.05 | .852           | A        |
| 9.  | Collaboration is enhanced when innovative tools are adopted in teaching and learning chemistry                                   | 3.05 | .819           | A        |
| 10. | Teaching chemistry with innovation tools increases students motivation   | 3.38 | .857           | A        |
| 11. | Students that learn chemistry using innovative tools become inventors and problem solvers  | 3.21 | .869           | A        |

Hypothesis 1: there is no significant difference in the awareness of

innovative tools in teaching chemistry by pre-service teachers based on gender.

Table 3 shows that there is significant difference in the awareness of innovative tools by respondents based on their gender, Male ( $M=19.31$ ,  $SD=2.99$ ) and Female ( $M=17.91$ ,  $SD=3.04$ ),  $t(180)=3.10$ ,  $p=0.00$ . Since the p-value is greater than 0.05 this means that there is significant difference in the awareness of innovative tools used in teaching chemistry which is in favour of the male students. Therefore, the null hypothesis formulated is rejected.

Table 3

t-test analysis of Respondents' Awareness of Innovative tools based on Gender

| Gender | N   | Mean  | Std. Dev. | df  | t    | P   | Decision    |
|--------|-----|-------|-----------|-----|------|-----|-------------|
| Male   | 82  | 19.31 | 2.99      | 180 | 3.10 | .00 | Significant |
| Female | 100 | 17.91 | 3.04      |     |      |     |             |

Hypothesis 2: there is no significant difference in the awareness of innovative tools in teaching chemistry based on the institution of pre-service teachers.

There is no significant difference in the awareness of innovative tools by respondents based on their institution, College ( $M=18.80$ ,  $SD=2.29$ ) and University ( $M=18.35$ ,  $SD=3.55$ ),  $t(180)=0.98$ ,  $p=0.33$ . Since the p-value is less than 0.05 this means that there is no significant difference in the awareness of innovative tools used in teaching chemistry based on the institution of the respondents. Hence, the null hypothesis formulated is not rejected

Table 4

t-test analysis of Respondents' Awareness of Innovative tools based on Institution attended.

| Institution | N   | Mean  | Std. Dev. | df  | t    | P    | Decision        |
|-------------|-----|-------|-----------|-----|------|------|-----------------|
| College     | 76  | 18.80 | 2.29      | 180 | 0.98 | 0.33 | Not Significant |
| University  | 106 | 18.35 | 3.55      |     |      |      |                 |

Table 5 shows that there is no significant difference in the respondents views of roles of innovative tools based on their gender, Male ( $M=35.50$ ,  $SD=5.80$ ) and Female ( $M=34.06$ ,  $SD=6.35$ ),  $t(180)=1.58$ ,  $p=0.12$ . Since the p-value is less than 0.05 this means that there is no significant difference in the views of respondents on the roles of innovative tools used in teaching chemistry based on gender. Therefore, the null hypothesis formulated is not rejected.

Hypothesis 3: there is no significant difference in the roles of innovative

tools in teaching chemistry based on the gender of pre-service teachers

Table 5

t-test analysis of Respondents' Views on Roles Innovative tools based on Gender

| Gender | N   | Mean  | Std. Dev. | df  | t    | P    | Decision        |
|--------|-----|-------|-----------|-----|------|------|-----------------|
| Male   | 82  | 35.50 | 5.80      | 180 | 1.58 | 0.12 | Not Significant |
| Female | 100 | 34.06 | 6.35      |     |      |      |                 |

Hypothesis 4: there is no significant difference on pre-service teachers' views of the roles of innovative tools in teaching chemistry based on the institution attended.

Table 6 reveals that there is significant difference in the respondents views of roles of innovative tools based on their institution, College (M=33.06, SD=7.24) and University (M=35.89, SD=4.90),  $t(180) = -3.12$ ,  $p=0.00$ . Since the p-value is greater than 0.05 this means that there is significant difference in the views of respondents on the roles of innovative tools used in teaching chemistry which is in favour pre-service chemistry teachers in the Universities. Therefore, the null hypothesis formulated is rejected.

Table 6

t-test analysis of Respondents' Views of Roles Innovative tools based on Institution

| Institution | N   | Mean  | Std. Dev. | df  | t     | p   | Decision    |
|-------------|-----|-------|-----------|-----|-------|-----|-------------|
| College     | 76  | 33.06 | 7.24      | 180 | -3.14 | .00 | Significant |
| University  | 106 | 35.89 | 4.90      |     |       |     |             |

## Discussion

Based on the data analysis and result, finding from the study revealed that the pre-service chemistry teachers are not aware of all the 10 innovative tools presented to them. This shows that the pre-service chemistry teachers have poor knowledge of innovative tools in teaching chemistry which is not good enough for effective teaching and learning of the subject. The finding is in agreement with that of Oyelekan, Igbokwe and Olorundare (2017) whose finding revealed that science teachers were only familiar with two out of the 36 innovative strategies presented to them when investigating science teachers' utilization of innovative strategies for teaching school science. The finding is also in line with that of Saudale, Lerrick, Parikesit and Mariti (2019) who reported that chemistry teachers were aware of some of computational tools for molecular visualization but they were not aware of some when

the chemistry teachers' awareness, understanding and confidence toward computational tools for molecular visualization was investigated. The study disagreed with that of Samuel (2020) who investigated chemistry teachers' awareness and application of innovative instructional strategy, findings from the study revealed that the chemistry teachers were aware of innovative teaching strategies and they also apply them in their daily teaching.

Another finding from the study revealed that there was significant difference in the awareness of innovative tools in teaching chemistry by the pre-service teachers based on their gender which is in favour of male pre-service teachers. The finding disagreed with that of Samuel (2020) who found that gender did not influence awareness and application of instructional strategies. This may be attributed to the fact that male students are more conversant with the use of computer than their female counterparts which is the basis of all the innovative tools. But finding from the study revealed that there was no significant difference in the views of the respondents regarding the roles of innovative tools in teaching chemistry based on their gender.

Another finding from the study revealed that there was no significant difference in the awareness of the pre-service teachers based on their institution of pre-service training. This study also agreed with that of Oyelekan et al. (2017) who also reported that no disparity in the utilization of innovative strategies by chemistry teachers based on their qualifications. This may be because they are both receiving training as chemistry teachers and thus, they are both exposed to the same innovative tools. But there was significant difference in their views of roles of innovative tools in teaching chemistry which was in favour of the respondents in the universities. This may be due to the fact that the pre-service chemistry teachers from university are at higher place of learning and are more exposed than their counterparts in the colleges of education, and possess broadens knowledge about innovative tools used in teaching chemistry.

### **Conclusion**

As a result of the discussion so far, it can be concluded from the study that the pre-service chemistry teachers were not aware of innovative tools in teaching chemistry. But they were of positive views about roles of innovative tools in teaching chemistry. It can also be concluded that gender influenced the awareness of innovative tools in teaching chemistry by pre-service chemistry teachers which is in favour of male meaning that male respondents were aware of the innovative tools than their female counterparts. However, gender did not influence the views of the respondents regarding the roles of innovative tools, that is both male and female respondents viewed the roles of innovative tools the

same way. Finally, it is concluded that institution attended by pre-service teachers did not influence their awareness of innovative tools. That means respondents from both universities and colleges of education not aware of the innovative tools for teaching chemistry. But their views on the roles of innovative tools were influenced by their institutions in favour of the respondents from university, that is, pre-service teachers from university have positive views of roles of innovative tools in teaching chemistry.

Based on the findings from this study, the following recommendations are thought to be appropriate:

1. There is the need for creation of awareness of all the necessary innovative tools used in teaching and learning of chemistry for pre-service teachers in order to enhance their future teaching of chemistry.
2. Pre-service chemistry teachers should be given the opportunity to put into use the innovative tools in chemistry since they possess positive view about their roles.
3. The female pre-service chemistry teachers should be encouraged to emulate their male counterparts as regard the awareness of innovative tools in chemistry.
4. Institution of pre-service training should not be priority when there is the need to create awareness for the pre-service teachers.
5. Both male and female pre-service chemistry teachers should be given equal opportunity to put the innovative tools to use.
6. The pre-service chemistry teachers' trainers in the Colleges of Education should emulate their counterparts in the Universities by letting their students have adequate knowledge of roles of innovative tools in teaching chemistry.

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## ASPECTS OF FORMATIVE ASSESSMENT IN ACADEMIC EDUCATION

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**Abstract:** *The main objective of this article will lead us to a descriptive approach to formative assessment, along with a number of essential characteristics of this concept. Formative assessment is a continuously evolving process. This is an important concept in the field of education and focuses on the ongoing assessment and feedback during the learning process, in order to improve students' performance and comprehension. The basic idea is that assessment should not be just a moment when grades are given, but should be an integral part of the learning process.*

**Key words:** *assessment; formative assessment; students.*

We find assessment presented in the form of an act of comparison by reference to a set of rules, a subject, respectively an object or an activity. (Voiculescu, 2010)

This is an essential component of the educational process, along with teaching and learning. This is determined by the fact that any educational act involves assessment directly or indirectly, in an organized or unsystematic way. (Papuc, Bocoş, 2017)

Assessment represents „a complex action of collecting a set of relevant, valid and reliable information on the relevance and value of processes, performance, skills, educational or didactic behaviors and examination of the degree of adequacy between this set of information and a set of criteria established in correspondence with the objectives pursued and fixed beforehand.” (Bocoş, Răduţ-Taciu, Stan, 2016, p.127)

The concept of formative assessment was launched by M. Scriven in 1967 with the publication of the debates on the presentation of the concept of assessment as an activity that must be carried out in an operative and continuous way throughout the instructive-educational process. (State, 2017).

We find the idea of formative assessment incorporated in the educational process through which feedback is provided to both students and teachers, and which by observing the errors, allows the correction of gaps that can occur in the process. Formative assessment is performed in small stages of actions, resulting in a higher frequency of checks and



at the same time a swift correction of errors that are identified.(Pachef, 2008)

At a significance level, formative assessment is a continuous evaluation that strives for an uninterrupted verification within the instructive-educational process, but also for surpassing the continuous assessment through the process of a specific verification and by including feedback in the educational flow.(Roman, 2014)

Meyer G. describes formative assessment as the type of evaluation that is performed throughout a pedagogical approach, is frequent, regarding the temporal aspect in which it is done and aims to correct and improve the errors encountered by students. Formative assessment will not rank a student at a certain step, but rather will compare the performance obtained by him/her to a threshold of accomplishment that was established beforehand.(Meyer, 2000)

Gérard Scallon, a renowned specialist in assessment, defines formative assessment as follows: „ formative assessment is a continuous assessment, its main objective being to ensure the progress of each formable in the learning process, with the intention of changing the learning situation or the pace of progress, in order to improve or correct certain aspects.(Scallon,1988,p.155)

Jacques Tardif argues that the student has to be regularly informed about the cognitive learning model about his/her evolution, but also about the level of knowledge and skills that are targeted. The role of formative assessment being to provide students in a systematic way with information about their progress, regarding the results obtained at a given time and its previous results.(Tardif, 2006)

Manolescu presents a number of essential characteristics of formative assessment:

- it represents the assessment that is based on learning objectives;
- it symbolizes the fact that assessment is a part of the instructive-educational process;
- the student's failure is not considered a weakness, but it is rather seen as a moment in solving a problem;
- it intervenes in each learning task;
- it reveals the teacher as well as student what is the degree of mastery of the objectives;
- it supports a regulation of the student training processes so as to offer him/her an adaptation of the learning tasks;
- it is a component of the instructive-educational process, it is continuous and focused on the learner;
- one of the purposes of formative assessment is to overcome the difficulties that appear during the learning process.(Manolescu, 2010)

In addition to the information provided by Manolescu about the characteristics of formative assessment in his work „The Assessment of Competencies”, Roman suggests the following characteristics:

- first of all, the findings will be made starting from the analysis of the reasons that led to various errors and failures;
- errors are considered mandatory stages in the learning process;
- the student is a partner of the learning process;
- the student is a partner of the educational project in order to know the planned objectives, to be aware of the difficulties that can intervene along the way and to develop an approach to an autonomous progress;
- the concept of assessment is part of the learning process;
- the concept of assessment is open to guiding actions in order to increase the efficiency of education.(Roman, 2014)

Cizek G. indicates a series of characteristics of the formative assessment:

- it requires students to be responsible for their own learning process;
- it transmits and presents clear and specific learning objectives;
- it focuses on objectives that mark valuable educational outcomes with applicability beyond the context of learning;
- it mentions the students’ current competencies and the necessary steps to acquire the predetermined objectives;
- it requires plans to target the desired objectives;
- it motivates students to self-monitor the evolution towards learning activities;
- it presents examples of learning objectives including rules that will be used to assess students’ work;
- it establishes frequent assessment moments, including self-assessment;
- it includes feedback related to learning goals and provides opportunities for students to see and improve their work products;
- it supports metacognition and students’ reflection in connection to their individual work.(Cizek,2010)

Formative assessment is understood as a process of collaboration and communication between teachers and students, one of the important roles being that of providing feedback. In this relationship between teachers and students, feedback is a didactic communication tool, the

teacher having here the purpose of supporting students' progress. On these conditions the essence of the formative assessment has a series of characteristics:

- „ it is constantly and operatively integrated throughout the teaching process and it intervenes during each learning task;
- it allows the teacher to know at any given time what level the students are at and guides them in the learning process, making them aware of their own training;
- it provides students stimulation to resort to metacognition, causing them to modify their learning behavior during the learning process;
- it allows students to clearly analyze their own learning approach;
- it regulates "on the fly" the teaching process;
- it involves a diagnosis of factors that create learning difficulties for students;
- it stipulates the comparison of students' performance with a level of success established beforehand;
- it develops students' capacities for self-assessment and mutual evaluation.”(Bîrnaz, Spînu, 2016, p.82)

Formative assessment is diversly presented in the vision of the researchers, but the common aspects are limited to its character of diagnosis, remediation and correction of the training process.

In academic education, formative assessment includes in its center of interest a series of key moments: specifying and presenting the formative assessment methodology; the adaptation of methods to the activities of formative evaluation; supervising the students' individual work; self-assessment and last but not least, obtaining objective, positive feedback.

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## VIEWS OF UNDERGRADUATES ON THE INFLUENCE OF FARM PRACTICAL TRAINING IN MOTIVATING AGRICULTURAL STUDENTS FOR ENGAGEMENT IN AGRICULTURAL OCCUPATIONS IN NIGERIA

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**Abstract:** *The need to equip agricultural graduates with skills that could help them effectively engage in productive agricultural practices led to the introduction of Farm Practical Training into the curriculum of the University's Bachelor of Agriculture program the realization of which seemed uncertain. Thus, this study investigated the views of undergraduates on the influence of farm practical training in motivating agricultural students to engage in agricultural occupations in Nigeria Three research questions and one null hypothesis guided the study. The study was survey research on 500 level Bachelor of Agriculture undergraduates of Ladoke Akintola University of Technology, Ogbomosho, and University of Ilorin, Ilorin, Nigeria. Two hundred and thirty-three undergraduates were randomly selected for the study. Data was collected through a structured questionnaire. Mean and frequency were used to answer the research questions while one null hypothesis was tested with a t-test at 0.05 level of significance. Findings from the study showed that undergraduates have positive views about farm practical training and the knowledge acquired during the program could stimulate them into agricultural occupations. Also, no significant difference in the influence of farm practical training in motivating male and female undergraduates to engage in agricultural occupations. It was recommended that the farm practical training programme should be intensified and taken with utmost seriousness by the instructors and undergraduates, various farm operations and activities should be encouraged and job-oriented, adequate infrastructural facilities should be provided and farm practical training programme activities should not be gender biased.*

**Key words:** *farm practical training; motivation; engagement; agricultural occupation.*

## **Introduction**

Agriculture has been known to be the only source of food or nutrition for the survival of human beings. Agriculture is the catalyst for economic growth and development in many developing countries including Nigeria (Allwell, 2018). Agriculture is the cultivation of crops and rearing of crops for man use. However, in this modern time, the concept of agriculture has gone beyond the act of growing crops and tendering animals to include myriads of other products and activities. Extension.com (2014) noted that Agriculture is both science, and art, as well as the occupation of growing crops, rearing livestock, and cultivating the soil with the processes involved from the first step of identifying the land for cultivation of crops or rearing animals to all other processes involved until the produce gets to the table as food or the body as cloths or any other purposes. Agriculture according to National Geographic (2019) is both the art and science of tilling the soil, growing crops, and rearing livestock, and the preparation of those products obtained from plants and animals for human use and their distribution to markets. Thus, agriculture includes all the processing, financing, marketing, and distribution of agricultural products; farm production supply and service industries; the use and conservation of land and water resources; health, nutrition, and food consumption; development and maintenance of recreational resources; and related economic, sociological, political, environmental, and cultural characteristics of the food and fiber system.

Agriculture has been of great importance to Nigeria's economy from the pre-colonial era till today (Omorogiuwa, Zivkovic & Ademoh, 2014). Agricultural practices were the main activity of Nigerians, employing about 70 percent of the total population before the oil boom. Then, agriculture was the major source of export for the countries as the nation was a major supplier of many farm products like oil palm, groundnut, cotton, coffee, cocoa, and other produce to the world market (Adesina, 2012). During that era, agriculture was the major occupation of both old and young in most Nigerian traditional societies. However, with the advent of formal education and white-collar jobs, many youths were lured away from farming. This was further compounded by the discovery of the oil and oil boom era. White collar or government jobs predominate, and agile youths both educated and non-educated seek employment in other sectors of the economy other than farming. With the exit of the oil boom era and the nation's entry into a period of recession as well as its attendant youth unemployment, the importance of agriculture as a means of reviving the economy is now brought to the

fore.

The government's realization of the enormous importance of agriculture to individual and national development as demonstrated in the colonial and early post-independence period made it to be included as part and parcel of the Nigerian formal educational curriculum. Agriculture was made a major subject or course of study from primary to tertiary education. The major reason was to inculcate in the youths the appreciation of the dignity of labour as well as to encourage scientific inquiry in the field of agriculture, to increase food production as well as create job opportunities for the teeming youth population. Thus, agriculture has been studied in the Nigerian education system from the primary level since the pre-colonial era (Ekpeyong, 2015) to the university level since independence.

At the university level, agriculture was formally studied as a four-year course. Students are taught both the theories and practicals of agriculture and they are awarded the Bachelor of Science (B.Sc.) degree after completion (Ayanda, Yusuf & Salawu, 2013). Despite this, learners only offered agriculture as a course of study without really having the mind to engage in productive agriculture. Even, those who major in different areas of agriculture at the tertiary levels are offered it to be employed as officers in any government or private agricultural establishments (Zakaria, Adam & Abujaja, 2013). Then, due to the incidence of the oil boom and the availability of job opportunities in the countries, most graduates easily find jobs in other sectors of the economy other than agriculture. However, as the era of the oil boom expired with more unemployed graduates in the country, also, most Agriculture graduates found it difficult to get employment in the formal sector of the economy; the government then saw the need to diversify the country's major exports by returning the nation to the days where agricultural exports took a major part of the total export. Therefore, to address these issues and encourage youths especially those who studied agriculture to embark on farming, the Bachelor of Science in Agriculture curriculum was revised to make the programme more practical-oriented. In a bid to produce graduates of agriculture who will have the requisite knowledge, skills, and practical experience to practice the profession upon graduation, the National University Commission, in 1981, restructured the curriculum of agriculture at the undergraduate level by introducing **an** internship programme, otherwise known as Farm Practical Training (FPT). FPT is a programme designed for undergraduates of agriculture otherwise known as interns to be posted to farms or agriculture-related industries for the period of six months and later extended to 12 calendar months. This is for them to gain knowledge and practical skill through observation and practice, during which University supervisors would visit to evaluate them (Federal University

of Agriculture, Abeokuta [UNAAB], 2011). The document stated further that the new curriculum makes Farm Practical Training mandatory for agriculture undergraduates in the fourth year of the five-year degree programme leading to the award of a Bachelor of Agriculture Degree (B. Agric.) instead of the formal Bachelor of Science (B.Sc.) in Agriculture Degree. Thus, one additional academic session was added to the Bachelor of Science in Agriculture Degree programme to allow for dedicated practical training to improve the competence of the undergraduates.

The Farm Practical Training programme was founded on the philosophy that the training exercise will enable the trainee to learn by doing in the process of undertaking farming activities on both the crops and livestock section of the university farm. The initial design was that trainees would be posted to agricultural establishments outside the university but difficulties in securing places for all the students led to a rethink that engaging trainees on the University farms would be more productive rather than allowing them to roam about towns in search of potential places for attachment thereby losing time (UNAAB, 2011). The FPT aims to expose the students to work methods, tools, techniques, and practices that cannot be learned theoretically; to enable trainees to have direct contact with local farmers to obtain firsthand information on farming conditions and problems, as well as acquire knowledge that will enhance their smooth transition from school to the reality of life after school. It is also to complement classroom teaching with practical learning; improve the technical know-how of the nation's university graduates of agriculture and enhance youth retention in agriculture. The focus of the programme is to widen students' scope of knowledge to practical and mechanized agriculture as well as to enable students to pursue their chosen career/discipline in agriculture with courage, competency, and determination (Ayanda, Yusuf & Salawu, 2013; UNAAB, 2011; Oloruntoba, 2008;). If properly implemented by the faculties of agriculture, the farm year programme or FPT in Nigeria universities could go a long way in achieving sustainable agricultural development.

In addition to the above objectives which the programme is expected to achieve, the likely benefits of farm practical training to the Universities, graduates and the nation at large according to Oloruntoba (2008) are: FPT gives the university a unique opportunity to expose agricultural undergraduate to all aspects of the agricultural production process in crop production like tilling of land, sowing of seeds, weeding, and application of fertilizer, insecticide and herbicide, harvesting of this crops and processing of some of the harvested crops. FPT also enabled students to acquire skills in the aspect of animal production like; animal health, feed formulation, and animal processing among others. Farm



practical training assists students to become problem-solvers and to obtain hands-on experience within their profession before graduation. Other benefits derivable from FPT according to Okpara (2016), include helping undergraduates to prepare for agricultural occupation by acquiring knowledge and practical skills in agriculture; providing supervised occupational experience to undergraduates in agricultural productivity; assisting in generating income where circumstances demand that undergraduates market agricultural products; exposing undergraduates to the use of records and reports as used in agriculture enterprises; and providing students with practical experience in developing agricultural skills by giving the undergraduates opportunities to carry out demonstration plots and conduct agricultural experiment among others. FPT could make students of Agriculture acquire skills that will make them self-reliant and relevant to themselves and society. Hence, it builds in them the courage to embark on an Agricultural enterprise. Farm Practical programme addresses the shortcomings in the curriculum of agricultural undergraduates enabling them to acquire knowledge and practical skills needed to become proficient in agriculture.

Going by these benefits, it is expected that students would want to embark on farming or agricultural enterprise after graduation after going through the FPT. However, the present scenario in the nation where only 27.90% (Index Mundi, 2019) of Nigerians are employed in agriculture despite the vast agricultural resources that the nation is endowed with calls for concern to look into the effectiveness of farm practical training in realizing all the above benefits. Farm practical training was introduced to enable agricultural graduates to acquire skills that would enable them to transition smoothly from school to agricultural occupations (Oloruntoba, 2008). The government's objective of introducing FPT into University's agricultural programme according to Koyenikan and Anozie (2018) is to increase the availability of competent and committed human resources (graduates), especially in agriculture, to contribute to their quota achieving sustainable agricultural development for the nation. However, the prevailing youth apathy towards agriculture where most agricultural graduates prefer to be doing other menial jobs like sales representatives (Zakaria, Adam, & Abujaja, 2013) for non-agricultural related companies and being paid peanuts left one to wonder if the experiences that students gained during the farm practical training did not even stimulate or motivate them to pick interest in any field of agriculture. Hence, the need for this study to examine the impact of farm practical training in motivating agricultural undergraduates for effective engagement in agricultural occupation.

Motivation is an internal or external driving force that spurs someone into an action. Johannsen (2018) explained motivation as the effort, the

drive, desire, and energy a person uses to activate and maintain goal-driven behavior. Motivation could be intrinsic or extrinsic. It is expected that the series of activities that agricultural undergraduates are exposed to or participate in during the farm practical training year should be enough to generate a motivational force or passion that will propel them to engage in agricultural occupations after graduation. But the stark reality is that youths are more averse to taking up jobs in the agricultural sector than before despite the prevailing unemployment in the nation. Agricultural occupations are those series of jobs or work that anyone could engage in the agricultural sector. Among the agricultural occupations that prospective graduates can engage in include: production of various crops, fishery, poultry, piggery, arbitrary, snailery, apiculture, distribution of farm produce, Agro-allied industries like agricultural processing, supplies of farm input, operating a feed mill, lumbering, Agricultural consultant, Farm manager, Fish farm manager, Plant breeder/geneticist, Soil scientist, Animal nutritionist, Lumbering occupation, Poultry farmer, Swine farmer, horticulturist, agricultural journalist and host of others (Georgia Agricultural Education, 2015; ngcareers, 2019; Williams, 2019)

Despite these diverse opportunities in the agricultural sector which most agricultural graduates are aware of they still shun the sector like a plague thereby making one wonder if the FPT experience has no impact in motivating them into any of these agricultural occupations.

Thus, this study examined the influence of farm practical training in motivating agricultural undergraduates to effectively engage in agricultural occupation. The specific research questions that the study answered were:

- a. What are the conceptions of agricultural undergraduates about farm practical training?
- b. What is the realization that Agricultural Undergraduates get from Farm practical training that could make them engage in agricultural occupations after graduation?
- c. In what areas of agricultural occupations did the knowledge and skills acquired during Farm practical training stimulate undergraduates to effectively engage after school?
- d. What is the difference in the perception of male and female agricultural undergraduates on the impact of farm practical training in motivating agricultural undergraduates for effective engagement in agricultural occupation?

**Hypothesis:**

there is no significant difference in the perception of male and female agricultural undergraduates on the impact of farm practical training in motivating agricultural undergraduates for effective engagement in agricultural occupation

## Methods

The study adopted a survey research design. Halupa (2022) defined survey research as one which studied group of people or items by collecting and analyzing data from only a few representatives of the entire group. The design was considered appropriate for this study because the work intended to collect data from a representative sample of agriculture undergraduates to describe the entire population in determining the influence of Farm Practical Experience in motivating Agricultural Undergraduates to engage in agricultural occupations. The study was undertaken in two Universities that have a Faculty of Agriculture namely: the University of Ilorin, Kwara State, and Ladoko Akintola University of Technology Ogbomosho (LAUTECH), Oyo State, Nigeria. The population for the study comprised of all agriculture undergraduates in the Faculty of Agriculture at University of Ilorin and LAUTECH, Ogbomoso, Oyo state, Nigeria. The target respondents for this study were all 500-level agricultural undergraduates who had completed their farm practical training. Thirty percent of students from each department of the faculty of agriculture in both institutions were selected for the study. A simple random sampling technique was used to select respondents among the undergraduates in proportion to the population of students in each Department in the Faculty of Agriculture. A total number of 233 undergraduates were involved in the study.

A researcher-designed questionnaire was used for data collection. The questionnaire had two sections; section (1) and section (2) respectively. Section (1) contained the socio-economic characteristics of the respondents while section (2) contained statements on the research questions. The response option for items in section 2 is a 4-point Likert-type scale which was: SA - Strongly Agree, A – Agree, D – Disagree, SD - Strongly Disagree. The instrument was face-validated by experts in agricultural education. The researcher sought the permission of the appropriate authority and the consent of the respondents before conducting the survey.

The questionnaires were administered personally by the researcher to the respondents and the retrieval of the questionnaire was made by the researcher immediately. The data analysis was done using descriptive and inferential statistics. The demographic and research questions were answered using descriptive statistics of percentage and the research hypothesis formulated for this study was subjected to the independent t-test statistics and tested at 0.05 level of significance using Statistical Package for Social-Science (SPSS 23.0). Any mean value that is greater or equal to 2.50 is taken to be positive response while mean value less than 2.50 is taken to be negative response. Also, the null hypothesis was rejected when the probability value is less than 0.05 alpha level implying there is no significant difference in the tested variables.

**Results****Demographic Characteristics of Respondents****Table 1***Distribution of the Respondents by Age, Gender, Department and Level*

| Variables             | LAUTECH       |                     | UNILORIN      |                     |
|-----------------------|---------------|---------------------|---------------|---------------------|
|                       | Frequenc<br>y | Percentage<br>s (%) | Frequenc<br>y | Percentage<br>s (%) |
| <b>Age</b>            |               |                     |               |                     |
| 18 – 21<br>years      | 17            | 14.5                | 38            | 33.0                |
| 22 – 25<br>years      | 64            | 54.2                | 63            | 58.8                |
| Above 25<br>years old | 37            | 31.4                | 14            | 12.2                |
| <b>Total</b>          | 118           | 100.0               | 115           | 100.0               |
| <b>Gender</b>         |               |                     |               |                     |
| Male                  | 54            | 45.8                | 59            | 51.3                |
| Female                | 64            | 54.2                | 56            | 48.7                |
| <b>Total</b>          | 118           | 100.0               | 115           | 100.0               |
| <b>Department</b>     |               |                     |               |                     |
| AGY                   | 35            | 29.7                | 21            | 18.2                |
| CPT                   | 7             | 5.9                 | 15            | 13.0                |
| ANP                   | 25            | 21.2                | 29            | 25.2                |
| AEF                   | 45            | 38.1                | 33            | 28.7                |
| AXR                   | 6             | 5.1                 | 17            | 14.9                |
| <b>Total</b>          | 118           | 100.0               | 115           | 100.0               |
| <b>Level</b>          |               |                     |               |                     |
| Level                 | 500           | 118                 | 100.0         | 115                 |
|                       |               |                     |               | 100.0               |

The demographic information of respondents on Table 1 showed that 118 agriculture undergraduates were sampled from Ladoke Akintola University of technology, Ogbomoosho while 115 were sampled from University of Ilorin. Out of the 118 from LAUTECH 35, 7, 2, 5, 45 and 6 students, were from the Departments of Agronomy, Crop protection, Animal production, Agricultural Economics and Agricultural Extension respectively. From the same university, 17, 64 and 37 were within the ages of 18-21, 22-25, and above 25 years respectively; while 54 were male 64 were female.

With respect to University of Ilorin, 21, 15, 29, 33, and 17 students were

from the Departments of Agronomy, Crop Protection, Animal Production, and Agricultural Economics and Agricultural extension respectively. Where 59 were male 56 were female. With regards to their ages 38 of them were between 18-21 years, 63 were between 22-25 years while 14 were above 25 years of age.

### *Answering of Research Questions*

#### **What are the conceptions of agricultural undergraduates about farm practical training?**

**Table 2**

*Mean Values of the Responses of Agricultural Undergraduates on their Conceptions about FPT*

| S/N | Conceptions of Undergraduates' about FPT Programme  | Mean        |
|-----|---|-------------|
| 1.  | FPT makes me to be comparable with engineering students that also does SIWES, so I like it  | 2.95        |
| 2.  | The FPT helps me to appreciate the work of farmers  | 2.74        |
| 3.  | FPT is good as it teaches team spirit and sense of collaboration  | 2.98        |
| 4.  | The sufferings and labour during FPT does not worth it  | 2.27        |
| 5.  | FPT is labour intensive and a means of using student as farm labour   | 1.69        |
| 6.  | It is just an ordinary school activity that contributes nothing to my future  | 2.25        |
| 7.  | FPT experience make agriculture to be more practical  | 2.81        |
| 8.  | It exposes student to modern agricultural practices thereby changing my negative notions about farming  | 3.30        |
| 9.  | Training during the FPT could make agricultural graduates to be self-employed if they wish  | 2.99        |
| 10. | FPT imparts skills in animal, crop, marketing, extension and all other aspects of agriculture that are required in the work places or for self-employment | 2.64        |
|     | <b>Average Mean Score</b>   | <b>2.66</b> |

Data on Table 2 presents the conceptions of agriculture undergraduates about the farm practical training. The undergraduates holds that it exposes student to modern agricultural practices thereby changing their negative notions about farming ( $\bar{x}=3.30$ ), They believe that training during the FPT could make agricultural graduates to be self-employed if

they wish (2.99), that FPT is good because it teaches team spirit and sense of collaboration (2.98) and it makes agricultural undergraduates to be comparable with their engineering counterparts (2.95). Also, the undergraduates hold that FPT experience make agriculture to be more practical (2.81) and it help them to appreciate the work of farmers (2.74). Agricultural undergraduates believe that FPT imparts skills in animal, crop, marketing, extension as well as other aspects of agriculture that are required in the work places or for self-employment (2.64). However, all the negative conceptions on the table were strongly disagreed with by the undergraduates which implies that FPT is not labour intensive and not a means of using student as farm labour (1.69), it is not just an ordinary school activity that contributes nothing to students' future and that the sufferings and labour during FPT worth it. Thus, it could be inferred that undergraduates' agricultural students have good and positive conceptions about Farm Practical Training.

**What are the realization that Agricultural Undergraduates get from Farm practical training which could make them engage in agricultural occupations after graduation?**

**Table 3**

*Mean Values of the Responses of Agricultural Undergraduates on Realization from FPT which could make Agricultural students Engage in Agricultural Occupations after Graduation*

| S/N | Realization that Agricultural Undergraduates get which could make them engage in agricultural Occupations after Graduation | Mean        |
|-----|--|-------------|
| 1.  | Agriculture can bring better income than some paid jobs  | 2.93        |
| 2.  | Some aspect of agriculture can easily be started by unemployed graduate  | 2.42        |
| 3.  | Some can easily be self-employed with agriculture  | 2.81        |
| 4.  | To get land for land for agricultural practices is not that difficult in Nigeria   | 2.54        |
| 5.  | Venturing into agricultural jobs will require strong determination   | 2.81        |
| 6.  | All aspect of agriculture can easily be established  | 2.22        |
| 7.  | Market price of agricultural produce is always favourable to farmers   | 2.31        |
| 8.  | With acquisition of needed skills during FPT success in agricultural ventures is sure                                      | 2.68        |
|     | <b>Grand Mean</b>  | <b>2.51</b> |

Data on Table 3 shows the realization that undergraduates get during Farm practical training that could motivate them to engage in agricultural occupation. The responses showed that agricultural undergraduate agreed with 6 out of 8 items on the table showing that farm practical training had brought them to those realizations. However, they disagreed with 2 of the items as the realizations that they got from FPT. Through their involvement in farm practical training undergraduates are able to realize that Agriculture can bring better income than some paid jobs; someone can easily be self-employed with agriculture and that venturing into agricultural jobs will require strong determination. They also realized that to obtain land for agricultural practices is not that difficult in Nigeria and that with the acquisition of needed skills during FPT, success in agricultural ventures is sure. All these realizations serve as motivator for them. While, other realization that agriculture cannot easily be started by unemployed graduate; market price of agricultural produce is not always favourable to farmers and that not all aspect of agriculture can easily be established dampen their spirit.

**In what areas of agricultural occupations did the knowledge and skills acquired during Farm practical training stimulates undergraduates to effectively engage after school?**

**Table 4**

*Analysis of areas of agricultural occupations that knowledge and skills acquired during farm practical training stimulates undergraduates to effectively engage after school*

| S/N | Areas of Agricultural Occupations that the Knowledge and Skills Acquired during Farm Practical Training Stimulates Undergraduates to Engage after School | Mean |
|-----|--|------|
| 1   | FPT programme stimulate me to change my mind on the job I had always aspire before the training and engage in any aspect of farming                      | 2.42 |
| 2   | FPT enables me to develop interest in crop production  | 2.48 |
| 3   | The skills acquired during FPT stimulates me to like poultry farming   | 2.63 |
| 4   | The skills acquired during FPT motivates me to pick interest in dairy farming  | 2.60 |
| 5   | The skills acquired during FPT make me to like farm machine hiring services  | 2.43 |
| 6   | The skills acquired during FPT make marketing of agricultural produce appeal to me   | 2.67 |

|                           |             |
|---------------------------|-------------|
| <b>Average Mean Score</b> | <b>2.54</b> |
|---------------------------|-------------|

Table 4 shows the areas of agricultural occupations where the knowledge and skills acquired during farm practical training motivates undergraduates to engage after school. The major areas of agricultural occupation which FPT motivates undergraduates to be engaged after graduation were poultry farming, dairy farming and agricultural marketing with the mean value of 2.63, 2.60 and 2.67 respectively. However, undergraduates were not favorably disposed to engage in crop production and farm machine hiring services while it did not even change the former career aspirations of some. This is shown by the mean value of 2.48, 2.43 and 2.42 respectively.

**What is the difference in the perception of male and female agricultural undergraduates on the influence of farm practical training in motivating agricultural undergraduates for effective engagement in agricultural occupation?**

This research question is answered with the research hypothesis as follows

**Hypothesis: Ho<sub>1</sub>:** *there is no significant difference in the responses of male and female agricultural undergraduates on the Influence of farm practical training in motivating agricultural undergraduates for effective engagement in agricultural occupation.*

**Table 6**

*t-test Analysis of Influence of Farm Practical Training in Motivating Agricultural Undergraduates for Effective Engagement in Agricultural Occupation*

| Gender | No  | Mean  | Std. | Df  | Cal.t-Value | Sig. (2-tailed) | Decision                                   |
|--------|-----|-------|------|-----|-------------|-----------------|--|
| Male   | 103 | 17.07 | 5.23 | 198 | 0.95        | 0.34            | <b>Ho<sub>1</sub><br/>Not<br/>Rejected</b> |
| Female | 97  | 17.79 | 5.59 |     |             |                 |  |

$\rho > 0.05$

Table 5 presents the test of hypothesis on the difference in male and female agricultural undergraduates’ response on the influence of farm practical training in motivating agricultural undergraduates for effective engagement in agricultural occupation. As shown on Table , male students had mean score of 17.07 with standard deviation 5.23, while female students had mean score of 17.79 with standard deviation of 5.59, the calculated t-value was 0.95 while its probability value is 0.34 with the df of 221 at alpha level of 0.05. Since the probability value (0.34) was greater than 0.05 alpha level ( $\rho > 0.05$ ), the null hypothesis was therefore not rejected. This means that there was no significant



difference in the response of male and female agriculture undergraduates' on the influence of farm practical training in motivating agricultural undergraduates for engagement in agricultural occupation.

### **Discussions**

Findings from the study shows that undergraduates' agricultural students have good and positive notion about Farm Practical Training. This could be as a result of being enlightened by series of activities that they have been exposed to during the programme which they have realize is towards their own development. This is noted by Oloruntoba (2008) that Farm Practical Training assist students to obtain hands-on experience within their profession before graduation. This agrees with the findings of Mohd et al.(2009) as reported by Oladele, Subair and Thobega (2011) that, engineering students in Malaysia perceived Industrial Training Placement as beneficial effect and has improved their 'personal attitude significantly in the aspect of 'communication and 'work attitude. This implies that farm practical training helps students to have a better orientation and conception about agriculture

The study also reveals the realizations that agricultural students come to as a result of participating in FPT. Through their involvement in farm practical training undergraduates realize that Agriculture can bring better income than some paid jobs; someone can easily be self-employed with agriculture and that venturing into agricultural jobs will require strong determination. They also realized that to obtain land for agricultural practices is not that difficult in Nigeria and that with the acquisition of needed skills during FPT, success in agricultural ventures is sure. All these realizations serve as motivational factors for embarking on agricultural occupations after graduation. The study also found that coming to this knowledge could help undergraduates to easily fall back to agricultural occupation if he/she is faced with the hard reality of unemployment in the society. This is in accordance with the submission of Oloruntoba (2008) who remarked that FPT helps students to obtain firsthand information on farming conditions and help undergraduates to acquire knowledge that will assist in their smooth transition from school to life after school.

The study further reveals the areas of agriculture where the knowledge and skills acquired during farm practical training motivates undergraduates to engage in after school. These include poultry farming, Dairy farming and marketing of agricultural produce. In actuality, these are the areas of agriculture which provides daily supply of income once it is well established unlike crop production which is most times seasonal. In addition, the price for poultry or dairy products is fairly stable compared to the prices of crop produce which is poorly priced during the harvesting period. Moreover, crop production seems to be more labour intensive while equipment hiring is more expensive to

establish than animal farming. This is also similar to the findings of Zakaria, Adam and Abujaja (2013) who discovered that the areas of agriculture that have a high preference for self-employment are poultry and livestock enterprise as well as agro-processing and marketing. Thus, confirming that prospective agricultural graduates would like to venture into the area of livestock-poultry farming and marketing rather than engage in crop farming.

Finally, the study discovered that there was no significant difference in the views of male and female undergraduates on the influence of farm practical training in motivating them to embark on agricultural occupations after graduation. This could be a result of the fact that both male and female students were exposed to the same farming conditions during the farm practical training session. Faralu (2011) also found that in Kastina State, male and female youths had positive attitude toward career in agriculture. Thus, there is no difference in the way male and female students see FPT as well as the aspect of agriculture they would embark on due to the awareness they obtained from the programme.

### **Conclusion**

Farm practical training is a special programme introduced by the faculties of agriculture in the universities to instill practical skills in agriculture in undergraduates as well as prepare them to take up agricultural occupations after training. This study has tried to find out the conceptions of undergraduates about Farm practical training, the realizations that it brought to them as well as the agricultural occupations that farm practical training has motivated undergraduates to wish to embark on after graduation. Thus, in light of the findings, it can be conclude that undergraduate hold a good conception of the farm practical training exercise and they have come to the realizations that agriculture is a worthwhile venture that could be embarked upon after graduation, while the areas of agriculture that interests them most are poultry farming, dairy farming and marketing of agricultural produce. Thus, the knowledge and skills acquired during FPT could influence agricultural undergraduates to engage in some more lucrative aspect of agriculture.

Based on the findings from the study it is hereby recommended that undergraduates should be more enlightened about the benefits of FPT to help them appreciate all areas of agriculture while more lucrative opportunities in the field of agriculture should be introduced to undergraduates to motivate them into other areas of agricultural occupations.

FPT programmes should be more practical with the use of modern machines to eradicate any notion of the laborious nature of agriculture that the undergraduates could form which probably discourage them from crop farming. As much as possible there should be no disparity in

the activity given to males and females undergraduates during FPT.

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## PERSONALITY TRAITS AND JOB SATISFACTION AMONG TEACHING STAFF

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**Abstract:** *This article explores the transition towards modern managerial strategies within the pre-university education system in Romania, illustrating how this evolution responds to the dynamics of contemporary social changes. At the centre of the discussion is the implementation of the concept of "new management" in education, an emerging paradigm that distances itself from traditional hierarchical approaches, moving towards a more fluid, adaptable and participative organizational framework. The article analyses the key features of this new management model, such as distributed leadership, decentralization of decision-making and the emphasis on the development of key skills, as well as the benefits it brings to the current educational context. In addition, the study examines the role of institutional actors in this transition, from the Ministry of Education to individual educational units, highlighting how each contributes to the implementation and adaptation of these strategies. Particular attention is paid to the specific tools used to increase organizational performance, including the Institutional Development Plan (IDP), the School Action Plan (SAP) and the Management Plan.*

**Key words:** *personality; job-satisfaction; teaching staff.*

### 1. Theoretical aspects

Job satisfaction is characterized as a subjective evaluation and a positive emotional state that employees manifest toward their work tasks and the professional environment in which they are carried out. According to Constantin, T. (2004), job satisfaction is a balance achieved by the individual when they fully satisfy both their conscious and unconscious needs, and when their expectations align with what they actually receive

in the context of their position. Hulin (2014) noted that job satisfaction involves multidimensional psychological reactions, including cognitive, affective, and behavioral aspects. Ripon further suggested that job satisfaction stems from a specific psychological interaction between the individual and their work environment. This concept also involves a positive emotional response generated by meeting the job's requirements or a sense of fulfillment derived from performing work-related activities. According to the definition by Ivancevich, J.M., Glueck, W.F. (1986), job satisfaction is conceived as a generic, unidimensional construct that reflects the overall level at which employees' expectations are met. Thus, employees hold expectations, whether more or less conscious, regarding the outcomes they might achieve from their work. Drummond and Stoddart (1995) segmented the concept of job satisfaction into two distinct categories: general satisfaction and specific satisfaction. General satisfaction refers to the employee's personal perception of their overall job, while specific satisfaction focuses on various aspects of the job, such as working conditions, remuneration, interactions with colleagues and supervisors, and organizational policies.

Contemporary transformations in fields such as education, culture, economics, and technology place increased demands on the modern individual's higher cognitive faculties and social skills. A busy work schedule, an accelerated pace, and increased pressure, along with environmental stress factors, are just a few of the major elements contributing to the emergence of psychosocial and professional stress. Teachers, dedicating much of their time to the workplace, engage in a variety of educational activities and social interactions with their colleagues and managers. This diversity of tasks demands considerable mental, emotional, and intellectual effort. Over time, this continuous demand can lead to both physical and mental exhaustion.

Moldovan M. (1993) argues that specialists identify psychological burnout among educators as stemming from the nature of their pedagogical activity, which is characterized by significant emotional burden and the presence of a wide range of emotional factors, both objective and subjective, that influence their work and can generate severe tension and stress. The constant need for empathy, sympathy, and moral responsibility for the lives and health of the children entrusted to their care, as well as the pressure from both inside and outside their work environment, contribute to the emergence of adverse emotional reactions and the adoption of self-protective behaviors. The impact of organizational factors in preschool institutions is often associated with a psychologically unfavorable atmosphere for teaching staff. The presence of horizontal and vertical conflicts, coupled with a tense environment, leads some educators to exhaust their emotional resources, while others seek ways to conserve these mental reserves. Additionally,

dissatisfaction related to self-actualization in various aspects of personal and professional life is another personal factor contributing to psychological burnout among educators.

Neamțu M. (2007) argues that it is essential for educators to be able to make autonomous decisions, have access to comfortable and conducive working conditions, benefit from time and space for breaks and rest, and participate in motivational and personalized educational sessions, including stimulating seminars, training sessions for increasing personal effectiveness, and exercises to develop creativity—all of which have a positive impact. Open and friendly communication between management and educators serves as a guarantee of psychological comfort for both parties.

Occupational stress can be conceptualized as an adverse physical and psychological response that arises when job demands exceed an individual's resources, skills, or needs. This phenomenon can lead to health deterioration and even the onset of medical conditions. Occupational stress reflects the pressure and tension associated with the work environment, particularly when the role of a teacher involves multiple responsibilities—information provider, learning facilitator, manager, and counselor (Dughi & Dughi, 2019)—as well as adapting to the use of digital competencies (Dughi, Dughi & Torkos, 2023; Rad et al., 2023). Jobs that involve high responsibilities, significant risks, and tasks that either overburden or underutilize an individual's resources can generate stress. In a favorable context, work can act as a stress-reducing factor. However, when work violates the psychophysical integrity of the individual, it can become a source of stress. Ultimately, enhancing the prestige of the teaching profession and creating a culture of respect for their work are essential elements for improving the working conditions of educators. Additionally, the development of social support programs and investments in human resources, including continuous training and retraining for teaching staff (Dughi & Ardelean, 2020), are crucial to ensuring they possess the competencies needed to meet the complex demands of modern society.

The relationship between teachers' competencies and personality traits has been the subject of research in various studies, providing useful insights into what constitutes success in the teaching profession (Samfira, Dughi & De la Fuente, 2023). Other studies, such as the one conducted by Parker, P. D., Martin, A. J., Colmar, S., & Liem, G. A. D. (2012), titled "Teachers' workplace well-being: Exploring a process model of goal orientation, coping behavior, engagement, and burnout," focus on teachers' well-being and the link between this and personality traits. Teachers with high levels of neuroticism are more susceptible to burnout, while those with high agreeableness and emotional stability report higher levels of well-being and job satisfaction. Tschannen-

Moran, M., & Woolfolk Hoy, A. (2001) examine the concept of teacher efficacy and how it is influenced by personality traits. Teachers with high conscientiousness and emotional stability exhibit a higher perceived efficacy, which leads to more effective classroom management and improved student academic outcomes.

The study conducted by Skaalvik, E. M., & Skaalvik, S. (2011) explores the relationship between teachers' job satisfaction and their motivation to leave the profession, analyzing the school context, sense of belonging, and emotional exhaustion. The results indicate that a positive work environment and a strong sense of belonging increase job satisfaction and reduce the desire to leave the profession.

The relationship between personality traits and aspects of job satisfaction has been explored by Kim, K. R., & Kim, K. S. (2010). This study examines the relationship between teachers' personality traits, job satisfaction, and professional burnout. The results show that teachers with high levels of conscientiousness and emotional stability tend to be more satisfied with their work and experience less burnout. The study conducted by Caprara, G. V., Barbaranelli, C., Borgogni, L., & Steca, P. (2003), titled "Efficacy beliefs as determinants of teachers' job satisfaction," investigates how self-efficacy and personality traits influence teachers' job satisfaction. Teachers with high conscientiousness and emotional stability, who believe in their professional efficacy, report higher job satisfaction.

## 2. Research objectives

The objectives of this research are well-defined and aim to analyze the relationship between personality traits and job satisfaction, investigate the influence of personality traits on workplace emotions, and compare differences based on demographic characteristics. Through these objectives, the research seeks to highlight the importance of personality traits in the professional context of teaching staff and identify the psychological factors that influence job satisfaction and well-being in the workplace.

### Objectives:

- ✓ **Analyzing the relationship between personality traits and job satisfaction:**
  - Evaluating whether personality traits such as conscientiousness positively correlate with job satisfaction.



- Determining how other personality traits, such as extraversion and agreeableness, contribute to overall job satisfaction.
- ✓ **Investigating the influence of personality traits on emotions experienced at work:**
  - Exploring the correlation between conscientiousness and levels of joy, anger, and anxiety.
  - Examining the relationship between agreeableness and negative emotions, particularly anger and anxiety.
- ✓ **Comparing differences based on demographic characteristics:**
  - Analyzing differences in job satisfaction and emotions experienced based on gender, age, and work experience.
  - Investigating differences between urban and rural teaching staff regarding anger and anxiety.

## 2. *Research hypothesis*

**General Hypothesis:** The study proposes that personality traits, particularly conscientiousness, extraversion, agreeableness, negative emotions, and openness, significantly influence job satisfaction and the emotions experienced by teaching staff, varying based on gender, age, job position, work experience, and the work environment (urban/rural).

**First hypothesis:** The personality trait "Conscientiousness" is directly proportional to job satisfaction and joy.

**Second hypothesis:** The personality trait "Conscientiousness" is inversely proportional to anxiety and anger.

**Third hypothesis:** The personality trait "Agreeableness" is inversely proportional to anger and anxiety.

**Fourth hypothesis:** There is a statistically significant difference between rural and urban educational institutions in terms of anger and anxiety levels.

## 3. **Research variables and research type**

### **Independent Variables:**

- **Personality traits:** conscientiousness, extraversion, agreeableness, negative emotionality.
- **Demographic characteristics:** gender, age, work experience, work environment (urban/rural).

### **Dependent Variables:**

- **Job satisfaction.**
- **Emotions experienced at work:** joy, anger, anxiety.

### **Type of Research:** Correlational and Comparative:

- **Correlational:** The relationships between personality traits (independent variables) and job satisfaction, as well as the

emotions experienced (dependent variables), are analyzed to identify the existence and direction of these relationships.

- **Comparative:** Levels of job satisfaction and emotions are compared across different demographic characteristics (gender, age, work experience, urban/rural environment) to identify significant differences among subjects.

These research approaches allow for a detailed understanding of how personality traits and demographic characteristics influence the professional satisfaction and emotional well-being of teachers.

**Research Design:** Cross-sectional correlational design.

1. **Correlational:**

- The primary aim is to examine relationships between variables, specifically between personality traits (independent variables) and job satisfaction and emotions (dependent variables).

2. **Cross-sectional:**

- Data are collected at a single point in time from a sample of 60 teaching staff.
- It allows for comparisons across different demographic groups (gender, age, work experience, urban/rural environment) at a specific moment in time.

4. **Research instruments**

Utilizing the following research instruments, I developed a questionnaire that was completed by a total of 60 subjects. The research tools employed included:

- Questionnaire regarding the Conscientiousness Factor (Factor III: Conscientiousness);
- Questionnaire - Big Five Inventory-2: Short Form;
- Questionnaire - Job Satisfaction Assessment;
- Questionnaire - Teacher Emotion Scale.

**Factor III: Conscientiousness**

Conscientiousness, as a personality dimension, is assessed through a summative scale of 10 items, with each response recorded on a Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Items marked with (R) are reversed to ensure the internal validity of the scale and to control for automatic response tendencies. In the scoring process, the reversed items are adjusted so that the final scores accurately reflect the respondent's level of conscientiousness. The scores for all items are then summed to produce a total score that indicates the individual's degree of conscientiousness. This scoring method allows for a precise

and comprehensive evaluation of the trait of conscientiousness, providing essential insights into individuals' organized, responsible, and goal-oriented behavior.

### **Big Five Inventory-2: Short and Extra-Short Forms**

The Big Five Inventory-2 (BFI-2) is a psychometric tool designed to assess fundamental personality traits, utilizing both the short form (BFI-2-S) and the extra-short form (BFI-2-XS). This inventory is based on five primary dimensions of personality: Extraversion, Agreeableness, Conscientiousness, Negative Emotionality, and Openness to Experience.

The items in the inventory are structured on a 5-point Likert scale, where respondents express their level of agreement or disagreement with various statements describing personal characteristics. For instance, participants are asked if they agree that they enjoy spending time with others and must select a response that ranges from 1 (Strongly Disagree) to 5 (Strongly Agree). This allows for a nuanced measurement of personality traits.

The domain of Extraversion is assessed through items 1R, 6, 11, 16, 21R, and 26R, where "R" indicates items that require reversal. Agreeableness is measured through items 2, 7R, 12, 17R, 22, and 27R. Conscientiousness is evaluated through items 3R, 8R, 13, 18, 23, and 28R. Negative Emotionality is covered by items 4, 9, 14R, 19R, 24R, and 29, while Openness to Experience is assessed through items 5, 10R, 15, 20R, 25, and 30R. The short form of the inventory (BFI-2-S) employs all 30 items for a comprehensive and detailed assessment of personality, while the extra-short form (BFI-2-XS) uses the first 15 items for a rapid and efficient evaluation. This flexible structure allows for the adaptation of the instrument to various research and clinical application contexts, while maintaining the validity and reliability of the measurement of personality traits.

### **Job Satisfaction Assessment Questionnaire**

The Job Satisfaction Assessment Questionnaire is a psychometric tool designed to measure employees' levels of satisfaction regarding various aspects of their workplace. The instructions for completion request participants to circle the number that best reflects their opinion for each question, utilizing a 5-point Likert scale. The scale ranges from 1 (strongly disagree) to 5 (strongly agree), allowing for a nuanced evaluation of satisfaction.

The questionnaire is structured as a summative scale, with items marked with "(R)" reversed to ensure internal validity and control response

tendencies. The scores obtained for each item are then summed to produce total scores across different dimensions of job satisfaction. By employing this questionnaire, organizations can identify areas that require interventions to enhance workplace satisfaction, thus contributing to improved employee morale and productivity.

**Teacher Emotion Scale**  
 The Teacher Emotion Scale is a psychometric tool used to measure specific emotions experienced by educators in a professional context. Scoring is conducted on a Likert scale from 1 to 4, where 1 represents "strongly disagree," 2 "disagree," 3 "agree," and 4 "strongly agree." In the original article, the items were randomized to minimize response order effects and ensure the validity of the collected data. There are three main scales within this instrument, each assessing a distinct emotion: Joy, Anger, and Anxiety. These scales allow for a detailed understanding of the emotional state of teachers and the impact of these emotions on their teaching activities.

**5. Research sample**

The sample of my research consists of 60 subjects, aged between 19 and over 50 years. Among these, there are 41 female educators and 19 male educators. The distribution by gender, age, teaching experience, and work environment can be found in Tables 1-5.

*Table 1- Sample structure by gender*

|       |       | <b>Gender</b> |         |               |                    |
|-------|-------|---------------|---------|---------------|--------------------|
|       |       | Frequency     | Percent | Valid Percent | Cumulative Percent |
| Valid | 1     | 41            | 68.3    | 68.3          | 68.3               |
|       | 2     | 19            | 31.7    | 31.7          | 100.0              |
|       | Total | 60            | 100.0   | 100.0         |                    |

I have coded female gender as number 1 and male gender as number 2.

*Table 2 - Sample Structure by Age*

|       |       | <b>Age</b> |         |               |                    |
|-------|-------|------------|---------|---------------|--------------------|
|       |       | Frequency  | Percent | Valid Percent | Cumulative Percent |
| Valid | 1     | 14         | 23.3    | 23.3          | 23.3               |
|       | 2     | 11         | 18.3    | 18.3          | 41.7               |
|       | 3     | 20         | 33.3    | 33.3          | 75.0               |
|       | 4     | 15         | 25.0    | 25.0          | 100.0              |
|       | Total | 60         | 100.0   | 100.0         |                    |

*I have coded subjects aged 19-29 as number 1, subjects aged 30-39 as number 2, subjects aged 40-49 as number 3, and subjects aged over 50 as number 4.*

*Table 3 - Sample Structure by Position in Education (Tenured/Substitute)*

|       |       | <b>Function</b> |         |               |                    |
|-------|-------|-----------------|---------|---------------|--------------------|
|       |       | Frequency       | Percent | Valid Percent | Cumulative Percent |
| Valid | 1     | 48              | 80.0    | 80.0          | 80.0               |
|       | 2     | 12              | 20.0    | 20.0          | 100.0              |
|       | Total | 60              | 100.0   | 100.0         |                    |

*I have coded subjects who are tenured in education as number 1, and subjects who hold substitute positions in education as number 2.*

*Table 4 - Sample Structure by Subjects' Tenure in Education*

|       |       | <b>Tenure</b> |         |               |                    |
|-------|-------|---------------|---------|---------------|--------------------|
|       |       | Frequency     | Percent | Valid Percent | Cumulative Percent |
| Valid | 1     | 2             | 3.3     | 3.3           | 3.3                |
|       | 2     | 19            | 31.7    | 31.7          | 35.0               |
|       | 3     | 14            | 23.3    | 23.3          | 58.3               |
|       | 4     | 14            | 23.3    | 23.3          | 81.7               |
|       | 5     | 11            | 18.3    | 18.3          | 100.0              |
|       | Total | 60            | 100.0   | 100.0         |                    |

I have coded subjects with less than 1 year of service in education as number 1, subjects with 1-9 years of service in education as number 2, subjects with 10-19 years of service in education as number 3, subjects with 20-29 years of service in education as number 4, and subjects with over 30 years of service in education as number 5.

*Table 5 - Sample Structure by the Demographic Area of the Educational Institution Where the Subjects Teach*

|       |       | <b>Unit</b> |         |               |                    |
|-------|-------|-------------|---------|---------------|--------------------|
|       |       | Frequency   | Percent | Valid Percent | Cumulative Percent |
| Valid | 1     | 39          | 65.0    | 65.0          | 65.0               |
|       | 2     | 21          | 35.0    | 35.0          | 100.0              |
|       | Total | 60          | 100.0   | 100.0         |                    |

*I have coded urban areas as number 1 and rural areas as number 2.*

### **6. Data analysis and interpretation**

The descriptive analysis of the subscales used to evaluate personality and job satisfaction for a sample of 60 educators revealed the following results: the "Conscientiousness" scale recorded a mean of 41.45 (SD = 5.733), with scores ranging from 29 to 50. Regarding "Extraversion," the mean was 18.67 (SD = 2.022), with scores falling between 13 and 22. The "Agreeableness" subscale had a mean of 19.00 (SD = 2.300), with a score range from 13 to 27. "Negative Emotions"

recorded a mean of 19.52 (SD = 2.325), with scores between 14 and 26, while "Openness" had a mean of 18.32 (SD = 1.846), with scores varying from 14 to 22. Job satisfaction exhibited a mean of 121.28 (SD = 20.429), with scores ranging from 73 to 172. In terms of specific emotions, the "Joy" subscale had a mean of 18.08 (SD = 2.085), "Anger" recorded a mean of 6.13 (SD = 2.665), and "Anxiety" had a mean of 5.88 (SD = 2.853). These results provide a detailed overview of the personality profiles and job satisfaction levels among the analyzed educators.

### **Hypothesis 1: Conscientiousness Correlates Positively with Job Satisfaction and Joy.**

The first hypothesis proposes that the personality trait "Conscientiousness" correlates positively with job satisfaction and joy. Pearson correlation analysis indicates a significant positive correlation between "Conscientiousness" and "Job Satisfaction" ( $r = 0.369$ ,  $p < 0.01$ ), as well as between "Conscientiousness" and "Joy" ( $r = 0.490$ ,  $p < 0.01$ ). These results suggest that individuals with a higher level of conscientiousness tend to report greater job satisfaction and a higher level of joy. Therefore, the hypothesis that conscientiousness correlates positively with job satisfaction and joy is validated. This is consistent with the literature, which suggests that positive personality traits, such as conscientiousness, are associated with favorable attitudes toward work and positive emotions.

Conscientiousness is defined as a personality trait involving self-discipline, organization, and a strong desire to achieve goals and perform tasks to a high standard. Individuals with a high degree of conscientiousness are often methodical, detail-oriented, and responsible. These characteristics enable them to manage professional tasks better, plan effectively, and maintain a high level of performance at work. Consequently, this systematic and disciplined approach leads to greater job satisfaction, as individuals feel they are fulfilling their responsibilities efficiently and productively.

Moreover, conscientiousness significantly contributes to positive emotional experiences, such as joy. Conscientious individuals tend to have better control over their work environment, which reduces stress and uncertainty—factors that can diminish feelings of joy. Additionally, the inherent self-discipline and organization associated with conscientiousness facilitate the achievement of personal and professional goals, leading to a sense of fulfillment and personal satisfaction. These accomplishments driven by conscientiousness are powerful sources of joy and overall satisfaction in life.

The literature supports this view, highlighting that positive personality traits, such as conscientiousness, are essential for developing a positive work attitude and cultivating positive emotions. Research suggests that

conscientious individuals are more likely to engage in behaviors that promote professional success and emotional well-being, such as setting clear goals, maintaining a regular schedule, and proactively addressing problems. These behaviors not only enhance workplace performance but also contribute to a more positive emotional experience and a deeper sense of joy.

In conclusion, the validation of the hypothesis that the personality trait "Conscientiousness" correlates positively with job satisfaction and joy is supported by statistical data and the literature. This underscores the importance of conscientiousness in professional and personal life, highlighting its role in promoting emotional well-being and overall satisfaction. Therefore, the development and cultivation of conscientiousness could have significant benefits for both workplace performance and individuals' mental and emotional health.

**Hypothesis 2: Conscientiousness Correlates Negatively with Anxiety and Anger.**

Hypothesis 2 asserts that the personality trait "Conscientiousness" correlates negatively with "Anxiety" and "Anger." Pearson correlation analysis from the sample of 60 educators validates this hypothesis. The significant negative correlation between "Conscientiousness" and "Anger" ( $r = -0.585$ ,  $p < 0.01$ ) indicates that individuals with a high level of conscientiousness exhibit lower tendencies to experience anger. Similarly, the significant negative correlation between "Conscientiousness" and "Anxiety" ( $r = -0.489$ ,  $p < 0.01$ ) suggests that these individuals are less prone to anxious states. These correlational parameters highlight the importance of conscientiousness as a protective factor against negative emotions. Conscientious individuals, characterized by self-discipline, meticulousness, and a high degree of organization, tend to develop effective stress management and emotional regulation strategies, which contribute to reducing the frequency and intensity of episodes of anger and anxiety. This reflects an increased capacity for self-control and adaptation in the face of daily challenges, allowing them to maintain a more stable emotional balance and reduce the impact of stressors.

The validation of this hypothesis is consistent with the literature, which emphasizes the role of conscientiousness in promoting psychological well-being and emotional resilience. Thus, the results suggest that the development of conscientious traits could have positive implications for mental health and overall job satisfaction.

**Hypothesis 3: The Personality Trait "Agreeableness" Correlates Negatively with "Anger" and "Anxiety."**

Hypothesis 3 proposes that the personality trait "Agreeableness" correlates negatively with "Anger" and "Anxiety." Pearson correlation

analysis provides statistical evidence supporting this hypothesis. The significant negative correlation between "Agreeableness" and "Anger" ( $r = -0.290, p < 0.05$ ) indicates that individuals with a higher level of agreeableness tend to experience less anger. Similarly, the significant negative correlation between "Agreeableness" and "Anxiety" ( $r = -0.287, p < 0.05$ ) suggests that these individuals are less prone to anxiety. These findings are consistent with the literature, which emphasizes the role of agreeableness in emotional regulation and the promotion of psychological well-being.

Agreeableness is a personality trait characterized by altruism, empathy, cooperation, and a general orientation toward interpersonal harmony. Agreeable individuals are often concerned about the well-being of others and are willing to avoid conflicts, adopting a conciliatory and friendly attitude. This predisposition toward cooperation and empathy reduces the likelihood of experiencing anger, as agreeable individuals are better able to manage conflict situations in a calm and rational manner. Instead of reacting impulsively or aggressively, these individuals are more inclined to seek compromise solutions and maintain harmonious relationships with those around them.

Additionally, agreeableness plays a protective role against anxiety. Agreeable individuals, by their nature, tend to have positive and supportive interpersonal relationships, which contribute to a sense of security and emotional stability. Healthy and supportive relationships are fundamental in reducing stress and anxiety, as they provide the necessary social and emotional resources to cope with life's challenges. Furthermore, these individuals' ability to perceive and respond positively to the needs of others contributes to an increased sense of social connection and belonging—factors well known for their role in reducing anxiety.

The literature supports these findings, highlighting that personality traits such as agreeableness are crucial for effective emotional regulation. Research suggests that agreeable individuals are less likely to engage in destructive behaviors or experience intense negative emotions due to their orientation toward positive interpersonal relationships and developed social skills. These skills enable them to avoid situations that might generate anger and anxiety, thereby maintaining their psychological well-being.

In conclusion, the validation of the hypothesis that "Agreeableness" correlates negatively with "Anger" and "Anxiety" is supported by statistical data and the literature. These results underscore the importance of agreeableness as an essential personality trait for maintaining emotional balance and mental health. Therefore, cultivating agreeableness can have significant benefits for emotional well-being and



interpersonal relationships, contributing to the reduction of anger and anxiety while promoting a more harmonious and satisfying life.

**Hypothesis 4: There is a Statistically Significant Difference Based on the Rural/Urban Area of the Educational Institution Regarding Anger and Anxiety Dimensions.**

To test this hypothesis, we used the T-test.

|           |         | Group Statistics |      |                |                 |
|-----------|---------|------------------|------|----------------|-----------------|
|           | unitate | N                | Mean | Std. Deviation | Std. Error Mean |
| furie     | 1       | 39               | 5.38 | 2.391          | .383            |
|           | 2       | 21               | 7.52 | 2.639          | .576            |
| anxietate | 1       | 39               | 5.31 | 2.054          | .329            |
|           | 2       | 21               | 6.95 | 3.761          | .821            |

**Hypothesis 4** investigates whether there is a statistically significant difference in levels of anger and anxiety between teachers in rural and urban areas. To test this hypothesis, the T-test for independent samples was utilized. The statistical analysis showed a significant difference in anger levels between teachers in urban environments (M = 5.38, SD = 2.391) and those in rural environments (M = 7.52, SD = 2.639), with  $t(58) = -3.188, p = 0.002$ . This result suggests that teachers in rural areas experience significantly higher levels of anger than those in urban areas. Regarding anxiety, the T-test indicated a significant difference in variability between groups ( $F = 8.031, p = 0.006$ ), and a significant difference between urban (M = 5.31, SD = 2.054) and rural environments (M = 6.95, SD = 3.761) under the assumption of equal variances, with  $t(58) = -2.198, p = 0.032$ . However, when the assumption of equal variances was not held, the difference was not significant ( $t(26.577) = -1.860, p = 0.074$ ).

These results suggest that the hypothesis is partially validated. There is a significant difference in anger levels between teachers in rural and urban areas; however, for anxiety, the significant difference depends on the assumption of equal variances. These differences may be attributed to the diversity of work contexts, available resources, and differing psychosocial support in rural and urban environments. The literature confirms that the work environment can influence emotional states, as teachers in rural settings may be exposed to unique stressors that amplify feelings of anger and anxiety.

**Conclusions of the research**

This research has provided a comprehensive and in-depth perspective on the influence of personality traits on job satisfaction and emotional well-being among teaching staff. The empirical analysis highlighted significant relationships between traits such as conscientiousness, extraversion, and agreeableness, and various dimensions of professional

satisfaction and emotions experienced at work, including joy, anger, and anxiety. The results underscored the importance of conscientiousness and agreeableness in promoting a positive attitude and a harmonious work environment, while negative emotions were negatively associated with these traits.

Furthermore, the research revealed significant demographic differences, highlighting variability in satisfaction and emotional well-being based on gender, age, tenure, and the work environment (urban/rural). These findings not only validate the formulated hypotheses but also provide a solid theoretical framework for developing personalized interventions aimed at improving the professional quality of life for teaching staff. By identifying contextual and demographic differences, this study contributes to understanding the complexity of the professional experience among teachers and offers tailored solutions for its enhancement.

Additionally, the results demonstrated that the work environment (urban versus rural) has a significant impact on the levels of anger and anxiety felt by teachers, highlighting the need for differentiated intervention and support strategies. Teachers in rural areas, for example, may benefit from specific resources and programs that alleviate stress and promote optimal psychological well-being.

In conclusion, this paper makes a significant contribution to the literature, providing valuable practical implications for educational strategies and institutional policies aimed at supporting and developing human resources in education. By comprehensively addressing the relationship between personality traits and job satisfaction, this study offers new insights and practical solutions for enhancing the professional lives of teachers, emphasizing the importance of investing in their emotional and professional well-being.

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## IMPACT OF CONTINUOUS ASSESSMENT ON PRIMARY EDUCATION STUDENTS' ATTITUDE TOWARDS LEARNING IN TERTIARY INSTITUTIONS IN ANAMBRA STATE

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**Abstract:** *This study investigated the influence of continuous assessment (CA) on primary education students' attitudes towards learning in tertiary institutions in Anambra state. The study assessed various factors such as CA practices, resource availability, and student-lecturer ratios. The study employed a descriptive research design. A questionnaire with 40 items, validated by experts, was used. Distribution of the questionnaire was facilitated through virtual platforms namely Google online survey system, shared across WhatsApp, Instagram, Facebook groups, and other social media channels. A total of 63 correctly filled questionnaires were received, extracted from the Google platform, and transferred to Microsoft Excel for coding. Subsequently, the coded variables and data were analyzed using SPSS software, employing mean and standard deviation calculations. Findings reveal that CA positively impacts students' attitudes by providing regular feedback, promoting self-awareness, and reducing test anxiety. However, challenges such as resource scarcity, time constraints, and high student-lecturer ratios hinder effective CA implementation. The study emphasizes the importance of collaborative efforts from educational stakeholders to address these challenges and enhance the positive impact of CA on student learning experiences. Further research is recommended to explore additional factors influencing students' attitudes towards learning in tertiary institutions.*

**Keywords:** *assessment; impact; continuous assessment; primary education; attitude, learning.*

### **Introduction**

Continuous assessment (CA) has emerged as a fundamental component

of modern educational systems, aiming to enhance student learning experiences and outcomes. In the context of primary education, CA plays a crucial role in shaping students' attitudes towards learning. Continuous assessment (CA) is an educational approach that involves the systematic and ongoing evaluation of students' learning progress and performance throughout a course or academic program (Porta et al, 2023). Unlike traditional forms of assessment that rely heavily on summative examinations, CA encompasses a variety of formative assessment techniques, including quizzes, assignments, projects, and observations, conducted at regular intervals (Selemani-Mbewe, 2023). This dynamic assessment process emphasizes the importance of feedback, self-reflection, and incremental progress, fostering a deeper understanding of subject matter and promoting lifelong learning skills (Rai, 2019). One significant impact of continuous assessment on primary education students' attitudes towards learning is its ability to provide regular feedback and opportunities for self-assessment. Research by Osuala et al, (2018) found that continuous assessment practices positively influence students' self-awareness and motivation by offering them timely feedback on their academic performance. This feedback loop enables students to monitor their progress, identify areas for improvement, and take ownership of their learning journey. As a result, students develop a growth mindset and a more positive attitude towards learning, viewing challenges as opportunities for growth rather than obstacles.

Attitude towards learning refers to an individual's disposition, beliefs, and emotions regarding the process of acquiring knowledge and skills. It encompasses their overall approach, motivation, and engagement in learning activities (Aljermawi et al, 2024). A positive attitude towards learning is characterized by enthusiasm, curiosity, persistence, and a growth mindset, wherein challenges are viewed as opportunities for growth and learning. Conversely, a negative attitude may manifest as disinterest, apathy, or avoidance of learning tasks (Byukusenge et al, 2024). Attitude towards learning influences learners' behavior, choices, and academic performance, shaping their willingness to invest effort, seek help, and persevere in the face of difficulties throughout their educational journey.

Furthermore, continuous assessment helps to reduce test anxiety among primary education students, thereby fostering a more conducive learning environment. A study by Grace et al, (2024) observed that the ongoing nature of continuous assessment reduces the pressure associated with high-stakes examinations, allowing students to approach learning tasks with greater confidence and enthusiasm. By breaking down assessment into smaller, manageable components, continuous assessment alleviates the fear of failure and promotes a growth-oriented mindset, where

mistakes are viewed as valuable learning experiences rather than sources of stress.

Moreover, continuous assessment facilitates personalized learning experiences tailored to individual student needs and preferences. Ye et al, (2016) emphasize the flexibility inherent in continuous assessment practices, which allow educators to adapt instruction to address students' diverse learning styles, interests, and abilities. By providing differentiated feedback and support, continuous assessment empowers students to take ownership of their learning and pursue areas of interest that resonate with their unique strengths and passions (Modup & Sunday, 2015). This personalized approach fosters a sense of autonomy and intrinsic motivation, leading to a more positive attitude towards learning.

However, despite its numerous benefits, continuous assessment also presents challenges that can impact primary education students' attitudes towards learning. One such challenge is the potential for assessment overload and burnout, particularly in environments where continuous assessment practices are implemented excessively or ineffectively. Olubukola and Bankole (2015) highlight the importance of striking a balance between assessment frequency and quality, cautioning against the overreliance on assessment as a means of evaluating student progress. When continuous assessment becomes overly burdensome or repetitive, students may become disengaged or demotivated, leading to a negative attitude towards learning (Emunemu, 2018).

The motivation for the study on the impact of continuous assessment (CA) on primary education students' attitudes towards learning in tertiary institutions in Anambra state is crucial due to several reasons. Firstly, while CA is widely implemented in educational settings, there is a lack of comprehensive research focusing specifically on its effects on primary education students transitioning to tertiary education. This gap underscores the need to understand how CA practices in primary education influence students' attitudes towards learning as they enter higher education. Secondly, existing studies often focus on the academic outcomes of CA, neglecting its potential impact on students' attitudes, motivation, and engagement in learning. For instance, a study by Pather (2015) highlighted the importance of considering non-academic factors, such as attitudes towards learning, in assessing the effectiveness of educational interventions.

Moreover, understanding the relationship between CA and students' attitudes towards learning is essential for informing educational policies and practices aimed at improving teaching and learning outcomes. By identifying the factors that contribute to positive attitudes towards learning, educators can design more effective pedagogical approaches and interventions to enhance student motivation and engagement in the

learning process.

### **Research Questions**

- 1.To what extent does continuous assessment affect primary education students' attitude towards learning in tertiary institutions in Anambra State?
- 2.To what extent do the availability of resources impact the implementation of continuous assessment?
- 3.To what extent does the student-to-lecturer ratio affect the administration of continuous assessment?
- 4.What solutions address the challenges facing the administration of continuous assessment in tertiary institutions?

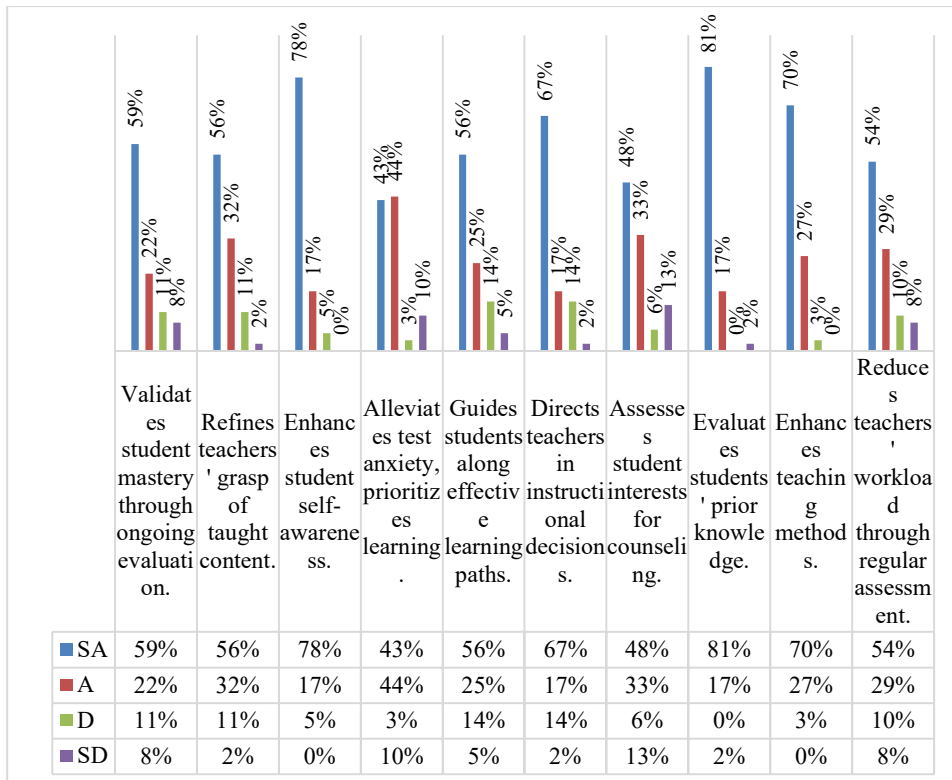
### **Methodology**

The research design for this study is descriptive, aiming to assess the impact of continuous assessment on primary education students' attitudes towards learning in tertiary institutions in Anambra state, Nigeria. The target population comprised students enrolled in primary education, early childhood education, and related courses across tertiary institutions in Anambra state. The research instrument utilized was a questionnaire consisting of forty items derived from the four research questions. It comprised two sections: Section A collected demographic data, while Section B contained the questionnaire based on the research questions, utilizing a four-point scale ranging from strongly agree (SA = 4 points) to strongly disagree (SD = 1 point). The questionnaire underwent validation by two experts in the Department of Measurement and Evaluation and one lecturer in the Department of Primary Education. Trial testing involved 15 students, ensuring reliability through the Pearson Product Moment Correlation Coefficient method, yielding a score of 0.95.

Distribution of the questionnaire was facilitated through virtual platforms such as Google online survey system, shared across WhatsApp, Instagram, Facebook groups, and other social media channels. A total of 63 correctly filled questionnaires were collected, extracted from the Google platform, and transferred to Microsoft Excel for coding. Subsequently, the coded variables and data were analyzed using SPSS software, employing mean and standard deviation calculations. Items scoring 2.50-4.00 were accepted, with a cutoff mean of 2.50 guiding the decision rule.

**Results**

**Research Question 1:** To what extent does continuous assessment affect primary education students' attitude towards learning in tertiary institutions in Anambra State?

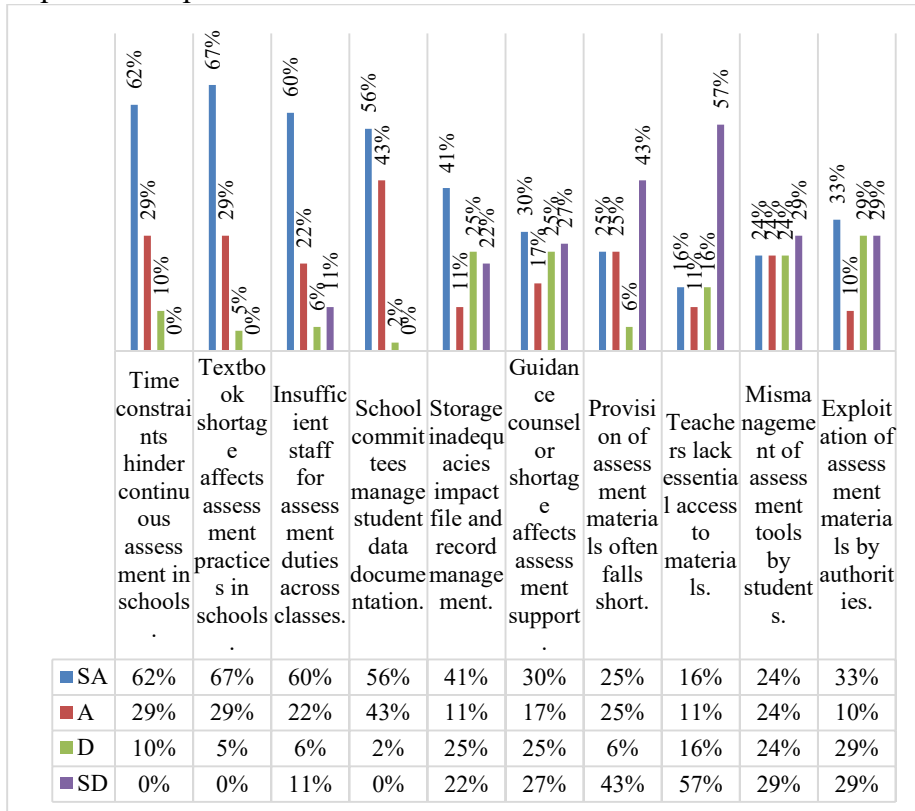


**Figure 1: How continuous assessment affect primary education students' attitude towards learning**

Figure 1 revealed the continuous assessment affect the primary education students Attitude towards learning. The data indicates varying perceptions of continuous assessment (CA) effectiveness among respondents, as shown by the percentages for each level of agreement: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Notably, a majority of respondents strongly agree or agree with CA's ability to validate student mastery (59% SA, 22% A) and refine lecturers' understanding of content (56% SA, 32% A). Additionally, CA is seen as enhancing student self-awareness (78% SA) and guiding effective learning paths (56% SA), while also directing lecturers in instructional decisions (67% SA). However, there are mixed views on CA's ability to alleviate test anxiety, assess student interests for counseling, and reduce lecturers' workload. Overall, the data suggests a positive perception of CA's benefits in education, with some areas warranting further consideration and improvement.



**Research Question 2:** To what extent do the availability of resources impact the implementation of continuous assessment?

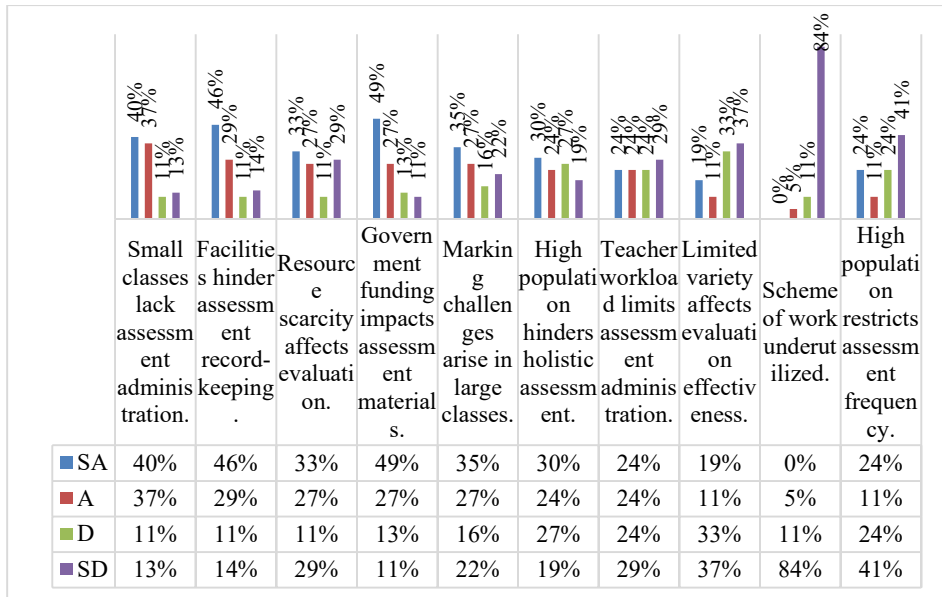


**Figure 2: Extent to which the availability of resources impacts the implementation of continuous assessment.**

The data in Figure 2 illustrates respondents' perceptions regarding the availability of resources for continuous assessment (CA) implementation, categorized into levels of agreement: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). It reveals prevalent challenges hindering CA practices, including time constraints (62% SA) and textbook shortages (67% SA). Furthermore, respondents acknowledge insufficiencies in staffing for assessment duties (60% SA), while also recognizing the role of school committees in managing student data (56% SA). Storage inadequacies (41% SA) and guidance counselor shortages (30% SA) are highlighted as additional barriers. Despite these challenges, there are concerns regarding the provision of assessment materials (25% SA) and lecturers' access to essential resources (16% SA). Moreover, the data suggests issues of mismanagement by students (24% SA) and exploitation by authorities (33% SA). Overall, the findings underscore the importance of addressing resource inadequacies to facilitate effective CA

implementation in schools.

**Research Question 4:** To what extent does the student-to-lecturer ratio affect the administration of continuous assessment?

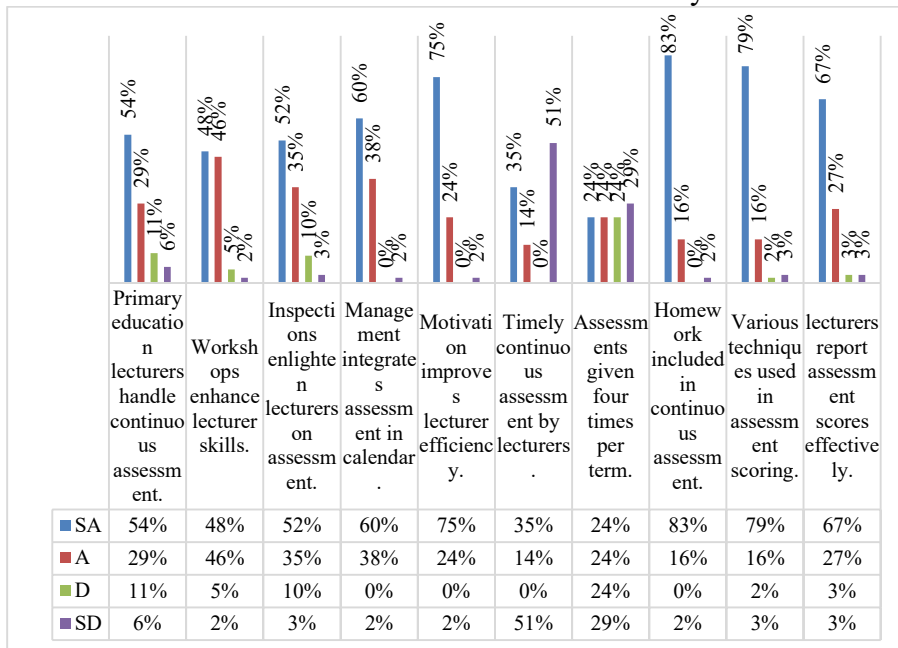


**Figure 3: Extent to which the student-to-lecturer ratio affect the administration of continuous assessment.**

The data in Figure 3 highlights perceptions regarding the impact of student-to-lecturer ratio on the administration of continuous assessment (CA), categorized by levels of agreement: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Respondents identify various challenges stemming from class size and resource availability. Notably, there is acknowledgment that small classes lack assessment administration (40% SA), while facilities hinder assessment record-keeping (46% SA). Resource scarcity (33% SA) and government funding (49% SA) are recognized as factors affecting evaluation. Marking challenges in large classes (35% SA) and high population hindering holistic assessment (30% SA) are also noted. Additionally, respondents perceive lecturer workload (24% SA) and limited assessment variety (19% SA) as impacting assessment administration. Furthermore, there are concerns regarding the underutilization of scheme of work (0% SA) and the restriction of assessment frequency due to high population (24% SA). Overall, the data underscores the need to address these challenges to ensure effective CA administration amidst varying student-to-lecturer ratios.

**Research Question 4:** What solutions addresses the challenges facing

the administration of continuous assessment in tertiary institutions?



**Figure 4: Solutions to the challenges facing the administration of continuous assessment in tertiary institutions.**

The data in Figure 4 presents solutions to challenges in the administration of continuous assessment (CA), categorized by levels of agreement: Strongly Agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD). Primary education lecturers are identified as pivotal in CA administration (54% SA), while workshops are recognized for enhancing lecturer skills (48% SA). Inspections are seen to enlighten lecturers on assessment practices (52% SA), and management integration of assessment in calendars is valued (60% SA). Moreover, motivation is perceived as crucial for improving lecturer efficiency (75% SA), and timely assessments are emphasized (35% SA). Additionally, assessments given four times per term (24% SA) and including homework in CA (83% SA) are seen as beneficial. Furthermore, respondents highlight the importance of using various assessment techniques (79% SA) and effective reporting of assessment scores by lecturers (67% SA). Overall, these solutions aim to enhance the effectiveness and efficiency of CA administration in primary education settings.

**Discussion of Findings**

Research question 1 dealt with how continuous assessment affect primary education students' attitude towards learning. Based on the analysis, Continuous assessment significantly influences primary education students' attitudes towards learning. It validates their mastery,

refines lecturers' understanding, enhances self-awareness, and guides effective learning paths. This finding aligns with Grace et al, (2024), who emphasized the positive impact of continuous assessment on student confidence and teacher adaptability. Additionally, continuous assessment directs instructional decisions and assesses student interests, promoting personalized learning experiences (Osiesi, 2023). However, in contrast, Rai (2019) highlighted challenges such as increased teacher workload and resource limitations, which may hinder the full realization of continuous assessment's benefits. Similarly, Solomon et al, (2018) pointed out potential stressors related to continuous assessment, such as time constraints and test anxiety. Despite these challenges, continuous assessment remains a valuable tool for nurturing positive attitudes towards learning in primary education.

Research question 2 examined the extent to which the availability of resources impacts the implementation of continuous assessment. The availability of resources significantly influences the implementation of continuous assessment (CA) in educational settings. Time constraints present a major hurdle for effective CA practices, limiting the amount of assessment that can be conducted within the allocated timeframe (Porta et al, 2023). Similarly, Girma et al, (2020) emphasized how the shortage of textbooks affects assessment practices by limiting the variety and quality of materials available for evaluation. Additionally, insufficient staff for assessment duties across classes can lead to increased workloads and decreased efficiency in administering CA. In contrast, school committees play a crucial role in managing student data documentation, which can streamline CA processes and ensure accurate record-keeping (Adil et al, 2018). However, despite these efforts, challenges persist as the provision of assessment materials often falls short, resulting in inadequate resources for effective assessment practices. Moreover, lecturers lacking essential access to materials and mismanagement of assessment tools by students' further compound resource availability challenges for CA implementation (Ndebele et al, 2022). Overall, while some aspects of resource availability support CA implementation, challenges such as shortages and inadequate access remain significant barriers to effective assessment practices in educational contexts.

Research question 3 dealt on Extent to which the student-to-lecturer ratio affect the administration of continuous assessment. The student-to-lecturer ratio significantly influences the administration of continuous assessment (CA), as evidenced by various research findings. In contrast to the finding that small classes lack assessment administration due to limited resources or time (Dale et al, 2023), larger classes face marking challenges due to the sheer volume of assessments. This finding agrees with Al-Alawi (2023) and Fassbender and Lucier (2014), who highlight

the impact of high student-to-lecturer ratios on hindering holistic assessment practices. Furthermore, high population sizes restrict assessment frequency and limit the variety of evaluation methods utilized. This finding aligns with the notion that resource scarcity affects evaluation, emphasizing the importance of adequate government funding for assessment materials (Glewwe et al, 2021). Overall, the student-to-lecturer ratio plays a critical role in CA administration, impacting various aspects such as resource allocation, workload, and assessment frequency. Addressing these challenges requires a comprehensive approach that considers both classroom dynamics and institutional support.

Research question 4 determined the appropriate solutions to the challenges facing the administration of continuous assessment in tertiary institutions. The solutions proposed to address the challenges in the administration of continuous assessment (CA) in tertiary institutions offer varied approaches to enhance assessment practices. In contrast to the finding that lecturers handle CA, Ebhaleme (2019) found that CA practices in Nigerian universities often involve lecturers from diverse academic backgrounds, potentially bringing a broader range of perspectives to assessment design and implementation. However, both studies emphasize the importance of workshops in enhancing lecturer skills, with Phillips and Phillips (2016) and Ledikwe et al, (2014) highlighting the role of workshops in improving the quality of assessment practices in schools. Similarly, while inspections aim to enlighten lecturers on assessment practices in one study, Saleem et al, (2021) emphasized the need for continuous professional development programs to support lecturers in implementing effective assessment strategies. Additionally, management's integration of CA into the academic calendar aligns with findings by Mukan et al, (2019), who underscored the importance of institutional support and infrastructure for successful CA implementation. Moreover, the motivation of lecturers to prioritize CA is consistent with Koyuncu and Demirhan (2021) findings on the positive correlation between lecturer commitment and assessment quality. However, in contrast to the recommendation of assessments four times per term, DeLuca and Bellara (2013) suggest that assessment frequency should be aligned with educational objectives and curriculum requirements. Overall, while there may be variations in the implementation of CA solutions across different educational contexts, the common goal is to enhance assessment practices and improve student learning outcomes.

## **Conclusion**

In conclusion, this study has provided valuable insights into the impact of continuous assessment (CA) on primary education students' attitudes

towards learning in tertiary institutions in Anambra state. Through a comprehensive analysis of various factors such as assessment practices, resource availability, and student-lecturer ratios, we have identified significant correlations between CA implementation and student learning outcomes. The findings suggest that CA plays a crucial role in shaping students' attitudes towards learning, as it provides regular feedback, promotes self-awareness, and reduces test anxiety. However, challenges such as resource scarcity, time constraints, and high student-lecturer ratios can hinder the effectiveness of CA implementation.

It is evident that addressing these challenges requires collaborative efforts from educational stakeholders, including policymakers, administrators, educators, and students themselves. By prioritizing investment in resources, providing adequate support for lecturers, and implementing evidence-based assessment practices, we can enhance the positive impact of CA on student learning experiences. Overall, this study underscores the importance of continuous assessment in fostering a positive learning environment and recommends further research to explore additional factors influencing students' attitudes towards learning in tertiary institutions.

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## EXPLORING STUDENTS' VIEWS ON DETERMINANTS OF ACADEMIC SUCCESS OF E-LEARNERS IN A NIGERIAN UNIVERSITY

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**Abstract:** *The Nigerian educational system is today beset by numerous problems. None of these is more genuine and tenacious than students' poor academic performance across all educational levels. This is one of the greatest drawbacks to educational advancement. The purpose of this paper was to explore students' views on factors influencing academic performance of e-learners. The population consisted of all students from second year to fourth year of the National Open University, South West geo-political zone. The respondents were asked to express their views on factors perceived to influence their academic performance. The study employed a qualitative study design as a means of carrying out the research. The sample of the study was made up of 48 respondents from the University which were selected using purposive sampling technique. Data were collected through focus group interviews, the interviews were audiotaped and transcribed, and data was analyzed through thematic analysis. The results of this study revealed factors such as computer reliance and knowledge, benefit of Internet, prior ICT experience, collaborative learning, parent influence – ICT literacy, self-efficacy and motivation and progressive use of computer and benefits as factors perceived by the students to influence their academic performance. Based on the findings of this study, it was recommended that distance e-learners should be encouraged to register for ICT training before being admitted into higher institutions. It was also recommended that the management of the university should give open access to the Internet and e-mail in the university by establishing ICT learning resource centres that give room for students to access relevant software, applications and technology of any form.*

**Keywords:** *ICT experience; self-efficacy; academic success; e-learning.*

## **Introduction**

Academic success of students is a principal yardstick of academic attainment at university level. Students with higher levels of achievement in higher institutions have high tendency to obtain good employment and salaries. Academic success is a key factor in education of a country because it can be seen as a determinant of success of education of a country (Coetzee, 2011). Academic success assumes a crucial role in producing the best quality graduates who will become outstanding pioneers in the workforce in a nation, and hence be in control of the nation's economic and social advancement. This can only be achieved if a nation values its education and is ready to bring innovation into the delivery system of learning.

The priority for educational stakeholders is the quality of students' academic success. The variables that contribute effectively to the academic success of students at all educational levels have been an issue of interest to stakeholders in education, trainers, policy makers, administrators and researchers. Most studies that have been conducted on variables influencing academic performance of students concentrate more on students at regular universities (face-to-face) in Nigeria but there is little or no research on variables influencing academic success of students under an e-learning setting and specifically a distance e-learner. This is partly because Nigeria, as a developing country, is at an infant stage of technology development, which makes it difficult to implement e-learning as mode of instruction. Recently the National Universities Commission (NUC), a body that regulates university operations, approved four universities to run e-learning in Nigeria. The National Open University of Nigeria (NOUN) was among the universities which received the approval. NOUN is the only uni-mode university mandated for open and distance learning in Nigeria, while the rest are dual mode. NOUN is the first fully fledged university that operates in an exclusively open and distance learning mode of education in Nigeria.

According to Singh (2013), academic performance refers to how students deal with their studies and students manage their studies and how they adapt to or fulfil diverse assignments given to them by their instructors. Academic performance can be defined as perfection in all academic disciplines in class as well as extracurricular activities. It includes excellence in sport, behaviour, confidence, communication skills, punctuality, assertiveness, arts, culture and the like. Martha (2010) studied the variables influencing student performance and measured the students in Uganda's achievement as their performance in

tests and coursework. The most critical and appropriate approach to measure the student academic performance in Malaysia is the Cumulative Grade Point Average (CGPA). Nigeria as a developing country also uses GPA to measure academic performance of students semester by semester.

Stevenson, Shin-Yin and James (2001) conducted a study on Chinese, Japanese and American students' academic achievement in Mathematics and measured performance in perceptual speed, coding skill, spatial abilities, vocabulary, verbal memory and general information. They found that Japanese and Chinese students performed better than their American counterparts. The outcomes in these distinctive parts of performance influence academic achievement in Mathematics. North Central Association (2000) gave methods for measuring student learning outcomes. These are evaluating learning increases through pre-test and post-test measures, and survey and self-report measures. Measurement of outcome is viewed as the best method for discovering data about students.

Considine and Zappala (2002) reported that parent's income or social status positively affects students' scores in examinations. According to Minnesota (2007), higher education performance is dependent upon the academic performance of graduate students. Many studies have been conducted in the area of students' performance and these studies identify and analyse the number of factors that affect the academic performance of the student at school, college and even at university level. Their findings reported the students' effort, previous schooling, parents' educational background, family income, self-motivation of students, age of student, learning preferences and entry qualification of students as important factors that have an effect on the student's academic performance in different settings. The current study is aimed at determining the factors that affect the academic performance of distance

### **Statement of the Problem**

Academic performance of students is one of the critical factors for judging educational standards and quality in Nigeria. The key reason behind this study is a recent decline in the standard of education in Nigeria and this is evident in the low academic performance in public examinations for all the educational levels, with distance education being no exception, as reported by Adedeji et al. (2011). The decline in standards of education in Nigeria has led to low academic performance of students in Nigerian higher institutions because of disadvantaged education background in both primary and post-primary education levels respectively. Kolawole and Dele (2002), as quoted by Olanipekun and Aina (2014), noticed that academic performance of Nigerian students is one of the existing educational concerns which have attracted public

discussion in recent times because of low level of academic performance in all educational levels. Academic performance of high school and higher institutions students is becoming problematic (Aina and Olanipekun, 2014).

Measuring academic performance of students in tertiary institutions has never been an easy task because it cannot be easily quantified precisely. Student performance may be seen to be a result of environmental, socioeconomic or psychological factors. However, refusal to understand these factors may slow down the educational system and lead to higher failure rates. This does not stop here, but it will create a chain effect by subjecting the throughput of good quality results to an unacceptable level of attrition. Therefore, it is necessary to analyse the factors that relate to suboptimal academic performance in order to set up a possible practical remedy (Schwerdt & Wuppermann, 2008). The majority of studies (Ajadi, Salawu & Adeoye, 2008; Oye et al 2011 and Okopi & Pindar, 2014) on e-learning in Nigeria focused on the problems, challenges, attitudes and expectations of e-learning and the motivation of distance e-learners' persistence. A small number of studies (Oladejo, 2010; Pitan, 2015; Ojokheta, 2010) on academic performance of distance learners in Nigeria focused on self-regulation, environmental influence and persistence. The researchers have observed from the literature review that there was limited research on the factors influencing academic performance of distance e-learners. This serves as an incentive for this research to fill up the existing important research gap in the literature.

### **Review of Related Literature**

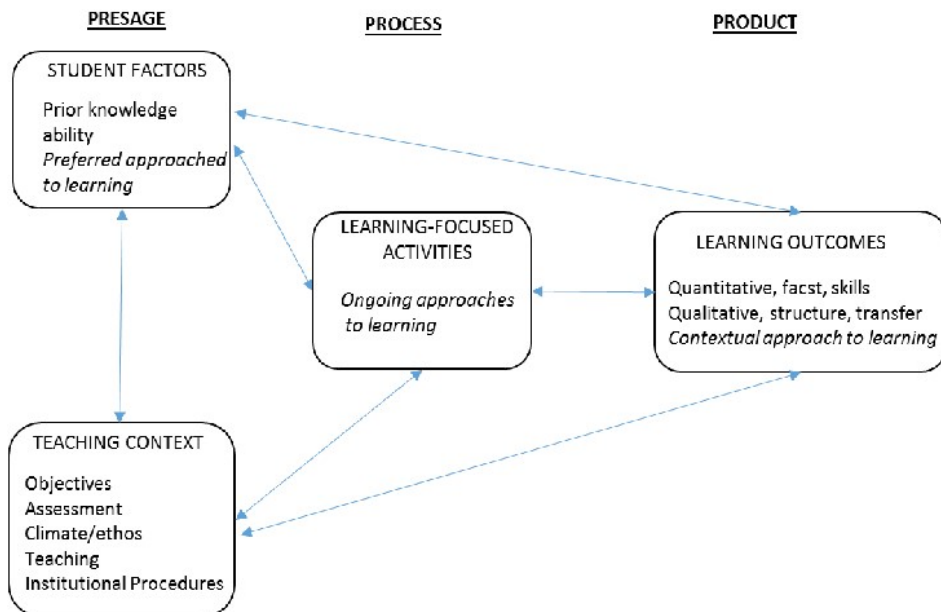
Asdaque, Khan and Rizvi (2010) found that students who used the Internet for downloading assignments and books/journals had a higher CGPA compared to those who used the Internet for purposes other than assignments or downloading software/songs. Ogedebe (2012) reported in his study that 79% of his participants agreed that Internet improved their academic performance. Siraj, Salam, Hasan, Roslan, & Othman(2015) concluded that high Internet usage brings about better academic performance because the Internet gives students the benefits of entering the information. Other researchers, (Lamb & Johnson, 2007; Jones, 2010; Chawner & Lewis, 2013), remarked that collaborative learning assisted students to interact with each other by participating in online discussions and sharing the knowledge gathered with one another. Bliss and Lawrence (2009) reported that group work through computer-mediated collaboration brings about improvement in academic performance, interaction and critical thinking. Kumar & Pokhrel (2017) who found that collaborative mobile learning and individual e-learning resulted to improved academic performance among the students in

contrast to the traditional method. Adekunle, Oguns & Ayegbo (2014) found a relationship between parents' computer literacy and academic performance of computer science students. In another study, based only on the quantitative results, Olukayode and Govender (2019) found a range of critical factors that influenced/best predicted academic achievement and amongst them were frequency of engagement with ICT, marital status, previous academic performance and previous qualification. Valcke, Bonte, Wever and Rots (2010) investigated the impact of parenting style on the Internet use of primary school pupils. They found that the parental style, parent Internet behaviour and parents' educational background significantly predicted the Internet usage of children at home. Other researchers, (Joo, Lim., & Kim (2013); Mega, Ronconi, & De Beni, 2014)) found that self-efficacy influences students' academic achievement. Abd-Elmoteleb and Saha (2013) as well as Govender and Govender (2009), remarked that students with high senses of self-efficacy have a tendency to engage in challenging tasks and show excellent academic performance in comparison with students who lack such confidence. Meral, Colak, & Zereyak (2012) reported that self-efficacy is an important variable on students' academic performance and self-efficacy has more influence on academic performance than socioeconomic variables.

Ahmad et al. (2011) defined academic performance as a way of quantifying the academic success of a student. Academic performance is related to the knowledge and skills developed by a student in various courses of study. Academic performance can be measured in several ways. The majority of researchers (Broh, 2000; Darling, 2005; Galiher, 2006; Stephen & Schaban, 2002) across the globe utilised the GPA to measure student performance. In Pakistan, Hijazi and Naqvi (2006) used test results to measure students' performance for the specific subject in a particular semester. Garner-O'Neale and Harrison (2013) noted that the level of academic performance is calculated using tests, assignments and final examination results and is dependent on the standards put in place by the educational institution. Pitan (2015) remarked that today's modern society expects everybody to be a high achiever. She noted that the key criteria to determine one's actual potentials and capabilities may be academic performance, which has turned into an index of the student's future and upward mobility. Academic performance is usually measured by levels and test scores (Kingdon 2007). In South Australia, Tan and Yates (2007) noted that academic performance is measured in terms of past examination performance, performance in the midterms and failure in modules. Maiyo & Ashioya (2009) commented that in Kenya, education is examination oriented and consequently the main assessment for performance is through examinations. As stated by Ali et

al. (2009), the social and economic improvement of the nation is fundamentally connected with student academic performance.

### 3P Model of Learning Approaches



The theoretical framework that supports this study is Biggs' (1999) 3P model of the student approaches to learning theory. The 3P model proposed by Biggs (1999) explains why students learn in different ways and how students' approach to teaching is related to quality of learning and outcome. The model integrates teaching-, student- and process-based approaches to learning. According to the 3P model, learning is seen as a progression from presage (learning context) through process (learning acts) to products (learning achievement). According to Chan (2011), the model was developed initially by Dunkin and Biddle (1974). This illustrated learning in the classroom with multi-components integrated system with a combination of presage, process and product. The three components are (1) prior learning environment and student characteristics (presage), (2) approach to learning (process) and (3) the learning outcomes (product). Personal and situational factors (presage) were proposed in the model to influence a student to use a particular approach to learning (process) which affects the learning outcomes (product) (Chan, 2011). The 3P Model of learning approach which was adopted in this study outlined the influence of presage, process and product factors. The three stages are applicable to this study, fit the model, and the variables are explained as they are related to this study.

#### a. Presage Stage

According to Bonsaksen, Tore, Ted, Hua, Kenneth (2017), the presage factors are linked to the background of students (socio-demographic factors) and readiness for better understanding. Also, presage comprises the situational context where learning occurs, which includes the specific area of specialisation and its traditions, the constantly adopted teaching and evaluation forms, and the time spent engaging with the appropriate time tasks. In summary, the presage stages are those factors that form the context and background for the learning experience. The presage variables integrate factors in place before learning takes place.

#### **a. Process Stages**

The process factors concentrated on learning activities which involve the real activities that happen in the lecture room. In the process stage the model begins with the interaction of student factors and learning setting or environment. This interaction regulates students' perceptions, and the perceptions drive the methods chosen to managing the teaching task. Gibbs (2010) viewed learning approach as the ability to engage students with feedback quality.

#### **Product Stages**

The last construct in the model, product, describes the outcomes achieved in the learning process. According to Gibbs (2010), this stage is referred to as learning outcomes, that is, academic performance and employability. The product factors were recognised as students' learning outcomes which can be described quantitatively (how much was learnt), qualitatively (how well it was learn), or both quantitatively and qualitatively. The learning outcome, which is also known as student achievement, is the product and reflects what we want the student to do (Jamieson, 2015).

The qualitative responses in this study are the perception of the distance e-learners (process stage). According to the participants, although it was not quantitatively proved that collaboration learning (learning activities), that is, the process of exchange ideas and knowledge among their colleagues and facilitators influence their academic performance (learning outcome). Before students will be able to collaborate or share ideas and knowledge with fellow students in a discussion forum, they must have prior ICT experience, which is a presage factor according to the model. This shows that there is a linear movement or a straight line from prior ICT experience to collaborative (exchange of knowledge) to academic performance. Distance e-learners under this study perceived the knowledge they acquired through interaction with colleagues during discussion under an e-learning setting as influencing their academic performance (learning outcome). Also, during the qualitative results revealed that the participants proved that prior ICT experience, parental influence (ICT literacy), benefit of Internet, progressive use of a

computer and self-efficacy or motivation influenced their academic performance. These perceptions cannot be isolated from their background or student's activities that take place before learning started, which is referred to as presage stage according to the model. There is a link between these perceptions and students' activities, which will eventually reflect in their academic performance. For instance, the participants commented that they were able to perform better under an e-learning setting because of their prior ICT experience. The presage in this case is prior ICT experience which was their background or prior experience before learning started, process stage is e-learning activities such course participation, discussion forum or interactive forum while academic performance is the leaning outcome. This study supports previous studies that prior ICT knowledge influences distance e-learners' learning processes and their academic performance. They were able to participate effectively because of the link. The explanation above proves that this study fits into the three stages of the model.

### **Purpose of the Study**

The purpose of this study was to explore students' views on factors influencing academic performance of e-learners.

### **Research Question**

Based on the purpose of the study, the below research question was raised:

- i) What are the factors perceived by e-learners to influence their academic performance?

### **Research Method**

This study adopted a qualitative case study design. Qualitative studies are known for their ability to understand phenomena from the participants' point of view (Croswell, 2013). The study investigated factors affecting e-learners' academic performance from the point of view of the students themselves. The study was conducted in a university under an e-learning setting. The university was chosen because it has experienced a decline in academic performance and graduation rates, and hence it was considered an information-rich site.

### **Population and Sampling**

Students from second year up to fourth year participated in the study to form the population of the study. A purposive sample of 25 male and 23 female students participated in the study. These students were drawn from second to final year and were deemed experienced enough with teaching and learning practices in the university to provide useful insights on factors affecting students' academic performance of e-learners .



### **Data Collection**

The researchers used focus group interviews as a mode of collecting data from the participants. The researchers arranged for 8 focus groups, each containing 6 participants. Each session were audio-recorded with the permission of the participants. A laptop computer was used both for audio recording the conversation as well as for preparation of transcription. In addition to that, the researcher used a smartphone for audio recording. The phone was used to ensure that the complete focus group interview was recorded and also to verify the recording for the purpose of transcription.

### **Reliability and Validity**

Validity in qualitative research is associated with the authentic nature of the findings of the study and the conclusions drawn from that piece of work (Bryman, 2012). According to Maree (2010), validity and reliability in qualitative research refer to research that is credible and trustworthy. In order to ensure reliability and validity of the outcomes of the study, the researchers ensured that there were no biases and undue influence during the whole interviewing process. This process adhered to the recognized procedures, which ought to be followed when coding, categorizing and analyzing data. The researchers reflected his position through engagement in the field as an insider in the process of data generation as he was involved in conversations with participants and undertook observations of events and activities. Finally, the researchers included primary data in the results to allow the reader to see the basis upon which the researchers' conclusions were made. For instance, some of the participants' views were given with actual quotations as evidence.

### **Data Analysis**

Thematic analysis was adopted in analyzing the data collected. Several hours of audio recording was obtained. This was transcribed and then analysed. The data analysis was arranged under themes.

### **Results of the findings**

#### **Themes Emerging from the Study**

The following themes emerged from the study after transcription.

#### **Theme 1: Computer Reliance and Knowledge**

The participants commented that without a computer they cannot do anything under an e-learning system of learning and this indicates their total reliance on computers. They believed that their computer knowledge assisted them in using a computer for various activities. This is what the participants had to say:

*Without computer knowledge, I wouldn't be able to do anything, due to computer age that is the reason. It is everything will do with computer. If I don't have knowledge of computer, I will not be able to perform under e-learning setting(Respondent 4)*

*Let me say in our Open University here, without computer knowledge you can't do anything(Respondent 17)*

*By handling the computer, I improve on it as I'm using the computer by studying, by reading through the computer. As I'm using the computer, I understood more of my subject areas(Respondent 23)*

*When I got to NOUN, I learnt more about computer because I'm going to use computer for exam and other things. When I got here I used computer often, everyday, regularly. Even though, I'm planning to have café on my own(Respondent 34).*

*My computer knowledge makes me to perform in e-exams better than pen-on-paper exams because we are in computer age. People are ready to sit down with computer rather than sit down with book and read(Respondent 41)*

*So, I can say with my computer, it influences my performance, even in my exam I'm having good grade. I work with computer a lot. I don't have computer knowledge before I was admitted, I only have elementary knowledge(Respondent 44)*

#### Theme 2: Benefit of Internet

The participants commented that the benefit from Internet usage in term of downloading useful materials, Google searching for relevant information and for electronic examination has really influence their academic performance.

The following are extracted from the responses of the participants:

*I opened my laptop searched for all cases online as a Law student and I was able to download them(Respondent 4) (Respondent 11).*

*I think we are learning in higher way because you have to go deep and deep down search by yourself and study on your own before facing the examination(Respondent 24)*

*It affects my academic performance because searching for what you don't know and bring it to academic world boost your ego. When you are talking of ICT, it goes wide you have to go Internet to google to gain one or two things(Respondent 28).*

*We download our course materials/contents from the Internet and that have assisted me to improve on my academic performance(Respondent 30).*

*I got a lot of information and development day by day through the Internet, ICT and this has reflected in my performance. Had it been that I don't know how to access Internet my performance will be lower(Respondent 40)*

*Do your assignment, your TMA even doing it at home online is part of ICT. It really influences performance because doing assignment you have to google, search the net(Respondent 41).*

### Theme 3: Prior ICT Experience

Almost all the participants were unanimous in supporting that prior ICT experience influenced distance e-learners' academic performance. They commented that those who have ICT experience will likely perform higher than their counterparts without ICT experience because of their mode of study.

The following are extracted from the responses of the participants:

*Like where I worked before in accounting firm, we exposed to computer come here now make it easier (Respondent 4)*

*If one has prior ICT experience, it will add like 100% contribution to his present academic performance(Respondent 18)*

*If you are study English without prior ICT experience, it might affect your academic performance. In short, ICT experience determines the academic performance(Respondent 24)*

*I was able to perform because of ICT experience. I have gone for different trainings on ICT. Assuming I don't know have knowledge of ICT, it will have affected my academic negatively(Respondent 33)*

*There is a correlation between ICT work experience and academic performance. My mates called me " guru " in the class but that is the result of my work experience. I have pre-knowledge of computer both theory and practical before I gained admission(Respondent 34)*

*With my ICT previous experience it make me know that this is the keyboard, monitor unlike those who are not having previous experience. There is different between person who is able to hold mouse before been admitted and those who cannot. The mostly different is the background (Respondent45)*

*It really helps me because I was working in a computer company as an engineer where I do interact with computer at times. I do engineer work all these stuffs with computer. So, I have some much interest in computer before getting to school and it impacted expensive and good thing into my career. When I get here to use computer to do my exam and test, it wasn't a problem for me and it influences my performance very well(Respondent 48).*

*It helps to share our ideas with students from other study centres. We are being using it very good for us. We have seen a lot of past questions. It really helps in our exam and test (Respondent 1)*

### 4: Collaborative Learning

Almost all the participants commented positively that the interactive (i-learn) forum at NOUN brings about collaborative learning. According

to the participants, the forum enabled them to come together to share ideas and knowledge in their areas of specialisation with their colleagues, university staff and facilitators. Those who are not constantly on the forum also agreed that the forum helps them to have collaborative learning among their colleagues and facilitators across the nation and thereby influences their academic performance.

The following are extracted from the responses of the participants:

*You meet different people you have not come across before; he/she shed more light on what you don't know before. If you are the one that know the topic, you bring the topic and started chatting on the topic. I think it really helps(Respondent 4)*

*This is an interaction forum, an i-learn blog when you are entering on the blog everyday and you are close to your departmental students. They will discuss something that will sink to your brain because the questions you pulled you will see many ways of solving them. You will see many things there in educational aspects. The social aspect is also there because when we are not social we can't organise ourselves. This has really contributed to my academic performance because we share ideas and knowledge on that i-learn(Respondent 8)*

*We interact with facilitators, colleagues from other centres all over the country. This is a forum where people come together to share ideas(Respondent 11)*

*The usefulness of that i-learn is that anybody from other universities can log in because many useful materials are there for students to make use of. People interact there, to exchange ideas and share knowledge(Respondent 19)*

*On getting there, you put the question on the forum. Is there anybody that can show more light about this particular subject matter and before you know people from different study centres will respond, you will be enlightened. This will definitely contribute to my performance(Respondent 21)*

*It gives room for interaction with students from other centres not only Akure centre across the whole centres in the federation. They are sometime you can get past question, likely questions when you answer them. I think that has really helped me in one of my exams, the likely questions that may come out in the examination. When you practice it, it becomes part and parcel of you. That interaction forum really influences my academic performance((Respondent 33)*

### **Theme 5: Parent Influence – ICT Literacy**

Some participants commented that their parents' ICT literacy influenced their academic performance positively. They commented that they were

earlier introduced to computer by their parents because they were ICT literate, and they were also encouraged by their parents.

Below are some of their responses.

*Because my father is educated, he introduced me to computer so that I can have more knowledge. He did so because he is ICT literate/compliance. What I can't get in the school and I will get it online. That is why my parents supported me. Although what one do continuously will become part of him(Respondent 11)*

*He bought palmtop for me, being a computer and ICT literate. In short, my parent ICT education really influences my academic performance (Respondent 20)*

*I think this has influenced my academic performance because of his ICT literacy and the knowledge transferred. My Dad is computer literate, being an educated person. There is a widely know philosophy that we are in computer age and everybody believe this is true. So, being an educated person he was the one that asked me how to do you do your TMA? Don't you need a computer? Don't you need a phone to do those things? He bought palmtop for me, being a computer and ICT literate. In short, my parents' ICT education really influences my academic performance(Respondent 43)*

*They are computer literate. Assume they are not computer literate; it will not influence my (Respondent 47)*

### **Theme 6: Self-Efficacy and Motivation**

The participants totally disagreed that their courses of study do not influence their academic performance in any way under e-learning during the focus group interview but their self-efficacy and motivation do.

The following quotes were extracted from their responses:

*The academic performance doesn't depend on your course of study but determination to excel. I don't agree that students in computer science will perform better than those of us Law under e-learning setting. Even if you are not computer literate but you can determine to be one(Respondent 5)*

*The course of study does not determine the academic performance of students under e-learning setting. What determine my performance is the interest and the knowledge of ICT(Respondent 11)*

*The academic performance doesn't depend on your course of study but determination to excel. I don't agree that students in computer science will perform better than those of us Law under e-learning setting. Even if you are not computer literate but you determine to be one(Respondent 19)*

*Course of study has nothing to do with academic performance of students under e-learning setting but determination and interest do(Respondent 33)*

*The fact my colleague is study computer doesn't indicate that he will perform better than me. What matters is how to manipulate computer not course of study(Respondent 36)*

*The course of study does not determine the academic performance of students under e-learning setting. What determine my performance are the interest and the knowledge of ICT(Respondent 39)*

*In my year 1, I happened to be the one that scored highest mark in CIT 100 which is a general computer course and despite that the fact that I'm not study computer. This was possible because of self motivation/ determination(Respondent 42)*

*Everything being equal  $1+1=2$ , computer science may have edge over others but not everybody due to determination. The way they use it may be a little fast but due to determination one can perform well irrespective of course of study. If I work harder I can beat the person in computer whether is e-learning setting or not(Respondent 46)*

*I don't believe that the person in computer technology can perform more than me studying agricultural extension management since e-learning system is not until you know the whole computer before you can operate system. The whole thing is for you to get yourself prepare for the examination with computer. So far you know how to operate computer, I don't think those in computer technology can perform better than me. It depends on your seriousness and how you concentrate not the course of study(Respondent 48)*

### **Theme 7: Progressive Use of Computer and Benefits**

The participants commented that as they were progressing in computer usage for educational purposes from year to year, so also their academic performance improves. They also commented that the more they continue to progress in computer usage for their learning, the more improvement in their knowledge which reflects positively in their academic performance.

The following are extracted from their responses:

*Every year I can see that I'm upgrading, adding more knowledge to my knowledge (Respondent 5)*

*My first year was easy because I was average in term of ICT but now I'm improving and we did general course then but now we are on three unit course, congent courses. It takes reading and*

*browsing. This really contributes to my performance(Respondent 13)*

*What I have not been exposed to, I think every semester, and I'm exposed to it. So that it has improved my knowledge(Respondent 17)*

*You know as an empty student, it is very compulsory for the students that have just been admitted in any university to be developing academically. In my first semester of 100 level, I experienced many things and knew a lot of things and in my second year I also know a lot of things. The knowledge I acquired in my 100 level has nothing to do with that of 200 level. The knowledge I acquired in my 200 level is very advance. Even it helps to be a student that can speak publicly and to have confidence in myself confidence. In short my year of study has a lot to do my academic performance(Respondent 25)*

*When I first got in first semester, everything was new. I will perform better because things are no longer new and my feets are on ground(Respondent 29)*

*Because of the school I am right now. We do most of the things online. Because of my frequent engagement with ICT, I'm able to learn more(Respondent 31)*

*I will perform better in my year 2 because things are no longer new and my feets are on ground(Respondent 38)*

*There is an improvement in year by year. I was a Novice in ICT in my year 1 but I observed rapid improvement in year2 likewise year 3(Respondent 42)*

### **Discussions of the Findings**

The participants' comments in theme 1 have revealed that computer reliance and knowledge influences their academic performance. This may be because computer knowledge assisted them in using a computer for educational activities or purposes. The participants commented in theme 2 that the benefit from Internet usage in term of downloading useful materials, Google searching for relevant information and for electronic examination has really influence their academic performance. This may suggest that benefit from Internet usage for educational purpose play a significant role in the academic performance of distance e-learners or frequency usage of Internet for educational purposes contribute positively to the academic performance of distance e-learners. The result of the finding is supported by Asdaque et al(2010) who found that students who used the Internet for downloading information for assignments and books/journals had a higher CGPA compared to those who used the Internet for purposes other than assignments or downloading software/songs. The result of the findings is in line with

Ogedebe (2012) who reported in his study that 79% of his participants agreed that Internet improved their academic performance. The result of the findings is in agreement with Siraj et al (2015) who concluded that high Internet usage brings about better academic performance because the Internet gives students the benefits of entering the information. They reported that computer-illiterate students indicated that the lack of computer experience influenced their ability to pass computer-related subjects. The participants commented in theme 3 that those who have ICT experience will likely perform higher than their counterparts without ICT experience because of their mode of study. The participants commented in theme 4 that the collaborative learning helps them to share ideas and knowledge among their colleagues and facilitators across the nation and thereby influences their academic performance. Participants commented positively that the interactive (i-learn) forum in their university brings about collaborative learning. This may due to the fact that the forum enabled them to come together to share ideas and knowledge in their areas of specialisation with their colleagues, university staff and facilitators. The result above was supported by previous studies (Lamb & Johnson, 2007; Jones, 2010; Chawner & Lewis, 2013) who remarked that collaborative learning assisted students to interact with each other by participating in online discussions and sharing the knowledge gathered with one another. This study is consistent with the findings of researchers Bliss and Lawrence (2009) who reported that group work through computer-mediated collaboration brings about improvement in academic performance, interaction and critical thinking. This study is also in agreement with Kumar et al. (2017) who found that collaborative mobile learning and individual e-learning resulted to improved academic performance among the students in contrast to the traditional method. The results of this finding are consistent with the study conducted by Adekunle et al. (2014) to determine the relationship between parents' computer literacy and academic performance of computer science students. They concluded that there was a significant relationship between the two. The result of the finding is similar to the study carried out by Valcke, Bonte, Wever and Rots (2010) on the impact of parenting style on the Internet use of primary school pupils. They found that that parental style, parent Internet behaviour and parents' educational background significantly predicted the Internet usage of children at home.

Participants' comments in theme 6 revealed that those with high self-efficacy and motivation will likely perform higher than their counterparts with low self-efficacy and motivation. This may be because academic performance of distance e-learners depend on determination and interest. These researchers supported the above comments that self-efficacy influences students' academic achievement: Joo et al. (2013)



and Mega et al. (2014). Consistent with the above were Abd-Elmotaieb and Saha (2013) who remarked that students with high senses of self-efficacy have a tendency to engage in challenging tasks and show excellent academic performance in comparison with students who lack such confidence. The comments are also in line with Meral et al (2012) who reported that self-efficacy is an important variable on students' academic performance and self-efficacy has more influence on academic performance than socioeconomic variables.

### **Conclusion**

The researchers concluded that the following themes emerged from the study are factors perceived by the students to influence their academic performance:

- Computer Reliance and Knowledge;
- Benefit of Internet;
- Prior ICT experience;
- Collaborative learning;
- Parent influence – ICT literacy
- Self-efficacy and motivation' and
- Progressive Use of Computer and Benefits

### **Recommendations**

The researchers therefore recommend that distance e-learners should be encouraged to register for ICT training before admitted into higher institutions. This will enable them to acquire previous ICT knowledge and exposure. The researcher recommends that instructors should concentrate on interactive learning tasks in order to encourage collaborative learning to facilitate sharing of knowledge and ideas. Course facilitators should continually promote the setting up of online tutorial study groups or discussion forums intended for sharing of ideas and knowledge. The participants agreed that their parents' ICT exposure or literacy influenced their academic performance. The researchers recommend that the university should promote adult education by providing ICT literacy courses. The participants commented that the benefit from Internet usage in terms of downloading useful materials, Google searching for relevant information and for electronic examination has a real influence on their academic performance. The researcher recommends therefore that the university should sustain present Internet links and connect additional PCs to the Internet. The management of the university should give open access to the Internet and e-mail in the university by establishing ICT learning resource centres that give room for students to access relevant software, applications and technology of any form. Government should subsidise Internet access in all the universities in Nigeria for educational purposes

in order to improve academic performance. Government should make Internet connectivity a priority for the university by increasing bandwidth to enable the students to use the Internet effectively for educational purposes. The participants agreed that under an e-learning setting, those with high self-efficacy and motivation will likely perform higher than their counterparts with low self-efficacy and motivation. Therefore, as stated above, the need for frequent engagement with ICT and students ICT literacy are necessary which will also lead to self-efficacy and self-motivation. The researcher recommends that the management of the university should integrate learner control in an e-learning setting as a component of the course design, which will enable the distance e-learners to have high self-efficacy over their learning environment.

### **Limitations of the Study**

The researchers were only able to cover four centres of NOUN in South-Western Nigeria, because of the vast extent of the land and spread of study centres across the nation. Otherwise, the researchers would have covered many more areas in South-Western Nigeria. Therefore, any prediction or generalisations can only be applied over these four study centres.

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**TECHNOLOGICAL PEDAGOGICAL CONTENT  
KNOWLEDGE SELF-EFFICACY OF TRAINEE SCIENCE  
TEACHERS IN COLLEGES OF EDUCATION IN ILORIN,  
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**Abstract:** *One of the key elements influencing the adoption of technology in science teaching and learning is the efficacy of teachers in using technological pedagogical content expertise. This study examines trainee science teachers enrolled in three Ilorin colleges of education and their efficacy in using technological pedagogical content expertise. The study specifically focused on colleges of education that were owned by the federal, state, and private sectors. This study took into account variables including gender, year of study, specialization, and type of school. The study used descriptive survey research method. A multistage sampling approach was employed to choose 221 science pre-service teachers from selected schools. The research instrument used to elicit responses in this study was an adapted TPACK self-efficacy questionnaire. The questionnaire was validated, and an internal consistency reliability test was carried out to determine its reliability. Cronbach's alpha statistics was used to determine the reliability coefficient, and a value of 0.94 was obtained. Hence, the instrument was considered reliable. The data gathered was subjected to analysis using Welch's t-test and Kruskal Wallis test. The results indicated that trainee teachers*

*sampled in this study had a moderate level of TPACK self-efficacy when it came to teaching, and that there was a significant difference in pre-service teachers' self-efficacy depending on their gender, year of study, area of specialization, and type of school attended.*

**Keywords:** *Self-efficacy; Trainee teachers; Technological pedagogical content; knowledge.*

## **Introduction**

The quest for producing students who can contribute to technological advancement globally through the knowledge of science has been one of the primary purposes of science instruction. Consequently, developing scientifically literate individual is one of the stated goals of science instruction. This goal of science teaching leaves teachers of science with the responsibility of training future scientist and develop specific scientific literacy in students. Therefore, it becomes imperative that teachers should be equipped with sufficient knowledge on the pedagogy of teaching science with emphasis on how to use technology to engage diverse learners in their classrooms during science instruction. Badmus et. al. (2018) had reported that in spite the importance of technology in improving the quality of teaching, a low percentage of teachers deploy it in their instruction. This reported slow integration of has posed challenge to science teaching and learning (Furlong, et. al, 2011).

To successfully implement an effective science instruction, teachers must be able to utilize several important kinds of expertise which include knowledge of subject matter, pedagogical knowledge as well knowledge of technology (Mishra & Koehler, 2006). However, a theoretical knowledge of each of this knowledge base is not sufficient for a teacher to excel in classroom instruction but the ability of the teacher to blend/integrate them to make instructional decisions for teaching specific topics in classroom situations. Studies on the application of the Technological Pedagogical Content Knowledge (TPACK) framework in planning, designing, teaching, and reflection have multiplied in response to the expanding influence of technology in education. This is due to the fact that the TPACK framework clarifies concepts and offers details on how technology is integrated into the process of instruction and learning (Sheffield, et al., 2015). However, several factors have been associated with the incorporation of technology for instruction which include availability of technological infrastructure, teachers' knowledge about computer software, attitude towards and self-efficacy (Onalan & Kurt, 2020). Evidence in literature suggests that self-efficacy is strongly correlated with technology integration into teaching (Barton & Dexter,

2019, Njiku, Mutarutinya & Maniharo, 2020).

Self-efficacy in technology can be conceptualized as individuals' capacity for effective deployment of technology in the classroom. Technology incorporation confidence, according to Schlebusch (2018), is a person's assessment of their own capacity to use technology to achieve their desired objectives. Teachers' efficacy of technology integration into teaching environment becomes an important issue in education research. This is due to the fact that effective technology integration into instruction happens when educators have hands-on experience using digital resources to hone their critical thinking and digital literacy skills (Yapıcı & Mirici, 2023). Having noted that several constructs of TPACK have dynamic relationship with one another, and should not be considered as individual components. It therefore, appears that TPACK self-efficacy level of a teacher plays a significant role in the application of TPACK model (Birisci & Kul, 2019). Hence, teachers' need to accurately adapt the different constructs in the model for them to acquire the desired competency in utilizing the model.

This study used the Koheler and Mishra (2009) TPACK framework, which illustrates the intricate relationship between teachers' subject-matter, technology, and pedagogical expertise. In their study, Koheler and Mishra stress how important it is for the three knowledge bases to interact for the effective integration of technology into the classroom. TPACK is based on the PCK (Pedagogical Content Knowledge) framework, which was first created by Shulman (1986, 1987). An interactive representation is provided for three knowledge bases: PCK, TCK (technological content knowledge), TPK (technological pedagogical knowledge), and TPACK (technological pedagogical content knowledge).

Koheler and Mishra (2009) interpret content knowledge (CK) as teachers' comprehension of the subject matter also known as content knowledge. This knowledge encompasses teachers' conceptual understanding, ideas about theories and organizational framework as peculiar to their field. Meanwhile, the PK is conceptualized as the teachers' profound knowledge about the methods, practices and processes of instruction and learning. It was also noted that the PCK as conceived by Shulman (1986) represent teachers' understanding of transformation of subject matter to teaching which influences learners understanding. The PCK covers five components as specified by Magannuson, et.al (1999) to include teachers' orientation to science instruction; instructional techniques, curriculum, and assessment knowledge; and comprehension of students' understanding. The technological knowledge thus refers to teachers' knowledge about technology and how to utilize them while the TCK is conceptualized as teachers' understanding of how subject matter knowledge is represented

and transformed to yield meaningful learning. Koheler and Mishra (2009) referred to TCK as teachers' knowledge of ways in which subject matter knowledge and technology influences one another. TPK is described as teacher's awareness of the influence of technology on instructional activities when learning of specific content. As represented by Guzey and Roehrig (2009), it includes teachers understanding of how instructional activities change when specific technologies are employed. As opined by Kiray, Celik and Colakoglu (2018), TPACK is the incorporation of knowledge of pedagogy and technology into specific subject matter knowledge. However, when the subject matter is regarded to be science, then it becomes specific to science (Lin, et. al. 2013). TPACK as conceptualized by Koheler and Mishra (2009) is teachers' knowledge that emerges as a result of interrelationships among specific understanding of subject matter, pedagogy, and technology. It provides the cornerstone for effective incorporation of technology into instruction. It therefore becomes necessary to investigate the TPACK self-efficacy among trainee teachers to provide insight into their readiness of technology integration into teaching science.

### **Research Questions**

The following research questions provide direction to this study:

1. To what extent does trainee teachers of science enrolled in education colleges feel they are capable of applying TPACK?
2. What variations exist in TPACK self-efficacy among trainee teachers when gender is considered?
3. What discrepancies exist in TPACK self-efficacy among trainee teachers based on their year of study?
4. Does the TPACK self-efficacy of among trainee teachers differ when their area of specialization is considered?
5. Does the TPACK self-efficacy of among trainee teachers vary when their school type is considered?

### **Review of Literature**

Research within the domain of TPACK in science education has revealed a variety of trends. These include evaluating teachers' pedagogical approaches and knowledge mediated by technology, identifying the interplay between TPACK and other facets of technology integration, investigating strategies for fostering TPACK among pre-service science educators, examining how teachers implement TPACK in their teaching practices, and formulating instruments to measure TPACK. However, there is a noticeable scarcity of studies focusing on the development of TPACK measurement tools and the relationship between TPACK and other factors that influence the integration of

technology into science education (Setiawan et al., 2019). In their 2019 study, Muhaimin et al. explored TPACK among Indonesian science teachers currently in service, employing an explanatory sequential design. The research included 356 participants and considered variables such as the teachers' gender and experience. Data was collected through a modified questionnaire, and analyses were conducted using t-tests and ANOVA. The results indicated that the teachers perceived their knowledge related to technology as inferior to their non-technology-related knowledge. Specifically, the average scores for the TK, TPK, TCK, and TPCK sections were notably lower compared to the scores for the CK, PK, and PCK sections. Gender-based analysis revealed no significant differences in the CK and TCK scores between male and female respondents. However, there were notable disparities, with females outperforming males in the PK and PCK areas, and males scoring higher in the TK, TPK, and TPCK areas. The study found no significant differences across the constructs when considering the teachers' years of experience.

In a 2009 investigation, Guzey and Roehrig scrutinized the impact of a career advancement program on four science teachers actively engaged in service. This program was dedicated to integrating technology to enhance inquiry-based science teaching in K-12 education. Data was collected and assessed qualitatively through a descriptive multi-case study methodology. The findings suggested that the program positively influenced the teachers' TPACK development to varying extents. However, it was observed that the teachers' pedagogical reasoning and situational factors impacted their ability to apply the acquired knowledge in their classrooms. Similarly, Kartal and Dilek (2021) examined the evolution of TPACK among elementary science teacher candidates during a methodology course. This experimental study, which adopted a pretest-posttest control group design, involved two distinct groups. The control group did not receive any specific training on technology-enhanced teaching methods, whereas the experimental group was exposed to such techniques. The TPACK self-assessment scale was utilized for data collection, and statistical tools such as mean, standard deviation, and t-test were applied for analysis. The results revealed that the experimental group experienced significant improvements in integrating technology into science teaching. The group also acknowledged that successful technology integration in science education requires an understanding that extends beyond mere technical skills, emphasizing the need for pre-service teachers to grasp the interconnections between science, technology, and pedagogy.

The literature also underscores studies aimed at measuring teachers' self-efficacy in incorporating technology into science instruction, particularly focusing on trainee teachers at the university level (Yulianti



et al., 2020; Aquino, 2015). Yulianti et. al. (2020) investigated the TPACK self-efficacy of 312 trainee teachers enrolled at a university. The study was grounded in quantitative research methodologies. The data collection instrument was adapted from the Koehler and Mishra framework. Techniques such as Kaiser Normalization, Varimax Rotation, confirmatory component analysis, and Cronbach's alpha were employed to ascertain the instrument's validity. The original instrument, which comprised 7 subscales with 55 items, was revised to include 8 subscales with 50 items. The internal consistency reliability coefficient for the revised items was calculated using Cronbach's alpha, yielding values ranging from 0.81 to 0.92 for the subscales. The instrument was administered to the participants, and the findings indicated that the trainee teachers demonstrated moderate self-efficacy across all eight constructs, with the TCK construct receiving the lowest scores and the TPK construct the highest. This suggests that the participants felt most confident in the TPK construct.

In another study, Aquino (2015) probed the TPACK self-efficacy of trainee teachers specializing in biological science at a public university. The research identified that factors such as internet connectivity, gender, and the type of electronic device utilized by the participants influenced the trainee teachers' self-efficacy. A descriptive survey method was adopted, and 37 individuals consented to participate. The data were analyzed using independent t-tests, mean, and standard deviation. The outcomes indicated that the participants' gender, ownership of electronic devices, and internet access significantly influenced their high TPACK self-efficacy. Further analysis revealed that female students exhibited greater TPACK self-efficacy than their male counterparts, and students with access to more electronic devices demonstrated higher self-efficacy than those with fewer devices. In a related vein, Karakaya and Yazici (2017) explored the relationship between pre-service science teachers' material development abilities and their TPACK efficacy using a relational screening method within a descriptive research framework. Data were collected from 141 trainee science teachers at a university using the TPACK Self-confidence survey. The t-test and ANOVA were utilized to analyze the data. The study's results indicated that pre-service teachers' TPACK self-efficacy concerning material development was influenced by their access to instructional technology and related coursework, with those having such access showing greater benefits. TPACK self-efficacy also varied according to the grade level, with third-year students scoring higher on average than their peers in the second and fourth years. However, factors such as gender, academic performance, and the extent of technology usage impacted the pre-service teachers' TPACK self-efficacy. Despite previous research efforts in this area focusing on pre-service teachers, there remains a lack

of studies on the TPACK self-efficacy of college-educated teachers. This particular group of pre-service educators is trained to teach science at the basic education levels, especially in Nigeria.

## **Methodology**

### ***Research Type***

The survey-style descriptive research methodology was used in this investigation. Creswell (1994) asserts that the descriptive research method gives the researcher the ability to learn about a phenomenon as it is occurring at the moment. This kind was thought suitable for the study since it enables the investigator to collect pertinent information regarding the TPACK self-efficacy of trainee instructors across a range of subject areas.

### ***Population, Sample and Sampling Techniques***

The study's target population consisted of pre-service science instructors enrolled in Kwara State, Nigeria's education colleges. A state-owned and a federal government-owned college of education in the metropolis were chosen using the multistage sample technique. The first phase of the sample selection deployed purposeful sampling technique. This purposive selection was based on the criteria that each of the colleges of education offers science-based courses, enrolled students for the last 10 years and are situated within the metropolis. In the second phase, two hundred and twenty-one (221) respondents were selected at random from the education colleges.

### ***Instrumentation***

This study adapted a survey instrument titled TPACK Self-efficacy questionnaire from the works of Bwalya and Rutegwa (2023). Seven subscales in the TPACK components were intended to be measured by the instrument. A 5-point Likert scale with options that ranged from strongly disagree (1) to strongly agree (5) was used as the response mode. Three professionals in the field of science education validated the instrument's face and content. Twenty respondents with similar characteristics to the study sample were given the instrument to test its reliability, and the collected data was examined using Cronbach's alpha statistics. The constructs were found to have an overall reliability coefficient of 0.94, with reliability values ranging from 0.61 to 0.83. The instrument was regarded to be reliable as a result.

### ***Procedure for Data Collection***

Data was gathered from this study through an online google form from 2<sup>nd</sup> year and 3<sup>rd</sup> year trainee teachers enrolled in the selected colleges of education. The respondents were approached to sensitize them on the purpose, benefit, and the implications of the outcome of the research for science instruction. They were made to realize that they will not be exposed to any risk during, and after the study. The researcher also

assured them of the confidentiality of the information provided and will be strictly used for research purpose. The researcher provided a Google link for responders to complete the form, but only those who gave their approval to participate in the study were requested to do so. Data gathered were analyzed using mean, standard deviation and non-parametric statistics of Welch's t-test and Kruskal Wallis-H statistics.

## Findings

The findings from the study are provided in this section

### *Demographic Characteristics of the Survey Participants*

**Table 1**

*Frequency and Percentage Distribution of Participants' Demographic Information*

| <b>Variable</b>        | <b>Category</b>      | <b>Frequency</b> | <b>Percentage</b> |
|------------------------|----------------------|------------------|-------------------|
| Gender                 | Female               | 102              | 46.15             |
|                        | Male                 | 119              | 53.85             |
|                        | <b>Total</b>         | <b>221</b>       | <b>100</b>        |
| Year of study          | 2 <sup>nd</sup> year | 140              | 63.35             |
|                        | 3 <sup>rd</sup> year | 81               | 36.65             |
|                        | <b>Total</b>         | <b>221</b>       | <b>100</b>        |
| Area of Specialization | Biology              | 64               | 28.96             |
|                        | Chemistry            | 137              | 61.99             |
|                        | Physics              | 20               | 9.05              |
|                        | <b>Total</b>         | <b>221</b>       | <b>100</b>        |
| School Type            | Federal COE          | 26               | 11.76             |
|                        | State COE            | 104              | 47.06             |
|                        | Private COE          | 91               | 41.18             |
|                        | <b>Total</b>         | <b>221</b>       | <b>100</b>        |

**Research Question One:** To what extent does trainee teachers of science enrolled in education colleges feel they are capable of applying TPACK?

In response pre-service teachers' degree of TPACK self-efficacy, the TPACK self-efficacy instrument requires the respondents to rate their degree of agreement with certain statements. On a scale of 1 to 5 (strongly disagree to strongly agree), the mean of their responses was categorized into low (1.00 -2.90), moderate (3.00 -3.90), and high (4.00 -4.90) using the interquartile range.

Table 2 demonstrates that trainee science teachers in the sampled schools have an acceptable degree of TPACK self-efficacy. This is evident in the overall mean of the TPACK self- efficacy sub-sections ( $M= 3.00$ ,  $SD= 1.11$ ). However, it is apparent that for all the constructs, respondents had a moderate self-efficacy level in the TK construct ( $M=$

3.29,  $SD=0.96$ ) as against other constructs where the mean is below 3.0. This suggests that pre-service teachers have low levels of TPACK self-efficacy in other TPACK self-efficacy domains.

**Table 2**

*Mean and Standard Deviation of Trainee Teachers' Responses on their TPACK Self-efficacy*

| <b>Construct</b>       | <b>N</b>   | <b>Mean</b> | <b>SD</b>   | <b>Decision</b> |
|------------------------|------------|-------------|-------------|-----------------|
| CK                     | 221        | 2.96        | 1.07        | Low             |
| PK                     | 221        | 2.97        | 1.20        | Low             |
| TK                     | 221        | 3.29        | 0.96        | Moderate        |
| TPK                    | 221        | 2.95        | 1.29        | Low             |
| TCK                    | 221        | 2.98        | 1.26        | Low             |
| PCK                    | 221        | 2.94        | 1.31        | Low             |
| TPCK                   | 221        | 2.88        | 1.39        | Low             |
| <b>TOTAL<br/>TPACK</b> | <b>221</b> | <b>3.00</b> | <b>1.11</b> | <b>Moderate</b> |

**Research Question Two:** What variations exist in TPACK self-efficacy among trainee teachers when gender is considered?

Table 3 presents a summary of a non-parametric Welch's t-test analysis as result of equality of variances not assumed. This is considered appropriate due to a  $P < 0.05$  in Levene's test for variance equality as presented in Table 3.

**Table 3**

*Levene's Test for Variance Equality*

| <b>Construct</b> | <b>F</b>                         | <b>Sig</b> |
|------------------|----------------------------------|------------|
| TOTAL<br>TPACK   | 33.73                            | 0.00       |
|                  | Variances equality<br>assumed    |            |
|                  | Variances quality not<br>assumed |            |

According to Table 4, the TPACK self-efficacy of female respondents is greater ( $M = 3.44$ ,  $SD = 0.86$ ) than that of male respondents ( $M = 2.63$ ,  $SD = 1.16$ ). The report also shows a significant disparity ( $t_{(215)} = 6.01$ ,  $SD = .00$ ) in favor of the female instructors in the trainee science teachers' overall TPACK self-confidence level across the selected colleges of education. This implies that female trainee teachers have a higher TPACK self-efficacy than the males.

**Table 4**

*Summary of Welch's t-test Analysis on Trainee Science Teachers' Gender and TPACK Efficacy*

| TPACK Self-efficacy | Gender | N  | Mean | SD   | t-value | df     | Sig. (2-tailed) | Decision |
|---------------------|--------|----|------|------|---------|--------|-----------------|----------|
| Total TPACK         | Female | 10 | 3.44 | 0.86 | 6.01    | 214.69 | .00             | Rejected |
|                     | Male   | 11 | 2.63 | 1.16 |         |        |                 |          |

**Research Question Three:** What discrepancies exist in TPACK self-efficacy among trainee teachers based on their year of study?

Table 5 presents a summary of a non-parametric Welch’s t-test analysis as result of equality of variances not assumed. This is considered appropriate due to a  $P < 0.05$  in Levene’s test for variance equality as presented in Table 5.

**Table 5**  
*Levene’s Test for Equality of Variances*

| Construct   | F     | Sig  |
|-------------|-------|------|
| TOTAL TPACK | 16.75 | 0.00 |

Table 6 shows that 3<sup>rd</sup> year trainee teachers have a higher TPACK self-efficacy level ( $M = 3.66, SD = 1.08$ ) than their colleagues in their 2<sup>nd</sup> year of study ( $M = 2.60, SD = 0.79$ ). Report further indicates a discernable disparity exist in the total TPACK self-efficacy level of trainee science teachers in the selected colleges of education ( $t_{(215)} = 6.01, SD = .00$ ) in favor of the 3<sup>rd</sup> year pre-service teachers. This implies that respondents in their 3<sup>rd</sup> year have a higher TPACK self-efficacy level than those in their 2<sup>nd</sup> year.

**Table 6**  
*Summary of Welch’s t-test Analysis on Respondents’ Year of Study and TPACK Self-efficacy Level*

| TPACK Self-efficacy | Year of Study   | N  | Mean | SD  | t-value | df    | Sig. (2-tailed) | Decision |
|---------------------|-----------------|----|------|-----|---------|-------|-----------------|----------|
| Total               | 2 <sup>nd</sup> | 14 | 2.60 | 1.0 | 8.3     | 207.2 | .00             | Rejected |

|              |                      |    |      |     |   |   |   |
|--------------|----------------------|----|------|-----|---|---|---|
| <b>TPACK</b> | year                 | 0  |      | 8   | 4 | 5 | d |
|              | 3 <sup>rd</sup> year | 81 | 3.66 | 0.7 |   |   | 9 |

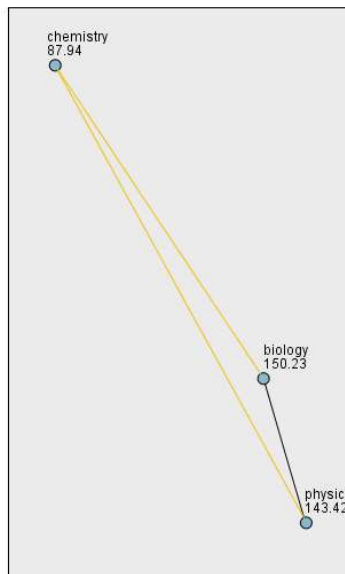
**Research Question 4:** Does the TPACK self-efficacy of among trainee teachers differ when their area of specialization is considered?

The three groups of biology, chemistry, and physics majors had their TPACK self-efficacy levels measured using the Kruskal Wallis test as presented in Table 7. An output of  $H_{(2, n=221)} = 48.04, P < 0.00$ , indicates that there were significant variations in the rank totals of 150.23 (biology), 87.94 (chemistry), and 143.43 (physics).

**Table 7**  
*Summary of Kruskal Wallis-H test on Trainee Teachers’ TPACK Self-efficacy*

| Construct   | Specialization | N  | Mean Rank | df | H   | P   | Decision |
|-------------|----------------|----|-----------|----|-----|-----|----------|
| Total TPACK | Biology        | 64 | 150.23    |    |     |     |          |
|             | Chemistry      | 13 | 87.94     | 2  | 48. | 0.0 | Reject   |
|             | Physics        | 7  | 143.43    |    | 03  | 0   |          |

In attempt to determine the direction of significance, a pair-wise comparison was conducted and this shows that a discernable disparity exist between chemistry and physics group ( $P = 0.00$ ), then, chemistry and biology group ( $P = 0.00$ ). Nevertheless, there was no discernable variation between the physics and biology group ( $P = 1.00$ ).



**Figure 1:** Pairwise comparison of the three groups based on area of

specialization

**Research Question 5:** Does the TPACK self-efficacy of among trainee teachers vary when their school type is considered?

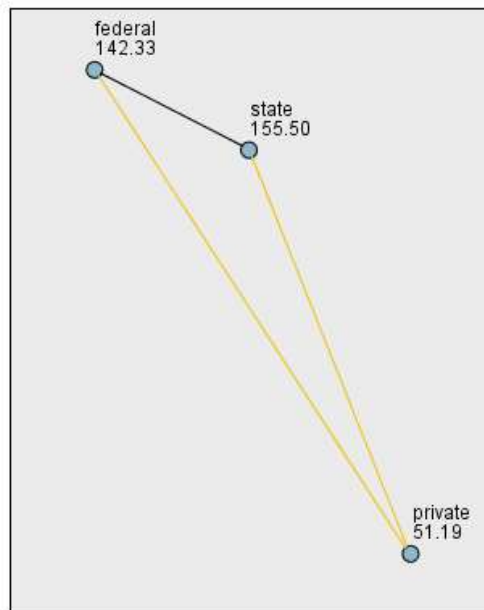
To ascertain the TPACK self-efficacy level of the three groups enrolled in federal, state, and private colleges of education, a Kruskal Wallis test was conducted. An output of  $H_{(2, n=221)} = 139.08, P = 0.00$ , indicates that there were significant variations between the rank totals of 142.33 (federal), 155.50 (state), and 51.19 (private) as presented in Table 7.

**Table 7**

*Summary of Kruskal Wallis-H test on Trainee Teachers' TPACK Self-efficacy*

| Construct   | Specialization | N  | Mean Rank | Df | H      | P    | Decision |
|-------------|----------------|----|-----------|----|--------|------|----------|
| Total TPACK | Federal        | 26 | 142.33    | 2  | 139.08 | 0.00 | Reject   |
|             | State          | 10 | 155.50    |    |        |      |          |
|             | Private        | 4  | 51.19     |    |        |      |          |

A post-hoc was conducted to test pair-wise comparisons between the groups. Findings indicate that there is a discernable difference between private and federal ( $P= 0.00$ ), then, private and state ( $P= 0.00$ ). However, there was no statistically significant variation between the federal and state group ( $P=1.00$ ).



**Figure 2:** Pairwise comparison of the three groups based on area of school type

### **Discussion of Findings**

Out of the seven subscales assessed, technological knowledge recorded a moderate self-efficacy, while other six i.e., CK, PK, TPK, TCK, TPK, TCPK construct recorded a low self-efficacy. This implies that pre-service teacher lacks basic skills, and the zeal required for effective implementation of TPACK for technology incorporation into their instructional practices. This is in contradiction with the findings of Yulianti, et. al. (2020) indicating a moderate self- efficacy for all the eight constructs; and that of Aquino (2015) that confirm that teachers have good self-efficacy. Also evident from the study was a discernable variation that exists between male and female respondents in favour of female. This suggests that pre- service females are more favourably disposed to incorporate TPACK into their instructional activities than their male counterparts. This could be unconnected to the popular assumption that presumed teaching as a female profession. The finding substantiates that of Aquino (2015) which establishes higher TPACK self-efficacy for females. However, the outcome of this study contradicts that of Muhaimin et. al. (2019) which reported no discrepancy in male and female students' self-efficacy. On year of study of pre-service teachers, those in third year had better efficacy than those in second year. The disparity in self-efficacy may be due to more experience, more familiarity, more stable and exposure of the year three students to TPACK components than year two students. This validates the finding of Karakaya and Yazici (2017) that conveyed a higher self-efficacy for 3<sup>rd</sup> grade students when compared with 2<sup>nd</sup> and 4<sup>th</sup> grade students. Also evident from this research was a discernable difference in TPACK self-efficacy of pre-service science teachers from different area of specialization. This is to say that different disciplines have varying degree of assisting students in realization of TPACK self-efficacy.

### **Conclusion and Recommendations**

The research found that trainee science teachers have moderate TPACK self-efficacy, suggesting a need for improvement across seven constructs. Factors like gender, specialization, year of study, and school type significantly affect self-efficacy. Recommendations include adopting strategies to enhance TPACK understanding, providing training programs, and considering student variables in program design. Encouraging interest in TPACK mastery, especially among new students, is also advised.

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## INFLUENCE OF PERSONALITY TRAITS ON ACADEMIC MOTIVATION IN A SMALL SAMPLE

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**Abstract:** *The present study sought to investigate the impact of personality traits on academic motivation measured by the MUSIC inventory. Personality traits are known as important factors that are related to the motivation and specifically, to academic motivation. This is a topic of interest because due to the interest of many people in studying and the pressure for obtaining better academic results, also it is considered that understanding the relationship these two, personality and motivation, could play an important role in improving teaching. The hypothesis was that students' personality traits, measured using The Leonhard-Shmishek questionnaire, have an impact on academic motivation, measured by the MUSIC inventory. The sample of this study consisted of a voluntary group of 28 students who studied the Psychology of education in the first year of the psycho-pedagogical module, from several specializations. The study had a cross-sectional design. The search of results for this study was accomplished through correlation and regression analysis. Interpretation of results from this study suggested that the hypothesis of this study was only partially confirmed, out of 10 personality traits measured by the Leonhard-Shmishek questionnaire in this small sample only three of them (dysthymic, hyperthymic and anxious) have been found to have a linear or nonlinear impact on some of academic motivation the scales (empowerment, interest, success and caring) measured by MUSIC questionnaire. Results obtained suggests that when are considered the effects of personality traits on academic motivation could prove worthful to consider different types of impacts not only the "linear" one.*

**Keywords:** *Personality traits; academic motivation; nonlinear.*

### **Background**

Personality traits are known as important factors that are related to the motivation and specifically, to academic motivation (Hazrati-Viari et al., 2012). This is a topic of interest because due to the interest of many people in studying and the pressure for obtaining better academic results,

also it is considered that understanding the relationship these two, personality and motivation, could play an important role in improving teaching. Numerous studies in latest years focus on this relationship using the BigFive tool for measuring personality traits (Bozanoğlu & Sapancı, 2015; Komarraju et al., 2009; Komarraju & Karau, 2005). Although the BigFive personality inventory is a good and reliable assessment tool, there still are authors (especially in Eastern Europe) that are using the Leonhard-Shmishek questionnaire that intends to evaluate accentuated personality traits (Gulfiya & Karimova, 2016). Choosing the second option could be related to the intention to draw more attention to pathological aspects of personality or could be a matter of tools available or theoretical/methodological trends in specific institutions or areas. But, even using the BigFive personality inventory can offer clues related to negative aspects of personality. In several studies (Ahmadi et al., 2023; Clark & Schroth, 2010; De Feyter et al., 2012; Komarraju & Karau, 2005) neuroticism trait was examined in relation with academic motivation and academic results. And, neuroticism trait, assessed with the BigFive personality inventory, is related to anxious and depressive symptoms. There are also authors that manifest an explicit interest in studying associations between psychopathology and academic performance (Pagerols et al., 2022; Sijtsema et al., 2014; Voltas et al., 2014); in these studies, again depressive and anxious symptoms are discussed and further, attention problems, hyperactivity, ADHD, delinquent behavior are evaluated in relation with academic performance.

Another point of interest is the discussion about the distinction between academic motivation and academic performance (De Feyter et al., 2012). Personality traits assessed using the BigFive personality inventory, the Leonhard-Shmishek questionnaire, or any other personality questionnaire can have a different impact on these two aspects of academic life, motivation and performance. In this study the main focus is on evaluating the relationship between personality traits and academic motivation.

For motivation, the assessment tools used by researchers are more diverse: Intrinsic Motivation Scale toward Learning (Tanaka et al., 2009), Academic Motivations Inventory (Komarraju & Karau, 2005). Despite the numerous already existing motivation scales, new scales on this psychological process continue to be tested and in the present article is used the MUSIC inventory. Its author, Jones D. Brett, proposes a definition of the motivation as the „extent to which one intends to engage in an activity” and then explains each concept: extent as a magnitude, intent as goal-directed behavior, engagement as a measure of behavioral and cognitive effort done by a person, activities as specific activity the person is interested in (Jones, 2018). This tool is a compact one, with

easy questions, students having no problems to understand and answer them.

Related to statistical analyses that could evidence the associations or causality effects between personality traits and academic motivation most of existing studies were using correlation (Ahmadi et al., 2023; Komarraju et al., 2009; Komarraju & Karau, 2005) and regression (Ahmadi et al., 2023; Komarraju et al., 2009; Tanaka et al., 2009). These two analyses indeed are useful for the above mentioned purposes and are also used in the present study trying to find and explain the relationship between accentuated personality types and MUSIC scores.

### **Hypothesis**

Students' personality traits, measured using The Leonhard-Shmishek questionnaire, have an impact on academic motivation, measured by the MUSIC inventory.

### **Research design**

This study follows a cross-sectional design aimed at conducting a correlational type of research.

### **Sample**

This study was conducted in the first semester of the academic year 2020-2021 on a voluntary group of students who studied the Psychology of education in the first year of the psycho-pedagogical module. The questionnaire was distributed in the last week of the first semester, and 107 students were invited to participate. Of these, 28 completed the questionnaire received. The mean age of the sample was  $M = 27.50$  (S.D. = 10.871). Given the high value of the standard deviation, the value of the median (19.50) and the mode (19) were also calculated. These values indicate a group with significant age differences between its members, the minimum value being 18 years and the maximum 50 years. The distribution of frequencies by sex indicated 19 females and 9 males. The mean age for students was  $M = 26.63$  (S.D. = 11,558) and for students  $M = 29.33$  (S.D. = 9,631). The calculation of the significance of the difference between the two means (T-test Independent Sample) indicated that although there is a difference of almost 3 years between the means, there was no statistically significant age difference between the two subgroups (students):  $t(26) = -0.607$ ,  $p = .549$ .

A Crosstab-type analysis using age and sex variables indicated the following frequencies (Table 1):

**Table 1. Crosstab analysis for variables Sex \* Age**

|       |           | Age |    |    |    |    |    |    |    |    |    |    | Total |    |
|-------|-----------|-----|----|----|----|----|----|----|----|----|----|----|-------|----|
|       |           | 18  | 19 | 20 | 28 | 31 | 32 | 35 | 37 | 42 | 43 | 48 |       | 50 |
| Sex   | Feminine  | 2   | 9  | 1  | 1  | 1  | 0  | 1  | 0  | 1  | 1  | 0  | 2     | 19 |
|       | Masculine | 0   | 3  | 0  | 1  | 2  | 1  | 0  | 1  | 0  | 0  | 1  | 0     |    |
| Total |           | 2   | 12 | 1  | 2  | 3  | 1  | 1  | 1  | 1  | 1  | 1  | 2     | 28 |

And, a Crosstab-type analysis that used the variables specialization and sex indicated the following frequencies (Table 2):

**Table 2. Crosstab analysis for variables Specialisation \* Sex**

|                |                                   | Sex      |           | Total |
|----------------|-----------------------------------|----------|-----------|-------|
|                |                                   | Feminine | Masculine |       |
| Specialization | Public Administration             | 2        | 0         | 2     |
|                | Social assistance                 | 3        | 0         | 3     |
|                | Law                               | 1        | 1         | 2     |
|                | Physical education and sports     | 2        | 6         | 8     |
|                | Kinetherapy and special motricity | 3        | 1         | 4     |
|                | Sociology                         | 1        | 1         | 2     |
|                | Occupational Therapy              | 7        | 0         | 7     |
| Total          |                                   | 19       | 9         | 28    |

## Instruments

a) The Leonhard-Shmishek questionnaire. This questionnaire was designed to identify one or more accentuated personality traits that a person may present at a given time. Shmishek developed the instrument taking into account the contributions already made by K. Leonhard, who indicated two categories of accentuations, some of character and others of temperament. Being a test for adults for a variety of purposes, including in the education process, it was considered a useful tool to apply to this sample of students. The number of questions is not equal for each assessed trait but are 4, 8 or 12 questions. Some questions are rated for the affirmative, others the opposite, for the negative. A trait is considered accentuated if the

person provides answers to which more than half of them are considered relevant to that trait.

Both tools were introduced in Google Forms as a multi-section questionnaire. In Google Forms, the questionnaire was anonymous in order to stimulate answers as close as possible to what students feel and believe, even if this anonymity may have partially contributed to the decrease in the sample of participants.

b) The MUSIC inventory. In the User Guide for Assessing the Components of the MUSIC® Model of Motivation, the author, Jones D. Brett, enumerates the inventory principles: Empowerment, Usefulness, Success, Interest and Caring. Although the inventory evolved and were developed shorter versions (of 20 or 19 items) in this study was used the original 26 items inventory. The inventory uses a 1 to 6 rating scale, each number being associated a verbal description. Each principle is measured by a number of items:

- Empowerment score = (item 2 + item 8 + item 12 + item 17 + item 26) / 5
- Usefulness score = (item 3 + item 5 + item 19 + item 21 + item 23) / 5
- Success score = (item 7 + item 10 + item 14 + item 18) / 4
- Interest score = (item 1 + item 6 + item 9 + item 11 + item 13 + item 15) / 6
- Caring score = (item 4 + item 16 + item 20 + item 22 + item 24 + item 25) / 6

The inventory was used in several large studies (Jones et al., 2021, 2022; Jones & Wilkins, 2023)

In this study the MUSIC inventory was translated by two translators in Romanian; these translations were merged through a synthesis by a committee (two translators, previously mentioned, and an expert in the field) and finally, the Romanian version was translated again in English by another translator and a second expert in the field.

## Results

In order to be able to perform the analyses leading to results needed to test the hypothesis, it was necessary that answers from the survey be converted into numerical variables and scores for all five principles calculated. These calculated scores were used in the descriptive statistics, correlation and regression analysis.

First analysis was that of correlation between scores of accentuated personality traits and MUSIC scores. In this sample the significant relationships were between Dysthymic personality trait and Empowerment score  $r(26) = -.528$ ,  $p = .004$  and Caring score  $r(26) = -.406$ ,  $p = .032$ , for the relationship with Interest score the correlation



coefficient was marginally not significant ( $p = .051$ ). These three correlation coefficients were indirect. Dysthymic personality trait had also an indirect correlation with the Usefulness and Success scores from MUSIC inventory but, these scores were statistically not significant. All the possible relationships between the remaining accentuated personality traits and MUSIC scores were statistically not significant.

The second type of statistical analysis used in this research was the regression analysis. Using the linear regression was confirmed the impact of the dysthymic personality trait on the Empowerment score: ( $F([1],[26]=[10,046])$ ,  $p= [.004]$ ). The  $R^2$  was  $[.279]$  indicating that Dysthymic personality trait explained approximately  $[28]\%$ , of the variance in the Empowerment score.

For the impact of the dysthymic personality trait on the Caring score the regression values were: ( $F([1],[26]=[5,120])$ ,  $p= [.032]$ ). The  $R^2$  was  $[.165]$  indicating that dysthymic personality trait explained approximately  $[17]\%$ , of the variance in the Caring score.

Because previous studies have found that also other personality traits can have influence on motivation further analyses were performed looking for nonlinear relationships among personality traits and academic motivation scores. Statistically significant results are presented:

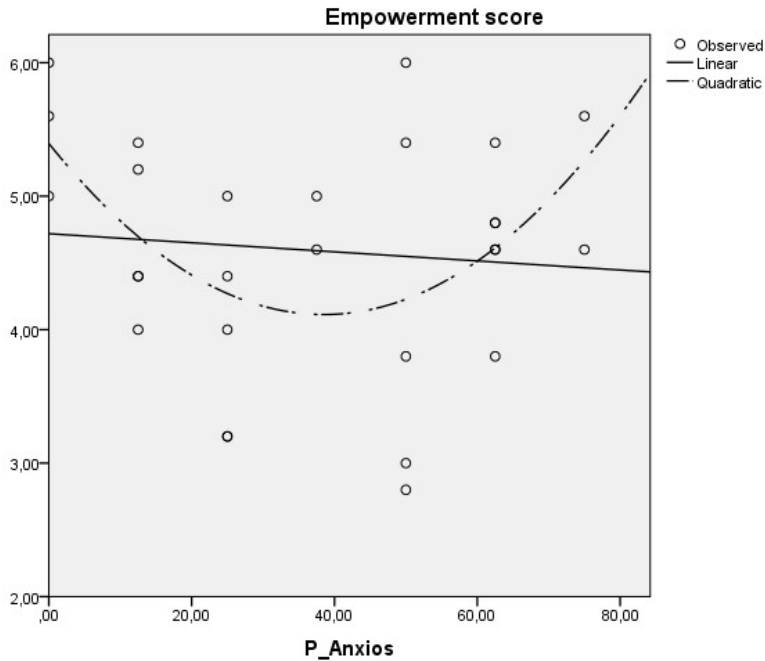
Anxious trait impact on Empowerment score

**Table 3. Model Summary and Parameter Estimates. Impact of anxiety on Empowerment score**

Dependent Variable: Empowerment score

| Equation  | Model Summary |       |     |     |      | Parameter Estimates |       |      |
|-----------|---------------|-------|-----|-----|------|---------------------|-------|------|
|           | R Square      | F     | df1 | df2 | Sig. | Constant            | b1    | b2   |
| Linear    | ,009          | ,228  | 1   | 26  | ,637 | 4,719               | -,003 |      |
| Quadratic | ,220          | 3,533 | 2   | 25  | ,045 | 5,395               | -,067 | ,001 |

The independent variable is P\_Anxious



**Fig. 1. Linear and quadratic regression curves of anxiety on Empowerment score.**

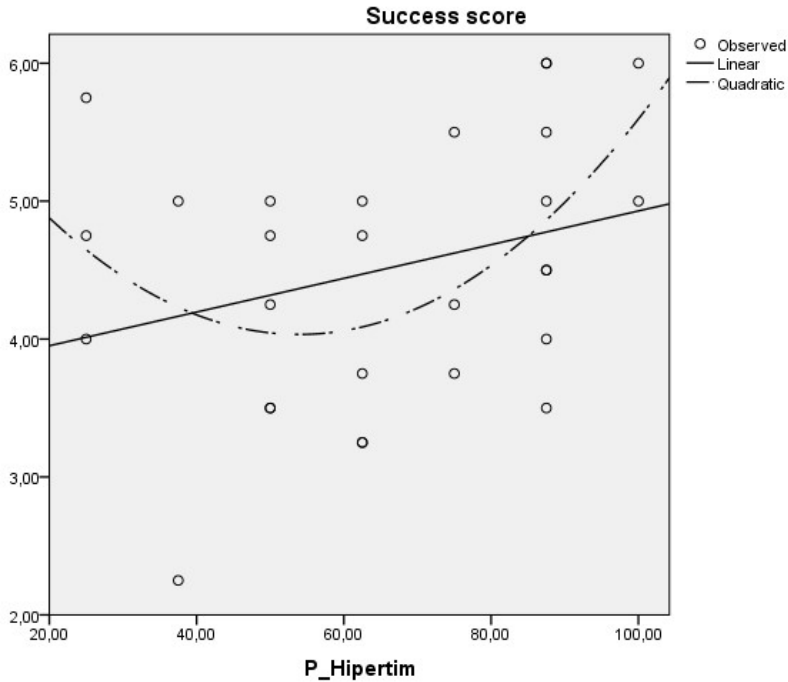
Hyperthymic trait impact on Success score

**Table 4. Model Summary and Parameter Estimates. Impact of hipertimic trait on Success score**

Dependent Variable: Success score

| Equation  | Model Summary |       |     |     |      | Parameter Estimates |      |      |
|-----------|---------------|-------|-----|-----|------|---------------------|------|------|
|           | R Square      | F     | df1 | df2 | Sig. | Constant            | b1   | b2   |
| Linear    | ,086          | 2,454 | 1   | 26  | ,129 | 3,707               | ,012 |      |
| Quadratic | ,227          | 3,678 | 2   | 25  | ,040 | 6,169               | ,079 | ,001 |

The independent variable is P\_Hipertim.



**Fig. 2. Linear and quadratic regression curves of hyperthymic trait on Success score.**

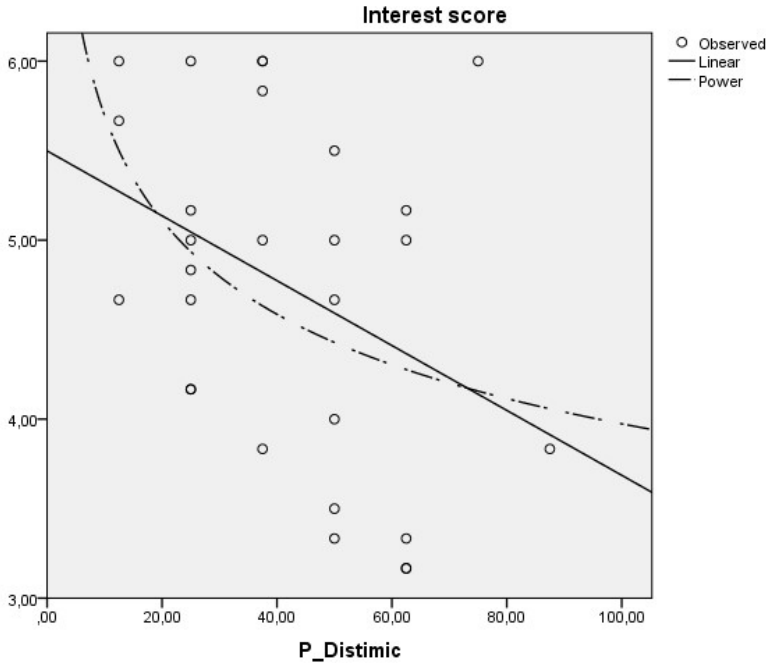
Dysthymic trait impact on Interest score

**Table 5. Model Summary and Parameter Estimates. Impact of dysthymic trait on Interest score**

Dependent Variable: Interest score

| Equation | Model Summary |       |     |     |      | Parameter Estimates |       |
|----------|---------------|-------|-----|-----|------|---------------------|-------|
|          | R Square      | F     | df1 | df2 | Sig. | Constant            | b1    |
| Linear   | ,139          | 4,197 | 1   | 26  | ,051 | 5,499               | -,018 |
| Power    | ,157          | 4,855 | 1   | 26  | ,037 | 8,165               | -,156 |

The independent variable is P\_Distimic.



**Fig. 3. Linear and power regression curves of dysthymic trait on Interest score.**

**Discussion**

Hypothesis of this study is only partially confirmed; out of 10 personality traits measured by the Leonhard-Shmishek questionnaire in this small sample only three of them (dysthymic, hyperthymic and anxious) have been found to have a linear or nonlinear impact on some of academic motivation the scales (empowerment, interest, success and caring) measured by MUSIC questionnaire.

The Leonhard-Shmishek questionnaire short description of these three accentuated personality types includes:

- Dysthymic: serious, conscientious, meditative, affected by the sad events of life, impulse to action diminished, slow thinking.
- Hyperthymic: continuous joy; need for action (that's why they are not good organizers); digressions in thinking (flight of ideas); establish relationships easily; inclination towards alcohol (in combination with the demonstrative trait).
- Anxious: they cannot defend themselves (affirm) in a dispute, docile, sometimes an overcompensation occurs, tendencies to panic, tendencies toward hypochondria.

In this study, dysthymia proved to be the most significant personality trait that have an impact on the academic motivation.

Concerning the MUSIC questionnaire, the description of these

four constructs, relevant in this study, is (Brett, 2017):

- Empowerment: he or she has control of his or her learning environment in the course
- Success: he or she can succeed at the coursework
- Interest: the student considers that instructional methods and coursework are interesting
- Caring: the instructor cares about whether the student succeeds in the coursework and cares about the student's well-being

Dysthymia as personality trait has only indirect correlations and a "linear" (on Empowerment and Caring) or "power" (on Interest) negative effect. The "power" relationship with Interest shows that Interest is diminished even if dysthymia has below average score on Leonhard-Shmishek questionnaire (Fig. 3).

On the other hand, anxiety and hyperthymia, produced in this study results that indicate a "quadratic" relationship, in which, small and high scores on Hyperthymic or Anxious personality traits were related to a higher academic motivation (Fig.1: Anxiety on Empowerment / Fig.2: Hyperthymia on Success).

These types of relationships between depressive symptoms (dysthymia being considered a persistent mild type of depression) and anxiety with academic motivation are confirmed by a previous study in which regression analyses "showed that depressive symptoms were negatively associated with academic motivation, while anxiety was positively related to academic motivation in both genders" (Elmelid et al., 2015).

In conclusion, although this study has its limitations, results obtained suggests that when are considered the effects of personality traits on academic motivation could prove worthful to consider different types of impacts not only the "linear" one.

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## PROBING COMPUTER-ASSISTED INSTRUCTIONAL EFFECT ON ACADEMIC ACHIEVEMENT OF SECONDARY SCHOOL STUDENTS IN PHYSICS

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**Abstract:** *This study explored the effect of Computer-Assisted Instruction (CAI) on academic achievement of senior secondary school students in physics in Awka south L.G.A in Awka Education Zone. Two research questions guided the study and three hypotheses were tested at 0.05 level of significance. The study is quasi-experimental research specifically pre-test post-test non-randomized control group was adopted. The population consisted of 553 (384 males and 169 females) senior secondary two (SS2) students offering physics and a sample of 41 (21 males and 20 females) SS2 students was drawn from the population using multi-stage sampling. The sample students who were in two intact classes were randomly assigned to experimental and control groups using a flip of coin. The instrument Physics Achievement Test (PAT) was used for data collection which was validated by three experts from Nnamdi Azikiwe University, Awka and a reliability coefficient of 0.89 was obtained using Kuder Richardson-21 formula. The research questions were answered using mean and standard deviation while the hypotheses were tested using Analysis of Covariance (ANCOVA). The findings revealed that CAI had significant effects on students' academic achievement in Physics than Lecture Method (LM). The result also showed that gender was not a significant factor in students' overall academic achievement when taught Physics using CAI. Also, there was no interaction effect of teaching methods and gender on student's academic achievement in physics. Based on the conclusion, the researcher recommended that Physics Teachers should use CAI in teaching physics to both male and female students so as to enhance their academic achievement in Physics and the*



*curriculum planners to adopt CAI as an innovative teaching strategy in planning and reviewing physics curriculum in secondary schools.*

**Keywords:** *Computer –Assisted Instruction (CAI); Academic Achievement; Physics; Gender.*

## **INTRODUCTION**

In this 21<sup>st</sup> century, the world is becoming more digitalized in all aspects and the educational aspect cannot be left aside especially in teaching science subjects. Similarity, in educational term, computer assisted instruction can be understood as the application of digital equipment to all teaching and learning aspects (Adeyemo, 2020). Computer assisted instruction consists of the hardware, software, networks and media for the collecting, storing, processing, transmission and presentation of information. The use of CAI as stated by Adeyemo (2020), falls into four (4) major categories; constructing knowledge and problem solving through the internet, mail, CD-ROMs, database, video conferencing; using process skill; aiding explanation of concepts and communicating ideas. Teachers need to be active participants to make CAI effective for their students (Cavalluzo, Lowther, Mokher and Fan, 2022). CAI programs use tutorials, drill and practice, simulation and problem solving approaches to present topic; they test student's understanding and evaluate student's academic achievement.

Academic achievement has to do with how much knowledge the individual has acquired from school and how long it can be retained and retrieved when needed. Students' achievement connotes performance in school subject as symbolized by a score or mark on an achievement test. Students' academic achievement is dependent upon several factors among which are instructional methods and learning environment (Atherson, 2023). This is to say that inappropriate instructional methods adopted by a teacher has the ability to influence the learning outcome of students in a given classroom experience. The power of teaching method in the hand of a teacher cannot be overemphasized. Any teaching method that does not encourage interaction between the teacher and the students is incomplete (Muokwe and Okeke, 2021). Hence, the most effective and skilful teachers use a diversity of methods to assist their students in the learning process, arouse their interests and curiosity, engage the students thereby creating an impressive learning experience so that the concepts learnt remain with the students long after the class. Recognizing its significance, there is a strong advocacy for integrating computer-assisted instruction in science education to enhance students' academic achievement.

Physics is one of the science subjects taught at the senior secondary and

tertiary levels of education in Nigeria. It is defined a branch of science that is concerned with fundamental ideas about nature and attempts to establish relationship between different quantities as precise as possible. Physics is the most utilized basic science subject in most instruction-related professions. This may be why the federal government of Nigeria placed the subjects as one of the core subjects that each science student must be exposed to at the senior secondary school level, as stipulated in the National Policy on Education (FRN, 2014).

The importance of physics for the development of a nation and wealth creation cannot be over emphasized. For instance, Josiah (2022) noted that physics is a cross-cutting discipline that has applications in many sectors of economic development, including health, agriculture, water and energy and information technology. The knowledge of physics also facilitates the understanding of other disciplines. For instance, understanding physics concepts is equally necessary for developing new instrumentation and techniques in the health sector. With the help of medical physics, the right equipment for the diagnosis of diseases and the efficient communication of medical data are provided. Adeyome (2020) added that, physics is a unique subject that promotes the acquisition of specialized science skills and knowledge that explains the natural phenomena of life in society. It is a subject that evolved with civilization as man's quantitative needs increased. It has contributed to science and the development of civilization. Students acquire the knowledge and skills to understand how and why natural things happen the way they do, to make predictions and venture into unknown areas of knowledge, and more importantly, to use the knowledge and skills to design and make new things. The subject's relevance underscores the need for instructional method like computer-assisted instruction, which not only deepens students' understanding but also enhances their academic achievement (Akabuiké & Achufusi-Akah, 2023).

Furthermore, the study considers gender as a significant factor in learning preferences, with historical tendencies showing a division in subject interests between males and females (Chiketa & Okigbo, 2021; Nwoye et al., 2020; Nwuba & Osuafor, 2021; Obikezie et al., 2023). Nigerians generally uphold that males are superior to females in terms of physique, cognition, logical reasoning and even in academic achievements (Anigbogu as cited in Okafor, 2016).

### **Research Objectives**

The study was guided by the following research questions:

1. What is the difference in the mean achievement scores of students taught physics using CAI and that of those taught with LM.

2. What is the difference in the mean achievement scores of male and female students taught physics using CAI.

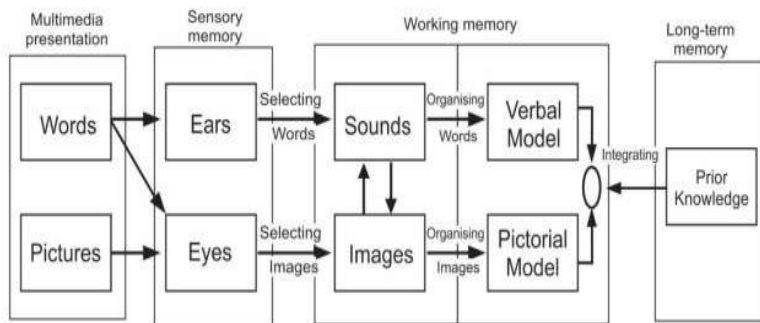
**Literature Reviews**

The theory adopted for the study was the cognitive theory of multimedia learning

**The Cognitive Theory of Multimedia Learning**

The cognitive theory of multimedia learning proposed by Richard E. Mayer in 1997 states that people learn more deeply from words and pictures than from words alone. According to Mayer, words should be presented in a personalized conventional style rather than a detailed description style. He explained that deeper learning is achieved when the following multimedia combinations are used; text and picture explanation rather than verbal explanation. He further explained the importance of the removal of irrelevant words, sounds and video, avoidance of complex verbal and pictorial representation with no relationship to prior knowledge of the learner. Based on Mayer’s assumptions and research, the cognitive theory related to multimedia learning has shown how people construct knowledge from words and pictures.

Mayer explained that the human mind has two channel systems of processing information which the use of multimedia took care of. The two channels are visual and verbal processing channels.



**Fig 1: Mayer’s Cognitive Theory of Multimedia Learning**

The verbal channel processes the sound we hear while the visual channel processes the things we see. The combination of these two processes enhances learning and improves students’ academic achievement.

The cognitive theory of multimedia learning is relevant to this study as the researcher focuses on improving students' academic achievement using CAI technique. From the theory it has been derived that visual-verbal (i.e text) is combined with visual-non-verbal materials (i.e graphics, etc) in order to enhance learner's academic achievement. Such learning method is learner-centred and not teacher-centred and supports learners learning at their pace (Akabuike & Achufusi-Akah, 2023).

### **Academic Achievement and its features**

In an organized formal teaching and learning process, assessment of whether learning has taken place or not is central and paramount. This is because different categories of people who are involved in the educational system are often interested in ascertaining the effectiveness of the entire teaching-learning process. Academic achievement is the result of what an individual has learned from some educational experiences. It refers to an academic position a study occupies in the class relative to the position of others in the class usually assessed by the teacher's use of rating scales, tests and examinations (Anekwe, 2011). Aroson (2012) stated that academic achievement depicts students' performance on a standard of measurement such as performance test, skill test, analytical test etc. Dagbonyi (2015) hinted that academic achievement is frequently measured in terms of examination performance using achievement test whose question are selected from the contents the individual has been taught over a given period of time in a particular program instruction.

Recognizably, academic achievement is very important in education as it is used to ascertain how much an individual has benefited from a programme or to what extent the programmed goals are achieved (Etuk, Koko, and Ebo, 2021). Ricarda, Anja, Anne and Linda (2017) stated that it prepares students for future careers, refines their intellect, and helps in shaping their mind which in return can help them in all spheres of life. Ricarda *et.al* (2017) further explained that academic achievement is the benchmark of academic progress as it helps educational bodies monitor students in schools and make changes in the educational system where necessary, as it prepares them for the future. So, in the context of this study, a student's academic achievement is defined as the gain in knowledge of a student which occurs as result of taking part in a learning activity or programme and will be ascertained in the study using Physics Achievement Test (PAT).

### **RESEARCH METHOD**

### **Research design**

In this quasi-experimental study, a non-randomized control group design was employed.

### **Hypotheses**

The following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant difference between the mean achievement scores of students taught physics using CAI and that of those taught with lecture method.
2. There is no significant difference between the mean achievement scores of male and female students taught physics using computer assisted instruction (CAI).
3. There is no interaction effect of teaching methods (CAI and Lecture method) and gender on academic achievement of students in physics.

### **Population and Sampling**

A sample size of 41 (20 males and 21 females) senior secondary year two (SS2) students drawn from the 553 SS2 students in Awka South LGA in Awka Education Zone of Anambra State, Nigeria, using multi-stage sampling procedure were the research participants. The research participants who were in two intact classes were randomly assigned to experimental and control groups using a flip of a coin.

### **Instrument for Data Collection**

Physics Achievement Test (PAT) validated by three experts with a reliability coefficient of 0.89 established using Kuder-Richardson 21, was used for data collection.

### **Experimental Procedure**

The experiment commenced with the briefing of the physics teachers (research assistants) from the two sampled schools, on three contacts, before the treatment process. The teacher in the control group was told to carry on as usual using the lesson plans on Lecture Method (LM), developed by the researchers, while the teacher in the experimental group was briefed on CAI, its features, and how to efficiently implement the instructional approach, during the teaching and learning process, using the lesson plans also developed by the researchers. Following the briefing, the PAT which functioned as the pretest, was given to the two drawn intact classes that were divided into the control (13 boys and 8girls) and experimental (7 boys and 13 girls) groups. Following the pre-testing, the two groups began a 4-week long treatment (teaching) activity. After the instructional sessions, both groups completed a post-test, which was used to calculate the post-test score.

### **Data Analysis**

Data collected from the administered tests were analyzed using mean and standard deviation to answer the research questions while Analysis of Covariance (ANCOVA) was employed at 0.05 alpha levels for testing the null hypotheses. In taking decisions, null hypothesis was rejected if the Probability (P) value is less than or equal to the level of significance (0.05), if otherwise, the null hypothesis was not rejected.

**FINDINGS AND DISCUSSION**

**Research Question One:** What are the mean achievement scores of students taught physics using Computer Assisted Instruction (CAI) and that of those taught with Lecture method?

**Table 1:** Pretest and Post-test Mean Achievement scores of students taught Physics using CAI and LM

| Gained<br>Groups |       | Pre-test |       |       | Post-test |
|------------------|-------|----------|-------|-------|-----------|
|                  |       | N        | Mean  | SD    | Mean      |
| SD               | Mean  |          |       |       |           |
| Experimental     |       | 20       | 39.70 | 8.57  | 80.25     |
| 12.79            | 40.55 |          |       |       |           |
| Control          |       | 21       | 33.81 | 13.53 | 40.24     |
| 13.41            | 6.43  |          |       |       |           |
| Mean Difference  |       |          | 5.89  |       | 40.01     |
| 34.12            |       |          |       |       |           |

Results in Table 1 reveals that the students taught using CAI had pre-test mean achievement score of (39.70) and post-test mean achievement score of (80.25) with gained mean achievement score of (40.55) while those in the control group taught with the lecture method has pre-test mean achievement score of (33.81) and post-test mean achievement score (40.24) with gained mean achievement score of (6.43). Students taught using CAI had a less spread of scores in the post-test (12.79) than those in the lecture group (13.41) indicating that students taught using CAI had a more homogeneous score in their post-test.

The difference between the mean gained achievement scores of the students in both groups is (34.12) in favour of CAI.

**Research Question Two:** What are the mean achievement scores of male and female SS II students taught Physics using CAI?

**Table 2:** Pre-test and Post-test Mean Achievement Scores of Male and Female Students taught Physics using CAI

| Gender       | N | Pre-test |    | Post-test |    |
|--------------|---|----------|----|-----------|----|
|              |   | Mean     | SD | Mean      | SD |
| Gain in Mean |   |          |    |           |    |

|                 |    |       |      |       |       |
|-----------------|----|-------|------|-------|-------|
| Male            | 7  | 43.57 | 9.15 | 84.29 | 11.78 |
| 40.72           |    |       |      |       |       |
| Female          | 13 | 37.62 | 7.40 | 78.08 | 12.79 |
| 40.46           |    |       |      |       |       |
| Mean Difference |    | 5.95  | 6.21 |       | 0.26  |

Table 2 reveals that the male students taught physics using CAI had pretest mean achievement score of (43.57) and post-test mean achievement score of (84.29) with a gain in mean scores of (40.72) while the female students have pretest mean achievement score of (37.62) and post-test mean achievement score of (78.08) with a gain in mean scores of (40.46). There was a higher spread of scores among the female students in the post-test (12.79) than among the males (11.78) indicating that the male students had a more homogenous score in the post-test. The difference between the mean gain achievement score of the male and female students is 0.26 in favour of the females.

### Testing Null Hypotheses

**Hypothesis 1:** There is no significant difference between the mean achievement scores of SSII students taught physics using CAI and those taught using Lecture method.

**Table 3:** ANCOVA Test of Significant in Mean Achievement Scores of students in Physics Based on Methods and Gender.

| Source          | SS         | Df | Mean Square | F    | Sig.    |
|-----------------|------------|----|-------------|------|---------|
| Decision        |            |    |             |      |         |
| Corrected Model | 21531.748  | 2  | 5382.937    |      | 107.153 |
| .000            |            |    |             |      |         |
| Intercept       | 1626.539   | 1  | 1626.539    |      | 32.378  |
| .000            |            |    |             |      |         |
| Pre-test        | 5251.394   | 1  | 5251.394    |      | 104.535 |
| .000            |            |    |             |      |         |
| Method          | 101199.911 | 1  | 101199.911  |      | 203.040 |
| .000 Sig        |            |    |             |      |         |
| Gender          | 26.292     | 1  | 26.292      | .523 | .474    |
| Not sig         |            |    |             |      |         |
| Method * Gender | 5.339      | 1  | 5.339       | .106 | .746    |
| Not sig         |            |    |             |      |         |
| Error           | 1808.496   | 36 | 48.451      |      |         |
| Total           | 168550.000 | 41 |             |      |         |
| Corrected Total | 23340.244  | 40 |             |      |         |

a. R. Squared = .923 (Adjusted R Squared = .914)

Table 3 shows that there is significant effect of the treatment on students' academic achievement in Physics  $F(2, 36) = 203.040, P = 0.000 \leq 0.05$ . Therefore, the null hypothesis is rejected meaning that there is a significant difference between the mean achievement scores of students taught physics using CAI and that of those taught using Lecture method in favour of CAI.

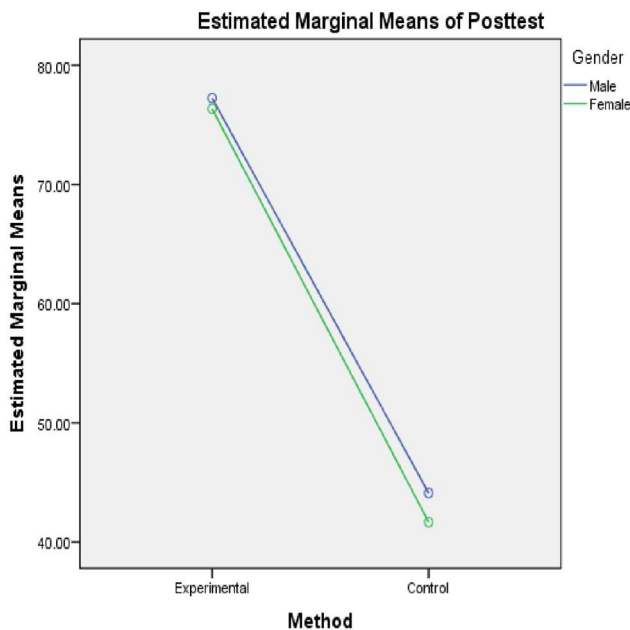
**Hypothesis 2:** There is no significant difference between the mean achievement scores of male and female students taught physics using CAI.

From table 3, it also shows that there is no significant main influence of gender on students' academic achievement in Physics  $F(2, 36) = 0.523, P = 0.474 > 0.05$ .

Therefore, the null hypothesis is not rejected meaning that there is no significant difference between the mean achievement scores of male and female students.

**Hypothesis 3:** There is no interaction effect of teaching methods and gender on students' academic achievement in Physics

From table 3, it further shows that there is no significant interaction of teaching methods and gender on students' academic achievement in Physics  $F(2, 36) = 0.106, P = 0.746 > 0.05$ . Therefore, the null hypothesis is not rejected meaning that there is no significant interaction effect of teaching methods and gender on students' academic achievement in Physics.



Covariates appearing in the model are evaluated at the following values: Pretest = 36.6829

**Figure 4: Plot of Interaction effect of teaching methods and Gender**



**on students' academic achievement in Physics.**

The study revealed that the students taught physics using CAI performed significantly better than those taught using lecture method. The level of higher academic achievement by the experimental group who received treatment could be as a result of self-evaluation and remedial activities provided by CAI which helped the students to master physics concepts better than the control group who were not exposed to CAI. The superiority of the use of CAI could be explained based on the presentation of the concepts with pictorial illustrations which sometimes appear in motion. The pictorial illustrations are considered effective in enhancing academic achievement in science for both concrete operational and formal students (Ajayi, 2017). These pictorial illustrations provide concrete basis for conceptual thinking and therefore facilitate a better and proper understanding of physics concepts. In addition, the use of CAI in teaching physics created multisensory channels for learning. This situation usually enhances learning since the students tend to learn more and better when more of the sense are involved than when one sense is involved. (Ratner, 2018). The findings of the study is in line with that of Ibrahim (2020) and Mudasiru and Adedeji (2010) which have shown that innovative instructional approaches like CAI enhance students' academic achievement more than traditional methods.

Regarding gender, the study found that there was no significant difference in the mean achievement score of male and female students taught physics using CAI. The finding of the study is that CAI uniformly affected the students. Since every student irrespective of gender partook in the activities, their academic achievement was equally affected but this was not significant. The study revealed that gender has no significant influence on academic achievement of students in physics. The result agrees with that of Ogbianigene (2014) and Anya (2017), that there is no significant difference in the academic achievement of physics students with respect to gender.

Additionally, the research indicated no interaction effect of teaching methods and gender was no significant for academic achievement in physics. Since both male and female students benefited from the instructional approach, it might help to reduce gender related differences in the study of physics. This is in line with Joseph, John, Eric, Yusuf and Olubunmi (2015) and Shazli (2017) that recorded no significant interaction between teaching methods and gender on students' academic achievement in social studies.

## **CONCLUSION**

Considering the findings, the study established that Computer-Assisted Instruction (CAI), regardless of gender, significantly improved students' academic achievement in physics. The study also revealed a non-significant influence of gender and teaching methods on students' academic achievement in physics. In light of this, it is therefore pertinent to say that CAI is a gender friendly instructional approach that promotes students' academic achievement in physics.

Following the results, the following recommendations were made:

1. Physics teachers should adopt CAI while planning their lessons to enhance students' interaction with each other and the learning materials to facilitate effective learning and improved academic achievement.
2. Curriculum Planners should adopt CAI as an innovative teaching strategy in planning and reviewing of curriculum in senior secondary schools physics.
3. The Science Teachers Association of Nigeria in collaboration with the government should organize seminars and workshops to train physics teachers on how to use CAI in teaching and learning of Physics.
4. The government, especially the Ministry of Education should introduce the use of CAI into the school curriculum for physics instruction.

## **LIMITATION AND FURTHER RESEARCH**

The major limitations of the study are outlined as follows:

1. The study was delimited to two intact classes of small size, this as a result may limit the generalizability of the study.
2. The study was carried out using only one level of students (SS2 physics students)
3. The study was conducted using only four concepts (machines, types of machines, classes of simple machines and friction) in physics.

In light of these limitations, the following suggestions for further studies were made:

1. A larger sample size should be sampled and studied to improve the generalizability of the study.
2. This study may be conducted using other levels of secondary school students to ascertain if the same effectiveness of CAI will be established.
3. The study could be conducted using other topics in physics to ascertain if CAI is effective in enhancing students' academic achievement.

## ACKNOWLEDGEMENT

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## ENHANCING ACCESSIBILITY AND LEARNING OUTCOMES IN HIGHER EDUCATION: THE ROLE OF UNIVERSAL DESIGN FOR LEARNING IN DIGITAL FORMATS

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**Abstract:** The use of digital formats has revolutionized teaching and learning approaches in the constantly changing field of higher education. The Universal Design for Learning (UDL) paradigm, which prioritizes offering many methods of presenting information, promoting active participation, and enabling diverse forms of expression, has become essential in promoting inclusive education. This article examines how the use of Universal Design for Learning (UDL) in digital media improves accessibility and learning outcomes in higher education. This article seeks to offer a thorough overview of the tactics and their efficacy by amalgamating recent peer-reviewed studies.

**Keywords:** *Universal Design for Learning; Digital Formats; Higher Education; Accessibility; Learning Outcomes.*

### Literature Review

#### 1. Multiple Means of Representation: An Overview

Recent research emphasizes the significance of offering multiple representations to cater to a wide range of learning preferences and demands. Al-Azawei et al. (2016) examine the ways in which UDL principles, namely the incorporation of various methods of presenting information, address the demands of a wide range of students, hence improving learning outcomes in digital settings. Advocates contend that offering content in many formats, such as text, audio, and visual aids, guarantees that all students, irrespective of their unique learning styles and talents, may readily access and comprehend the subject. In addition, Al-Azawei et al. discovered that the use of varied representations helps to decrease obstacles to learning and enhances both engagement and comprehension.

The research conducted by Basham et al. (2020) corroborates these findings, highlighting the efficacy of UDL in fostering equal learning chances. The statement emphasizes the ability of digital platforms to utilize UDL principles in order to provide many representations, hence promoting an inclusive educational setting. Their research indicates that

students who are exposed to many forms of representation exhibit greater levels of academic accomplishment and contentment in comparison to those in conventional, unidimensional learning settings. Dolan (2018) makes a noteworthy contribution by examining how technology enables various ways of representing information. Dolan highlights that the progress in educational technology has facilitated the integration of UDL tactics, such as interactive e-books and multimedia presentations, that accommodate various sensory modalities and learning preferences. Integrating these technology not only improves accessibility but also promotes the engagement and effectiveness of learning for a wide range of students.

## **2. Digital Tools and Resources**

CAST (2018) states that digital technologies, like as multimedia, interactive simulations, and hyperlinked resources, are crucial for implementing UDL. These tools offer alternate routes for students to obtain and understand knowledge, enhancing the personalization and effectiveness of learning. For example, multimedia tools can simplify intricate topics by presenting them in visual and audio formats, therefore assisting students with diverse cognitive abilities. Alnahdi (2020) explores the benefits of interactive simulations in facilitating practical learning experiences that are challenging to replicate in a conventional classroom environment. These simulations enable students to conduct experiments, investigate, and visually comprehend concepts in a dynamic and captivating way, hence augmenting their comprehension and memory of the subject matter. Alnahdi's research emphasizes the substantial beneficial influence of these tools on students' academic achievement and their capacity to comprehend abstract ideas.

Similarly, the research conducted by Black and Moore (2019) emphasizes the significance of hyperlinked resources in establishing a connected learning environment. Proponents assert that hyperlinks enhance effortless navigation and expedite access to correlated material, empowering pupils to delve into subjects extensively and at their own preferred speed. The adaptability of this approach is especially advantageous for pupils with varying learning requirements, since it empowers them to select the most efficient method to interact with the material.

## **3. Enhancing Comprehension through Multimedia**

The research conducted by Smith and Ayres (2020) highlights the efficacy of multimedia in enhancing understanding. By integrating movies, animations, and interactive graphics, educators can convey material using diverse methods, which can assist students with varying

learning styles and capacities. For instance, movies can effectively showcase intricate processes and concepts that are challenging to convey just through written word, while animations can visually depict temporal changes or intricate interactions.

According to Kimmons et al. (2017), multimedia learning has cognitive benefits as it can effectively decrease cognitive load and improve memory retention. Their research demonstrates that students who actively interact with multimedia materials achieve higher scores on exams and have a more profound comprehension of the subject matter. Kimmons et al. emphasize the significance of meticulously crafted multimedia components that are in harmony with educational objectives and the requirements of the learners.

Moreover, the study conducted by Hwang et al. (2018) about the utilization of interactive graphics illustrates how these tools can enhance the comprehensibility and tangibility of abstract and intricate information. Interactive graphics enable students to alter data and visually represent relationships, so promoting more profound learning and fostering critical thinking. Hwang et al. discovered that the utilization of interactive graphics by students resulted in enhanced problem-solving abilities and a heightened capacity to apply theoretical information to real-life scenarios.

#### **4. Accessibility Features in Digital Formats**

The research conducted by Smith and Ayres (2020) highlights the efficacy of multimedia in enhancing understanding. By integrating movies, animations, and interactive graphics, educators can convey material using diverse methods, which can assist students with varying learning styles and capacities. For instance, movies can effectively showcase intricate processes and concepts that are challenging to convey just through written word, while animations can visually depict temporal changes or intricate interactions.

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and fostering critical thinking. Hwang et al. discovered that the utilization of interactive graphics by students resulted in enhanced problem-solving abilities and a heightened capacity to apply theoretical information to real-life scenarios.

### **5. Personalized Learning Environments**

The study conducted by Rose et al. (2018) investigates the impact of individualized learning environments, facilitated by Universal Design for Learning (UDL), on students' ability to select the formats that align with their individual learning preferences. This adaptability enhances involvement and drive, resulting in improved educational achievements. Personalized learning environments have the ability to adjust to the specific requirements of individual students, offering customized information and learning opportunities that correspond to their abilities and interests.

According to Hehir et al. (2019), adaptive learning systems are highly effective in facilitating tailored learning experiences. These technologies utilize data and analytics to adapt the speed and complexity of instruction according to individual student performance, guaranteeing that each student is provided with the suitable amount of challenge and assistance. Hehir et al. discovered that students in adaptive learning environments exhibited superior academic progress and increased levels of involvement in comparison to those in conventional settings.

Furthermore, the study conducted by McGuire and Scott (2017) emphasizes the significance of student choice and autonomy in personalized learning settings. By granting students the autonomy to choose the resources and activities that most effectively cater to their individual needs, instructors may cultivate a sense of ownership and innate drive in learners. The study conducted by McGuire and Scott demonstrates that students who possess a greater degree of autonomy in their learning endeavors are more inclined to exhibit engagement, motivation, and achievement in their academic pursuits.

### **6. Cognitive Load Reduction**

In their publication, Meyer and Rose (2016) examine the notion of cognitive load and explore how the use of Universal Design for Learning (UDL) principles in digital media might effectively mitigate it. By presenting knowledge in discrete portions and employing unambiguous, succinct language, instructors can augment students' capacity to comprehend and remember information. Minimizing cognitive load is essential to avoid overwhelming students and to ensure their successful engagement with the provided material. Sweller et al. (2019) offer additional knowledge on the implementation of cognitive load theory in educational environments. According to their



research, using multimedia and presenting information in segments in instructional designs can greatly reduce unnecessary mental effort, leading to better learning results. They contend that by minimizing superfluous mental exertion, pupils can devote more attention to fundamental cognitive functions, such as problem-solving and critical thinking.

In addition, the research conducted by Chandler and Sweller (2020) further emphasizes the significance of effectively controlling cognitive load by utilizing worked examples and guided practice. These strategies assist students in constructing schema and automating specific skills, thereby liberating cognitive resources for more intricate tasks. Chandler and Sweller's research suggests that these tactics are especially successful in digital learning settings, where there is a greater risk of cognitive overload.

### **7. Student Engagement and Motivation**

Rao and Meo (2016) conducted a study which found that the use of Universal Design for Learning (UDL) in digital forms had a substantial positive impact on student engagement and motivation. Methods such as interactive content, gamified learning modules, and real-time feedback are employed to actively engage students in their learning process. The inclusion of interactive components enhances the learning experience, making it more interesting and applicable, hence potentially boosting student motivation and perseverance. The research conducted by Dabbagh et al. (2019) provides evidence that confirms these findings, emphasizing the significance of gamification in improving student engagement. By integrating gamification components such as points, badges, and leaderboards, educators can establish a more dynamic and incentivizing learning environment. Dabbagh et al. discovered that students enrolled in gamified courses had elevated levels of engagement and satisfaction in comparison to students enrolled in standard courses.

Furthermore, Cheung and Slavin (2016) highlight the significance of providing immediate feedback to students in order to sustain their active participation. Their research demonstrates that prompt feedback aids students in maintaining focus, comprehending their progress, and implementing essential modifications to their learning practices. Cheung and Slavin contend that real-time feedback is especially efficacious in digital learning environments, as it can be easily included into the instructional design.

### **8. Inclusive Education Practices**

According to Smith and Buchanan (2018), UDL promotes inclusive education by ensuring that all students have equal opportunities to

achieve success. Digital formats incorporating Universal Design for Learning (UDL) principles guarantee that educational information is both accessible and captivating for students with a wide range of backgrounds and skills. Inclusive practices have a dual advantage: they not only aid students with disabilities, but also enrich the learning experience for all students by fostering a range of learning techniques and views.

The study conducted by Black et al. (2020) emphasizes the efficacy of inclusive educational strategies when implemented in digital formats. Researchers discovered that when educators employ Universal Design for Learning (UDL) principles to create inclusive digital content, it leads to enhanced academic achievements and increased engagement for all students, especially those from underrepresented communities. Black et al. highlight the importance of inclusion in education, as it fosters a fair and helpful learning environment.

Similarly, the research conducted by Thompson and Thurlow (2017) investigates the influence of inclusive digital behaviors on students who have disabilities. Research has demonstrated that the utilization of digital tools and resources that align with Universal Design for Learning (UDL) principles can greatly enhance educational access for students with disabilities, enabling them to actively engage in the learning process. Thompson and Thurlow assert that these behaviors not only improve accessibility, but also foster a feeling of belonging and community among students.

## **9. Professional Development for Educators**

The research conducted by Novak and Thibodeau (2016) emphasizes the necessity of providing educators with professional development opportunities in Universal Design for Learning (UDL). Training programs that prioritize the use of Universal Design for Learning (UDL) strategies in digital forms can greatly improve teacher efficacy and student learning results. Professional development enhances educators' comprehension and implementation of UDL concepts, empowering them to establish learning environments that are more inclusive and accessible.

Santangelo and Tomlinson (2019) highlight the significance of continuous professional development in promoting a culture that values inclusion and fosters creativity. Their research demonstrates that educators who engage in ongoing UDL training are more inclined to employ efficacious and innovative educational approaches that cater to the different requirements of their pupils. Santangelo and Tomlinson assert that professional development should be a pivotal element in institutional endeavors to advance UDL.

Furthermore, the study conducted by Spooner et al. (2018) provides

evidence that engaging in professional development focused on Universal Design for Learning (UDL) can result in substantial enhancements in teaching methodologies. Researchers discovered that instructors who underwent UDL training had more self-assurance in their capacity to create and administer inclusive curriculum. Spooner et al. emphasize the importance of designing professional development programs that are thorough and customized to meet the individual requirements of educators in order to optimize their impact.

### **10. Future Directions in UDL and Digital Education**

In Burgstahler's (2020) analysis, the author explores the latest developments in Universal Design for Learning (UDL) and digital education. These advancements encompass the utilization of artificial intelligence and machine learning to construct adaptable learning environments. These innovations have the potential to enhance the learning experience for pupils by tailoring it to their individual needs and maximizing its effectiveness. Through the utilization of AI and machine learning, educators may create systems that adapt in real-time to the unique requirements and inclinations of every student, offering a highly personalized learning encounter.

The study conducted by Holmes et al. (2019) investigates the capacity of artificial intelligence (AI) to improve the application of Universal Design for Learning (UDL). Advocates contend that AI-driven solutions have the capability to examine student data in order to discern learning patterns and forecast areas in which pupils could require supplementary assistance. Holmes et al. discovered that the utilization of such technologies can greatly enhance student results through the provision of timely and focused interventions. In addition, Baker and Smith (2018) emphasize the significance of data analytics in upcoming UDL applications. They propose that through the collection and analysis of data on student interactions with digital information, educators can acquire useful insights into the effects of various UDL tactics on learning. According to Baker and Smith's research, utilizing data-driven methods can enhance and optimize UDL procedures, resulting in increased effectiveness and responsiveness to student needs.

### **Discussion**

Recent research highlights the significant impact that UDL in digital media can have on higher education. By providing several modes of presentation, educators may accommodate a wide range of learning requirements, hence improving accessibility, understanding, and involvement. Essential elements of this strategy include digital tools and resources, accessible features, customized learning environments, and

professional development for instructors.

## Conclusion

Implementing UDL concepts in digital formats shows great potential for developing inclusive and efficient learning environments in higher education. In order to maximize the effectiveness of digital technologies, it is crucial to engage in continuous study and professional growth. The research examined in this article establish a strong basis for comprehending the influence of UDL on student learning and emphasize the necessity for ongoing innovation and implementation in this field.

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**PODCAST: A TECHNOLOGICAL TOOL FOR IMPROVING  
LEARNING PERFORMANCE IN ALGEBRA  
AMONG PRIMARY SCHOOL PUPILS IN OSUN STATE**

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**Abstract:** *This study examined podcast potency as a technological tool for improving students' learning performance in mathematics. The study employed a mixed-method approach for the data collection. The quantitative was a quasi-experimental design with pre-tests and post-tests while the qualitative research data were obtained through in-depth interviews. The population comprised all primary school pupils in Osun State in Nigeria. Participants were drawn from two schools, purposively selected within the Oriade Local Government Area. Two different instruments were developed by the researchers titled: Podcasts Achievement Test (PAT) and Podcasts Interview Guide: (PIG) were used to collect the quantitative and qualitative data with a reliability value of 0.86 for the achievement test. The data collected was analysed using ANCOVA with pretest scores as the covariate. The findings of the study revealed that students in the experimental group performed better with a mean score of (M=18.2), than the control group with a mean score of (M=10.2) due to the intervention given to them. Thus, the result shows that there is a significant difference in the performance of pupils taught algebra using the two methods- podcasting and conventional methods. One of the major contributions of this study is that teachers should be encouraged to use podcasting to*

*teach mathematics at primary schools to improve learners' engagement and academic performance.*

**Keywords:** Podcast; Technological tool; Algebra; pupils.

### **Introduction**

Teachers' pedagogical strategies significantly influence the learners' capacity to remember and recollect the knowledge being taught to them. The procedure through which this information is conveyed determines how long the students can retain this knowledge in their long-term memory (Onowugbeda et al; 2024). Teaching strategies that are teachers-centered are passive and predominantly employ the lecture method which does not allow learners to actively participate in the class. This may result in challenges of students' poor knowledge retention (Bavishi et al., 2022). To provide students with relevant learning experiences, teachers must implement optimal information retention mechanisms using technology. In recent times, technology has become a teacher surrogate that has brought rapid innovations in the teaching and learning process by promoting learner engagement and knowledge retention.

The integration of technologies has brought modern devices into educational activities, allowing the education sector to operate more conveniently and easily even when knowledge is disseminated (Yugsan-Gomez et al, 2020 & Okoye et al, 2021). Technology places the learners at the centre of the learning process, emphasizing their active participation and engagement, departing from the traditional teacher-centred approach (Dayagbil et al. 2021). Technological knowledge and competencies have emerged as significant in improving the teaching-learning process (Odekeye et al., 2023). The pace of technological development influences innovation in education, as demonstrated by Olufunke (2019), who emphasises that Instructional materials are essential tools in learning every subject in the school curriculum. Adeyemi & Olatunde (2023) shows that instructional materials play a significant role in shaping students' academic success.

According to UNESCO (2020), using teaching materials such as electronic delivery devices like projectors, televisions, radios or computers and the internet promotes active students' participation and improves their understanding. One form of instructional tool that is beginning to appear in classroom settings is podcasts because learners are beginning to find it more useful in learning faster than using course notes (Copley, 2007). Podcast is an innovative and effective means of disseminating the required knowledge to the students (Chaves-Yuste & de la Peña 2023). Podcast is derived from two words "iPod" and "Broadcast" (International Podcast Day, 2017, & Indiana University

Knowledge Base, 2016). The acronym "POD" in Podcast stands for Portable on Demand, and "cast" originates from the word Broadcast (Business Dictionary, 2017). These broadcasts are published online through recordings and can be readily downloaded to desktop or laptop computers (Traxler & Kukulska-Hulme, 2019; Singh et al., 2022).

There are two types of podcasts, audio podcasts (simply referred to as podcasts) with solely audio content and video podcasts (also called vodcasts or video casts) which contain both audio and motion pictures as video clips. As Adegoke (2022) rightly proclaims, the step-by-step demonstrations provided by video podcasts serve as a valuable framework tool, enabling students to follow along and assimilate the problem-solving process. The utilisation of podcasts has grown in popularity over the years, especially in education. Podcasts are a form of technology that distributes sound or video to individuals (Robson, 2010), but they are typically similar to radio talk shows, in which the main form of media usage is sound distribution. Podcasts are distinguished from other forms of audio-video content, in that they are typically part of a series to which people can subscribe. Podcasts are easily available on mobile devices, increasing accessibility for the listener (Johnson, 2006; Khechine, 2013).

Podcasts became popular in the early 2000s through the advancement of the internet and were historically referred to as audio graphs, webcasts, vodcasts, and the now more common mainstream term podcasts (Kay, 2012; Loomes, 2002). Presently, they are widely used to share information, stories, and knowledge on a tremendous variety of topics through audio or video files. These files are made available online so that students may download and listen to or watch them as instructional materials outside of class at a time and place convenient to them (Copley, 2007). Studies have shown that video and audio podcasts can assist students in learning mathematics (Kay et al., 2019; Sun & Cheng, 2020; Gómez-Ramrez et al. 2022).

Beyond the classroom, students expose themselves to millions of hours of content through various podcasts. This exposure to diverse perspectives fosters critical thinking skills (Brown, 2023; Lee, 2021). Additionally, podcasts contribute to the development of communication and collaboration skills among learners (Kim, 2022; Smith, 2019). Another attractive feature of podcasts is that they allow the listeners to take a break from excessive visual input from computer screens or textbooks, as well as potentially allow auditory input to occur while dual-tasking. This is especially convenient for individuals with busy schedules, as it allows knowledge and information to be accessible on the go to enhance understanding (Wang, 2020).

Recently, mathematics has been increasingly used in sciences, technologies, engineering, social science, humanities, education and

other related fields. The emphasis placed on the significance of mathematics in the school curriculum from primary to secondary levels reflects the subject's role in our society. According to the National Policy on Education (2014), the philosophy of mathematics education is to equip students for life and enable them to make logical decisions. According to Gbeleyi et al. (2023), the standing of mathematics in the manpower and technological development of any nation cannot be overemphasized therefore, mathematics is a discipline that plays a significant role in the sustainability, security, and technological development of any nation (Oloda & Fakinlade, 2017). Despite all the importance of mathematics education, Nigeria is still facing several challenges that hinder student achievement, critical thinking, and problem-solving skills. This could be a result of the traditional teaching methods, limited access to technology, inadequate teacher training, and lack of personalised attention to support, as students individualised help with challenging concepts in mathematics (Ajibola, 2019; Eze & Onwuegbu, 2020; Idowu & Aina, 2021; Okoro & Achor, 2022; Onoyala & Ajayi, 2023). Considering podcasting's potential as an instructional tool, this study proposes a solution to lower the negative impact of teacher-centred instruction on students' academic performance, specifically in the field of learning mathematics among primary school pupils in Nigeria.

Learning performance in the context means measurable outcomes that demonstrate how effectively students have met defined educational goals. These outcomes may include academic performance like test scores and grades, along with other factors such as motivation, engagement, and the acquisition of skills (York et al. 2019). Strong learning performance is shaped by multiple factors, including teaching methods, the learning environment, and individual student characteristics (Usman, & Madudili, 2019). Learners' performance in mathematics is influenced by the teaching and learning methods (Ayebale et al. 2020). This implies that the methods used in teaching are the keys to enabling the learners to understand the underlying key concept.

### **Rationale for Algebra**

Algebra in mathematics at the primary level of education is a very vital topic that has great importance in helping children's growth and development psychologically. It has been identified as a mathematical gatekeeper that gives learners a passport to many educational opportunities (Ralston et al., 2018). Algebra often involves the manipulation of numbers and symbols to find unknown values, identifying and analyzing patterns, exploring relationships, making generalizations, and interpreting changes (National Council of Teachers



of Mathematics [NCTM], 2000; Stephens et al., 2015). A good understanding of algebra from primary school can help pupils learn to organise their thoughts, which makes it simpler for them to come up with rational replies when faced with challenging situations. It will enable students to comprehend symbols and manipulate and interpret the letters employed in various algebraic situations to provide solutions (Kieran, 2007; Sukirwan et al., 2018). Basic algebraic reasoning at the primary school level may include such problems as  $3+2 = \underline{\quad}$ ,  $3+y = 6$ , what is the value of  $y$ ?  $2g=10$ , what is the value of  $g$ ?

Algebra questions will assist learners in thinking mathematically and expressing language with words, symbols, tables, and graphs (Stacey & MacGregor, 1999). Competence in algebra is essential for people across all types of education and professions where they use this language. However, it has been observed that despite the recognition of the importance of understanding algebra as a fundamental branch of mathematics, students are still facing significant difficulties when working on algebraic problem-solving and formal algebraic systems (Niringiyimana & Maniraho 2023). These difficulties are attributed to the poor teaching approach (Umar 2014. According to Muhammed et al., (2020), the teaching approaches adopted by teachers play significant roles in students' learning ability. The schools, therefore, are responsible for giving learners competence in algebra, and it is on this note that the study aimed at exploring the efficacy of podcasts in teaching mathematics among primary school pupils in Osun State.

### Research Questions

1. Is there any significant difference in the performance of pupils taught algebra using podcasting instructional delivery and conventional methods
2. What are the perceptions of the pupils on the use of podcasts for instructional delivery

### Hypothesis

1. There is no statistically significant difference in the learning outcome of students taught algebra using podcasting instructional delivery and traditional methods.

### Method

This study employed a mixed-method approach for the data collection. The quantitative was a quasi-experimental design with pre-tests and post-tests for non-equivalent groups. This is due to the lack of random assignment to the experimental and control groups during data collection (Reichardt, 2009). The qualitative research data were obtained through in-depth interviews with the pupils. This study uses a pre-test measure

to evaluate the experimental and control groups after that only the experimental group receives the intervention. A post-test was conducted to assess both the experimental and control groups. The relative effectiveness of the intervention provided to each group was determined by comparing the performance of pupils in the experimental and comparison groups.

### **Population and Sampling**

The study population is made up of all primary school pupils in Osun State. A sample of 54 primary school pupils participated in the study from two different private schools in Oriade Local Government Area of Osun State, Nigeria. The schools were selected for this study based on the researchers' convenience. Both groups were used based on the pre-existing intact classes of these schools. There are 28 pupils (16 males and 12 females) in the experimental group while the control group consists of 26 pupils (9 males and 17 females). The mean age of the pupils in this study was 10 years. Thus, the sample for the study was made up of students of mixed ages, abilities, and genders.

### **Instruments**

Two different instruments were developed by the researchers titled: (i) Podcasts Achievement Test (PAT): This instrument was designed to evaluate the impact of podcasts on pupils' academic performance. (ii) Podcasts Interview Guide: (PIG): This instrument was used to get pupils' perceptions and obtain in-depth information about the intervention. These instruments were validated by five seasoned primary school mathematics teachers to ensure that the instruments measure what is expected. These experts were selected to ensure that the questions structured matched the context, correctness, behavioural objectives and logical presentation of the lesson plans. Test-retest was used to determine the reliability of the instruments and this achievement test was given to 15 pupils who were not among the participants in the study. After two weeks, the instrument was administered by the researchers to the same set of pupils. The results from the first and second administrations were exposed to stability testing. The data collected was analysed using IBM-SPSS version 23, and a reliability coefficient of  $r = 0.86$  was obtained. This shows that the instrument was reliable because the acceptable level is  $r \geq 0.7$ .

### **Results**

**Table 1: Analysis showing the gender and the teaching approaches used for teaching algebra**

| Gender | Podcasting Group |       | Conventional Group |     | Total |       |
|--------|------------------|-------|--------------------|-----|-------|-------|
|        | N                | (%)   | N                  | (%) | N     | (%)   |
| Male   | 16               | 57.1  | 9                  | 35  | 25    | 46.3  |
| Female | 12               | 42.9  | 17                 | 65  | 29    | 53.7  |
| Total  | 28               | 100.0 | 26                 | 100 | 54    | 100.0 |

Table 1 shows the number of male and female pupils in the podcasting and conventional method groups. The table shows that for the experimental group, 57.1% of the participants were male and 42.9% were female. In the control group, 35% were male while 65% were female.

**Table 2: Analysis Showing the Test of Homogeneity of Variances**

|               |                               | Levene Statistic | df1 | df2    | Sig. |
|---------------|-------------------------------|------------------|-----|--------|------|
| Posttest Mean | Based on                      | 1.53             | 1   | 52     | .22  |
| Median        | Based on                      | .66              | 1   | 52     | .4   |
| Median        | Based on and with adjusted df | .66              | 1   | 44.020 | .420 |
| trimmed       | Based on Mean                 | 1.38             | 1   | 52     | .25  |
| Pretest Mean  | Based on                      | .020             | 1   | 32     | .88  |
|               |                               | .020             | 1   | 52     | .89  |
| Median        | Based on                      | .020             | 1   | 51.2   | .89  |
| Median        | Based on and with adjusted df | .018             | 1   | 52     | .89  |
|               |                               |                  |     |        |      |
| trimmed       | Based on Mean                 |                  |     |        |      |

Table 2 shows that the posttest achievement and pretest achievement scores measures were not statistically significant. This confirmed that the variance between the experimental and control groups was equal and

both the groups passed the test of homogeneity of variance.

**Research Question 1:** Is there any significant difference in the learning performance of pupils taught algebra using podcasting instructional delivery and conventional methods?

**Table 3: Mean showing the performance of pupils taught with podcasting and conventional methods**

|          | Group        | N  | Mean | Std. Deviation |
|----------|--------------|----|------|----------------|
| Posttest | Experimental | 28 | 18.2 | 1.71           |
|          | Control      | 26 | 10.2 | 1.27           |
| Pretest  | Experimental | 28 | 6.00 | 1.92           |
|          | Control      | 26 | 7.31 | 2.04           |



Figure 2: Showing the performance of pupils taught with podcasting and conventional methods

Table 3 shows the students' average achievement scores before the intervention, with the control group scoring higher ( $M = 7.31$ ) than the experimental group ( $M = 6.00$ ). However, following the intervention, the experimental group's mean score increased to ( $M=18.2$ ), which became higher than that of the control group, which had a mean score of ( $M=10.2$ ).

**Research Question 2:** What are the perceptions of the pupils on the use of podcasts for instructional delivery?  
Based on the findings derived from students' interviews indicated that

podcasting as an instructional delivery had a positive impact on improving students' academic performance.

**Fiyin (Pseudo name, 10 years)**, the male said "I enjoyed podcast in class because I was able to understand algebra"

**Sofiat (Pseudo name, 11 years)**, female said "I enjoyed the videos that you used to explain algebra and the examples used because I will always remember them. I wish my mathematics will continue to use it to explain other topics to us".

**Seun (Pseudo name, 10 years)**, male said "The classes were always fun and I learn faster because the teacher will pause, replay and allow us to ask questions before playing again and again.

Chiamka (Pseudo name, 10 years), male said "I love the way you teach us and I am always happy when you are coming to teach us".

Deborah (Pseudo name. 11 years), female, said "The class is always interesting and I always understand your class. Thank you, sir.

Olajumoke (Pseudo name, 12 years), female "I enjoyed the class when compared with the way we used to learn from our class teacher and other teachers.

Based on this report, using podcasting as an instructional teaching tool increases students' readiness, promotes engagement and improves students' academic performance during the teaching and learning of algebra.

**Hypothesis 1:** There is no statistically significant difference in the learning performance of students taught algebra using podcasting instructional delivery and traditional methods.

Table 4: ANCOVA table showing the Post-test Achievement with Pre-test Achievement as Covariate

| Source          | Type III Sum of Squares | Df | Mean Square | F      | Sig. |
|-----------------|-------------------------|----|-------------|--------|------|
| Corrected Model | 862.62 <sup>a</sup>     | 2  | 431.31      | 189.68 | .00  |
| Intercept       | 756.96                  | 1  | 756.96      | 332.89 | .00  |
| Pretest         | 3.31                    | 1  | 3.36        | 1.48   | .23  |
| Group           | 804.67                  | 1  | 804.67      | 353.87 | .00  |
| Error           | 115.97                  | 51 | 2.27        |        |      |
| Total           | 12130.00                | 54 |             |        |      |
| Corrected Total | 978.59                  | 53 |             |        |      |

a. R Squared = .881 (Adjusted R Squared = .877)

Table 4 shows the pre-test achievement with a P-value of 0.00, indicating that the podcasting class and conventional method groups had different initial entry levels, which aligns with the Pretest's goal. The ANCOVA adjusted all students to the same baseline. The analysis of covariance revealed no statistically significant difference in academic performance between pupils taught algebra using podcasting and those

taught through conventional methods ( $F(1,51) = 353.87; P < 0.05$ ). Thus, the hypothesis is then REJECTED.

### **Discussion of findings**

The first research question was to find out whether there is any significant difference in the performance of pupils taught algebra using podcasting and conventional methods. The finding shows that the academic performance of pupils taught algebra using podcasting as an instructional delivery was better when compared to those taught using conventional methods. This result is in line with the findings of Mason and Berson (2019) who observed a marked improvement in students' performance when exposed to podcasts as an instructional tool, revealing that podcast-based instruction led to higher retention rates and improved problem-solving skills in subjects requiring abstract reasoning, such as mathematics. Also, this result agrees with the findings of Harris and Walker (2020) that integrating podcasts into mathematics lessons increases engagement and comprehension among learners. Their study reported that students engaging with podcast-based lessons performed significantly better in tests and exercises than those in traditional classroom settings. However, the finding from this study did not support the result of Roberts and Gardner (2021), who reported no significant difference in academic performance between students taught using podcasts and those taught through traditional methods. The discrepancy between their findings and ours could be attributed to variations in the use of podcasting to impart knowledge, study duration, or the specific content covered or the subject.

The second research question was to find out the learners' Perceptions of using podcasts for instructional delivery. Based on the researchers' findings, the results show that the use of podcasting as an instructional delivery in teaching algebra among primary school pupils positively improved students' academic performance. The result aligned with the findings of Clarke et al. (2017), who investigated the impact of audio learning aids on student achievement in STEM subjects, they concluded that podcasting as an audio learning aid had significantly improved students' ability to grasp difficult concepts and boosted their confidence in tackling mathematical problems. Also, there is no discrepancy between the findings from research question two and the results of the findings of Evan (2008), who found that students who used podcasts as part of their learning routine showed better retention rates compared to those who relied solely on traditional textbooks. According to Fernandes et al. (2009), the ability to pause, rewind, and re-listen to specific parts of a podcast helps students process and understand complex information at their own pace. This aligned with one of the points made by the learners during the interview that says classes were always fun and they

learn faster because their teacher will play, pause and allow them to ask questions before playing again and again.

The only hypothesis in this study was to find out if there was no statistically significant difference in the performance of students taught algebra using podcasting instructional delivery and traditional methods. The result revealed no statistically significant difference in academic performance between pupils taught algebra using podcasting and those taught through conventional methods. This result supported the study of Light and Pierson (2014) who found that there was a significant increase in student engagement and understanding of mathematical concepts when taught with podcasts in Chilean classrooms. It also aligns with the findings of Saeedakhtar et al. (2021), who highlighted the significance of podcast-based resources meeting learners' preferences to boost engagement and motivation.

### **Conclusion**

This study's findings indicate that podcasting is more effective for teaching algebra compared to conventional methods. A mixed-method approach was employed to test the two research questions (i.) Is there any significant difference in the performance of pupils taught algebra using podcasting instructional delivery and conventional methods (ii.) What are the perceptions of the pupils on the use of podcasts for instructional delivery and one hypothesis (i.) There is no statistically significant difference in the learning outcome of students taught algebra using podcasting instructional delivery and traditional methods in the study.

In this study, the experimental group's mean score was ( $M=18.2$ ), which was higher than that of the control group, which had a mean score of ( $M=10.2$ ). This means that pupils in the experimental group performed better than their counterparts in the control group. Also, the comparison of the performance between the experimental group taught algebra using podcasting and the control group taught using traditional methods using ANALYSIS OF COVARIANCE revealed a statistically significant difference in academic performance [ $F(1,51) = 353.87; P < 0.05$ ]. This indicates that students in the experimental group performed significantly better than those in the control group. This implies that podcasting is an effective approach to enhance students' understanding of algebra, a subject often considered challenging.

Finally, the findings suggest that podcasting should be adopted as an instructional tool in teaching-learning of algebra to enhance students' understanding. Further research is recommended to assess its long-term effectiveness in various educational contexts.

### **Recommendations**

Based on the findings of this study, the researchers' recommendations are as follows:

1. Curriculum planners at both state and national levels should actively provide the necessary facilities and resources to incorporate the use of podcasts as an instructional tool into the primary school curriculum.
2. Mathematics teachers should be encouraged and remunerated when they design or adopt the use of a podcast teaching approach to make the subject more engaging and accessible to pupils.
3. Training programs, workshops and retraining programs (such as conferences and seminars) that are related to mathematics should be organized to equip teachers with the skills needed to effectively create and use podcasts in their lessons
4. Schools should foster partnerships with technology providers and educational content creators to develop high-quality, curriculum-aligned podcast materials. Collaborations with experts can ensure that the podcasts used are pedagogically sound, relevant, and tailored to meet the specific needs of pupils.
5. Educational researchers should be commissioned to conduct further studies on the long-term impacts of podcast-based instruction across different subjects and educational contexts.

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## EXPLORING LEARNING STYLES TO ACHIEVE ACADEMIC PERFORMANCE

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**Abstract:** *In education, adapting teaching methods to students' learning styles is a fundamental concern for improving academic performance. This study investigates the importance of identifying and adjusting teaching practices to students' learning styles to optimize academic outcomes. The data collected, both through online teacher questionnaires and literature review, highlight that adapting to individual student preferences can significantly improve academic performance. Teachers recognize that tailoring teaching methods to prevailing learning styles contributes to student success, emphasizing the need to understand the diversity of learning styles in the educational process. These findings underscore the importance of adapting the learning process to the individual needs of students to improve academic performance.*

**Keywords:** *learning styles; learning environments; teaching strategies;*

*academic performance.*

## **1. Introduction**

In the field of educational sciences, a critical focus lies in understanding and optimizing learning styles to enhance students' academic performance. The adaptation of teaching methodologies to align with the individual learning styles of students significantly impacts the effectiveness of the educational process (Anca, 2022). Within this context, the present study addresses a crucial issue in modern education: the role of teachers in improving students' academic outcomes by tailoring their teaching strategies to accommodate the diverse learning styles prevalent in the classroom.

The central research question investigates the impact of teachers' identification of students' learning styles on academic performance. This inquiry aims to assess the importance of recognizing individual learning preferences as a means to enhance overall academic achievement. To achieve this objective, the study employs a mixed-method research design, exploring various learning styles, analysing coping strategies, and assessing the influence of learning styles on academic outcomes.

To test the hypothesis that teachers' identification of learning styles positively affects learners' academic results, several research tools were employed. These include direct observation, document analysis, an online questionnaire for academic teachers, and statistical data analysis. The questionnaire delves into teachers' experiences with students' learning styles and their influence on academic performance. Additionally, this study critically examines relevant academic papers authored by various experts in the field of education. All information collected will be treated confidentially, respecting the privacy of the respondents.

In the realm of educational research, a central objective revolves around identifying learners' individual learning styles to enhance students' academic performance (Beth A. R., et al., 2015). To achieve this aim, we will analyse data collected through an online questionnaire and relevant literature resources, paying particular attention to the specificity of participants and their educational backgrounds. This research seeks to make a valuable contribution by shedding light on the role that learning styles play in academic achievement. Additionally, it aims to provide practical recommendations for optimizing the educational process based on these diverse learning preferences.

Nonetheless, a notable limitation of this research lies in the restricted sample size of participants, potentially failing to offer a comprehensive representation of the entire academic population. Given the substantial variations in learning styles and educational contexts, a broader and

more diverse sample would provide a more comprehensive understanding of the topic under investigation.

## **2. Research methodology**

### **2.1. Mixed research**

For this research study, a mixed methods approach—also known as mixed methods research, integrative research, integrative research, multi-method research, pragmatist research, pragmatist research, mixed method, mixed method research, mixed method, multiple method or triangulated study—was applied. According to several authors, it refers to "the category of research in which the researcher mixes or combines quantitative and qualitative research techniques, methods, approaches, concepts or languages in a single study" (Johnson & Onwuegbuzie, 2004, p. 17). Blended research has been characterized by an integrated and interacting set of assumptions (epistemological, ontological, methodological, and rhetorical) that promote the compatibility thesis that "quantitative and qualitative approaches are neither mutually exclusive nor interchangeable" (Onwuegbuzie & Burgess, 2011, p. 397). The primary objective of employing a mixed-method research approach is to address the following question: "What methods and strategies can effectively identify diverse learning styles among students in relation to academic performance?" This method enables us to comprehensively explore various learning styles exhibited by learners, analyse coping strategies, and assess the impact of these learning preferences on academic outcomes from the perspective of educators.

### **2.2. Theoretical framework**

To investigate the primary research objective of exploring students' diverse learning styles and their impact on academic performance, we employed a mixed-methods approach that integrates both quantitative and qualitative methods. This comprehensive approach allowed us to construct a detailed and nuanced understanding of the phenomenon under study.

To achieve our research objective, we utilized several research methods and tools. First, we observed educational phenomena in their natural context, capturing real-world interactions and behaviours related to learning styles. Additionally, we conducted an in-depth analysis of relevant documents, including academic articles, books, and other literary sources. These materials addressed key topics directly correlated with our research question (Pavel, M., Pavel, D., 2023).

Furthermore, we addressed qualitative research questions by leveraging insights from the literature and observational data. The qualitative component provided valuable context and depth to our investigation. Simultaneously, we employed a quantitative questionnaire survey method to collect specific data related to our study hypothesis (H1). This

survey allowed us to quantify and analyse patterns associated with learning styles and their impact on academic outcomes.

H1: Teachers' identification of learning styles is presumed to improve learners' academic outcomes.

To complete this approach, we conducted statistical analyses on the obtained results to facilitate a rigorous interpretation of our research methodology.

### ***2.3. Personal position***

This article serves as an essential work assignment required for the completion of the Foundations of Pedagogy seminar. Within this context, both the teacher and the students meticulously examined the article's structure to fulfil the overarching purpose stated in the title.

### ***2.4. Data collection and analysis***

In the context of qualitative basic research, data collection methods included observation, document analysis, and a questionnaire, all rooted in the field of Educational Sciences (Merriam, 2009). The observation method facilitated an exploration of diverse learning styles exhibited by learners across various stages of the Romanian educational system. This exploration aimed to theoretically delineate the dimensions of the term "learning style" and illuminate learning and adaptation strategies.

By establishing a solid bibliographical foundation, this method informed the investigation of our research objective. Additionally, it guided the formulation of a targeted questionnaire comprising ten questions along a single axis. This online questionnaire was administered to academic teachers in Constanța County, involving a cohort of 28 educators representing different stages of Romanian education during the year 2024.

The questionnaire encompasses a comprehensive exploration of the following critical issues related to students' learning styles and their impact on academic performance:

- An assessment of students' learning preferences, observing whether they exhibit a preference for auditory or visual explanations, providing insights into their receptivity to different instructional approaches.
- To investigate whether the clarity and organization of tasks positively influence student performance.
- Identifying the learning strategies that students consistently employ, as observed by teachers.
- Determining students' preference for hands-on learning experiences, such as exercises and laboratory work.
- Observing the association between certain learning styles and higher academic performance.
- Exploring the association between specific learning styles (e.g., auditory, visual) and higher academic achievement.

- The adjustment of teaching methodologies to address the different learning styles of students.
- The need for teachers to adjust their teaching strategies to accommodate diverse learning styles (e.g., using the VARK model: Visual, Auditory, Reading/Writing, Kinesthetic).
- To assess the impact of teaching methods on academic performance. Specifically, we explore whether methods aligned with dominant learning styles contribute to improved student outcomes.
- Observing changes in student performance after implementing teaching methods adapted to individual learning styles.

The responses to these questions serve as an efficient means to gather essential data and acquire relevant information for our study. Additionally, insights extracted from academic papers and other authoritative resources will complement our research. Ultimately, our investigation aims to deepen our understanding of diverse learning styles and their impact on academic performance.

Research Methods: Observation; Theoretical data collection; Questionnaire and statistical data analysis through Google forms and "Jamovi".

In this study, we employed a mixed-methods research approach to investigate and comprehend students' diverse learning styles and their impact on academic performance. Our research methods encompassed observation, theoretical data collection, and a structured questionnaire, each contributing significantly to achieving our research objectives.

Observation is a qualitative research method that involves carefully and systematically observing behaviours and interactions in the participants' natural environment (Runcan, 2023). In our study, we employed observation to analyse the learning styles exhibited by learners across various stages of the Romanian educational system. Through this method, we directly identified several critical aspects:

- How students prefer to receive information—whether through visual, auditory, or kinesthetic channels.
- Insights into the learning strategies students consistently employ.
- Interactions between teachers and students during teaching activities.

Data collection is an essential process in any research study, involving gathering relevant information to answer the research questions (Mahmoudi, 2019). In our study, we employed the following methods to gather relevant information:

- Theoretical Document Analysis: We meticulously examined scholarly articles, books, and other pertinent literature related to learning styles and educational strategies.



- Questionnaire Survey: A pivotal tool for collecting quantitative data, the questionnaire survey involved a substantial sample of participants.
- Statistical Data Analysis: Using the statistical analysis program “Jamovi,” we rigorously analysed the collected data. The reliability coefficient ( $\alpha = 0.828$ ), as indicated in Table 1, surpassed the acceptable threshold ( $> 0.5$ ). Consequently, we deemed the questionnaire valid, enabling us to interpret the results. These findings were presented as percentages and visualized through graphs generated using the Google Forms questionnaire.

The questionnaire is a quantitative research method used to collect structured data from a large number of respondents (Bocoş, M.-D., et al., 2001). In this study, the questionnaire was purposefully crafted to elicit specific information regarding learning styles and perceptions of academic performance. The questionnaire, consisting of 10 questions, was distributed online and targeted:

- Academic teachers from Constanța County.
- 28 teachers from different stages of Romanian education.

The questionnaire played a pivotal role in our study by providing essential quantitative data to complement qualitative observations. Its purpose was to construct a comprehensive understanding of learning styles and their impact on academic performance. However, it is crucial to note that the questionnaire was not designed for broad generalization. The sample size of subjects was statistically insignificant, rendering it suitable for informational purposes only.

By integrating these research methods—qualitative observations and quantitative data collection—the study yielded detailed insights into how diverse learning styles influence students’ academic outcomes. Furthermore, it highlighted the importance of teachers adapting their teaching strategies to optimize educational success.

### **2.5. Research ethics**

Throughout our study, we adhered rigorously to ethical guidelines governing scientific research. We meticulously cited all bibliographical sources, ensuring transparency and intellectual integrity. Participants’ anonymity was strictly maintained; they were not required to disclose their names. This confidentiality safeguarded their privacy. Prior to data collection, we transparently communicated the research purpose and provided participants with a clear understanding of our objectives. These ethical considerations underscore our commitment to rigorous and responsible research practices.

## **3. Results**

### **3.1. Theoretical-historical analysis of learning style theories**

Learning styles encompass the diverse methods by which individuals prefer to acquire, process, and retain information and skills. Their significance within education stems from the fundamental premise that instructional strategies tailored to these preferences enhance student engagement and promote academic excellence (Dunn, R., Dunn, K. & Perrin, J., 1994). The hypothesis suggests that learning can be optimized if teachers deliver content in a manner that aligns with students' natural inclinations.

The concept of learning styles has intrigued researchers and educators since the early 20<sup>th</sup> century. Among the well-recognized models is the VARK model which identifies four primary learning preferences: visual learning, auditory learning, reading and writing preferences, and kinesthetic learning (Kendra C., 2023).

According to this model, visual learners' understanding is optimized through visual cues such as diagrams and spatial representations. Auditory learners thrive when information is conveyed through spoken language. Reading/writing learners engage most effectively with text-based input. Kinesthetic learners learn best through hands-on experiences and physical movement. These classifications underscore the uniqueness of each learner and offer valuable insights for educators. Recognizing this diversity, teachers should adopt a differentiated instructional approach—one that tailors methods to accommodate various learning styles. Departing from the traditional uniform approach, this shift allows educators to maximize educational success by reaching every student effectively (Raduan, 1982).

Howard Gardner's theory of multiple intelligences further extends this perspective, suggesting that there are many ways to demonstrate intellectual ability beyond conventional linguistic and logical-mathematical intelligence (Gardner, 1983). Understanding learning styles helps create favourable learning environments and supports students' self-awareness and the development of effective personal learning strategies. By recognizing the existence of different learning styles, educators can promote an atmosphere of respect and inclusiveness for diverse intelligences and learning methods (Silver, H., F., et al., 2000).

The concept of learning styles has garnered considerable attention, yet its empirical foundation remains a subject of scrutiny and debate. Critics contend that robust evidence supporting the effectiveness of tailoring instructional techniques to individual learning styles is lacking (Pashler et al., 2008). While the idea of accommodating learners' preferences may enhance motivation, it does not necessarily translate into improved academic performance. They caution against oversimplifying learning processes, suggesting that while adaptive preferences may boost motivation, this is not a guarantee for improved academic performance.

Despite the criticisms levelled against the concept of learning styles, one undeniable truth prevails: students exhibit diverse preferences and abilities. Consequently, the analysis and recognition of learning styles continue to hold significance within educational contexts. By acknowledging this diversity, educators can tailor their instructional approaches more effectively to meet the unique needs of each student. While the discussion surrounding learning styles remains nuanced and critical, embracing this concept can inspire innovative teaching practices that ultimately benefit all learners (Mulhayatiah, D., et al., 2024).

Learning style theories have evolved to become a fundamental component of educational discourse. These theories posit that individuals exhibit preferred modes of assimilating and processing information. Rooted in cognitive psychology and educational philosophy, learning style theory draws inspiration from early scholars like John Dewey, who championed the significance of customized education. At its essence, this theoretical framework advocates for a personalized approach to teaching—one that acknowledges the diverse cognitive profiles of learners and tailors instruction accordingly.

Throughout the 20th century, significant strides in psychology have given rise to diverse models for classifying learning styles. Among these, David Kolb's seminal work stands out. In the 1980s, Kolb introduced experiential learning theory, which remains influential. Central to this theory is Kolb's Learning Style Inventory (LSI), which categorizes learners into four distinct styles based on their information processing approaches: convergers, divergers, assimilators, and accommodators (Kolb, 1984). These styles are determined by the interaction between the perceptual continuum (concrete experience vs. abstract conceptualization) and the processing continuum (active experiencing vs. reflective observation).

Another prominent approach in the realm of learning styles, as previously discussed, is Fleming's VARK model, which emerged in the 1990s and focuses on sensory modalities as learning environments. Despite its widespread adoption in educational contexts, ongoing debates persist regarding the empirical evidence supporting the VARK model. Critics question its efficacy in significantly enhancing learning outcomes. Nevertheless, educators continue to utilize this framework to tailor teaching strategies to individual learner preferences, emphasizing the importance of accommodating diverse sensory modalities in the pursuit of effective education.

Howard Gardner's theory of multiple intelligences, introduced in his book "Frames of Mind" (1983), further diversified the concept of learning styles. Gardner proposed that intelligence is not a single general ability but a composite of multiple intelligences. His theory initially identified seven intelligences (later expanded to eight and potentially

more), each corresponding to a different domain of competence. This theory supported the concept that teaching could be adapted to capitalize on students' dominant intelligence.

Despite the widespread promotion of learning style theories in education, their empirical foundations have been contested. For example, Pashler (2008) has questioned the practical utility of adapting teaching methods to learning styles, citing a lack of rigorous evidence demonstrating improved student learning through this approach. (Pashler, et al., 2008). However, the appeal of learning styles lies primarily in their recognition of student diversity. They aim to create a more inclusive and responsive educational environment, acknowledging the multifaceted ways in which students learn (Fenwick, T. , J., Parsons, J., 2009).

The evolution of learning style theories signifies a continuous journey to understand and optimize the learning process. Their profound impact on educational strategies suggests a perpetual quest to match teaching techniques to the ways students learn most effectively. Consequently, these theories serve as historical benchmarks that inform contemporary educational practices and continue to be evaluated and refined in light of ongoing research and technological advances in education.

### ***3.2. Appropriate methods to identify learning styles***

In educational contexts, the identification of students' learning styles plays a pivotal role in customizing instruction to address their diverse needs. This practice significantly influences educational outcomes (Dunn, R., et al., 1999). Leveraging technological advancements, educators now have access to innovative tools and platforms that facilitate the adaptation of teaching methods to suit individual learning preferences.

Observation and assessment tools are essential strategies in identifying learning preferences. Observation, as a qualitative method, allows teachers to identify students' preferences by analysing their behaviour during learning activities (Fleming, N., D. & Mills, C., 1992)). Assessment tools, such as the VARK questionnaire and Gardner's Multiple Intelligences Theory, provide a quantitative approach (Gardner, 1983). However, Gardner has been criticized for the lack of empirical evidence to support his theory (Waterhouse, 2006).

Recent technological progress has significantly enhanced our ability to identify and accommodate diverse learning styles. Notably, learning management systems (LMSs) and intelligent educational software now leverage adaptive algorithms to discern patterns in student learning behaviours and preferences (Brusilovsky, 2001). These systems analyse vast volumes of student performance data, providing valuable insights into individual learning styles (Baker & Yacef, 2009).

Artificial intelligence (AI) and machine learning enable real-time

personalization. By adapting learning materials based on student interactions, AI enhances instructional effectiveness (Xie et al., 2019). Interactive software, such as simulations and educational games, serve as versatile platforms that simultaneously support multiple learning styles. These interactive tools dynamically recognize and adapt to learners' preferred strategies, fostering engagement and comprehension (Plass et al., 2013).

Upon identifying students' learning styles, curricular adaptations and personalized teaching strategies become imperative to align with their preferred cognitive processing methods. This alignment enhances student engagement and positively impacts academic achievement. Tomlinson (2001) introduced the concept of differentiation in education, which entails tailoring learning experiences by adjusting content, instructional processes, and learning products to match students' individual interests, readiness levels, and learning profiles.

In catering to students with visual learning preferences, educators can employ instructional strategies such as graphic organizers, visual aids, and concept maps (Gilakjani, 2012). Additionally, the integration of technology, such as interactive whiteboards, enables dynamic visual presentations. For auditory learners, fostering discussions, utilizing podcasts, and incorporating musical elements within lessons can effectively reinforce key concepts. Kinesthetic learners, on the other hand, benefit from active engagement through role-playing, hands-on experiments, and physical models. Finally, reading/writing learners can enhance their understanding through targeted note-taking techniques and text-based activities.

Gardner's Multiple Intelligences Theory (1983) argues for the need for curriculum activities that address diverse intelligences, reinforcing the call for multiple teaching strategies. Assessment plays a significant role in curricular adjustments. Assessment practices play a pivotal role in curricular adaptations. Formative assessments enable educators to collect data on students' preferences and strengths (Pashler et al., 2008). Furthermore, summative assessments should be differentiated to account for the varied competencies and learning modalities prevalent within a classroom.

Collaboration between educators is essential in developing a flexible curriculum responsive to learner diversity. Professional learning communities can help share strategies and experiences, supporting different learning styles (DuFour, 2004).

Adapted learning environments are essential in addressing the diverse needs of students and enhancing academic performance (Pashler et al., 2008). Their assessment involves analysing student learning outcomes, soliciting direct feedback from students, and considering evaluations by peers or other educators (Kolb, 1984). Longitudinal studies provide a

comprehensive perspective, shedding light on the enduring impact of these environments (Dweck, 2007). The integration of both quantitative and qualitative data is crucial for comprehending the efficacy of adapted learning environments and informing ongoing adjustments to educational strategies (Brusilovsky, P. & Peylo, C., 2001).

The process of tailoring educational content to accommodate students' diverse learning styles involves acknowledging variations in individual learning preferences and deploying personalized teaching approaches that foster comprehensive and effective learning. By engaging in ongoing self-reflection, rigorous assessment practices, and collaborative efforts, educators can establish an academic environment where each student is afforded the opportunity to thrive.

### ***3.2. The correlation between learning style identification and improving the quality of learning outcomes***

Learning styles refer to individuals' preferred cognitive processes for acquiring information within an educational context. Four prominent models for classifying learning styles have been examined: VARK, Kolb, Gardner, and Felder-Silverman. Neil Fleming's VARK model categorizes learners based on their preferences for visual, auditory, reading/writing, or kinesthetic modes of learning (Kendra C., 2023).

Conversely, Kolb's inventory of learning styles delineates an approach to learning encompassing concrete experience, reflective observation, abstract conceptualization and active experimentation, identifying four distinct learning styles (Kolb & Kolb, 2005).

Gardner's (1983) theory of multiple intelligences postulates the existence of eight distinct forms of intelligence, offering a comprehensive framework for understanding differentiated learning (Gardner, 1983). By acknowledging these varied intelligences, educators can tailor instruction to align with the individual strengths of each learner.

The Felder-Silverman Learning Style Model (FSLSM) (1988) outlines a multidimensional approach to understanding learning preferences. It identifies learner preferences on four scales: active/reflective, sensory/intuitive, visual/verbal and sequential/global (Felder & Silverman, 1988). For instance, an active learner may thrive in collaborative group settings, while a reflective learner may excel when working independently. This model emphasizes that learners may exhibit traits along a continuum, rather than being rigidly confined to specific categories (Wanniarachchi, W. & Premadasa, H., 2024).

Beaudry and Klavas (1989) conducted a review of studies that demonstrated a positive relationship between tailoring teaching methods to students' learning styles and academic outcomes. Specifically, when instruction aligns with learners' preferred styles, students tend to achieve higher test scores and develop more positive attitudes toward learning.

Similarly, Dunn and Dunn (1978) advocate for an individualized approach to instruction based on students' learning preferences, emphasizing its potential to enhance academic achievement and maximize student success.

Empirical evidence substantiates this assertion, as depicted in figure 1, which captures teachers' responses to the question, "After applying these methods, have you noticed a change in student performance?". When queried about the impact of implementing tailored teaching methods, 71.4% of teachers reported observing enhanced student performance.

Katz (1990) contends that aligning instructional content and methods with students' preferred learning styles can enhance comprehension and information retention. This principle is grounded in the recognition that learners possess dominant or preferred styles, and tailoring instruction accordingly can positively influence learning outcomes (Fleming & Mills, 1992). Our survey results further corroborate this theory: 67.9% of teachers reported when asked the question, "During lectures, do you notice that some pupils/students prefer to receive auditory explanations while others are more receptive to visual information?" that some students favour auditory explanations, while 17.9% indicated a preference for visual information (Figure 2). Consequently, understanding and accommodating students' learning preferences significantly impact the educational process and academic achievement. Figure 3, which investigates the presence of dominant learning styles within a group of pupils or students, reveals that 71.4% of the teachers observed the existence of such styles, including auditory or visual preferences. This finding implies that discernible patterns in learning preferences emerge within specific student cohorts, offering valuable insights for tailoring instruction to individual needs (Sandu, 2023). The integration of learning style assessments can enhance the effectiveness of instructional design by aligning it more precisely with students' unique requirements. Consequently, understanding and applying these trends in teaching underscore the pivotal role of educators who adeptly identify and respond to students' learning styles, thereby fostering a more efficient and personalized educational experience (Mona B., H. & Costache, C., 2023).

Tokuhama-Espinosa (2010) argues that a comprehensive understanding of the neurological underpinnings of the learning process, coupled with an appreciation for students' unique cognitive profiles, can inform the development of personalized and effective teaching strategies. Analysing the questionnaire results pertaining to the query, "If you have identified your dominant learning style (VARK), have you constructed your teaching strategies in accordance with these styles?" (Figure 4), reveals that 53.6% of teachers indeed align their instructional approaches with identified learning styles. This finding suggests that

these teachers are aware of the intricate relationship between learning style and teaching methodology, emphasizing its significance in achieving high-quality academic results.

Gardner (1983) extended the conventional notion of intelligence by identifying eight distinct forms of intelligence, necessitating adaptive teaching strategies tailored to individual students. This proposition finds empirical support in the results of the questionnaire, specifically in response to the query: “Have you noticed that some pupils/students perform better when given clear and well-organized tasks?” As depicted in figure 5, a substantial 82.1% of pupils/students affirmed that they indeed perform better under such conditions. The clarity of instructional tasks assumes paramount importance in contemporary teaching approaches and assessments, enabling students to augment formal learning experiences through structured and purposeful tasks, ultimately contributing to enduring learning outcomes (Angelo, T. & Cross, K., P., 1993, p. 131).

Facilitating long-term learning necessitates a profound understanding of students’ motivations and the adaptation of teaching practices to align with their individual needs and preferences (Urduan & Maehr, 1995). Analysing responses to the query, “Do you use appropriate methods to address students' different learning styles?”

” (Figure 6), reveals that 57.1% of teachers utilize such methods. This finding aligns with Claxton and Murrell’s (1987) assertion that recognizing multiple intelligences and incorporating them into lesson planning enhances engagement and learning outcomes. Consequently, customizing teaching approaches to accommodate predominant learning styles within the classroom, while also considering other modalities, emerges as a crucial strategy for fostering learning experiences in the long term (Mulhayatiah, D., et al., 2024).

An examination of responses to the question, “Do you consider that the use of teaching methods appropriate to the dominant learning style in the classroom contributes positively to student performance?” (Figure 7), reveals that a significant majority of teachers (75.0%) endorse this proposition. This consensus aligns with prevailing academic understanding, emphasizing that adapting instructional approaches to match prevailing learning styles positively influences academic outcomes. This trend underscores the growing emphasis on individualization and adaptive learning within education. Furthermore, it is plausible that this consensus arises from teachers’ firsthand experiences in the classroom, where they directly observe students’ responses to diverse teaching methodologies (Cojocar, 2022). Therefore, this finding underlines the contemporary shift toward personalized and effective educational approaches in modern education (Anca, 2022).



Pashler et al. (2008) argue the importance of exercising caution when applying learning style assessments in educational contexts, despite the substantial body of research supporting their use. The lack of conclusive evidence necessitates a critical and balanced approach to integrating these assessments into the educational process. Analysing the results from figure 8, which captures responses to the query, “Have you identified specific learning styles associated with higher academic performance?” reveals that 53.6% of teachers recognize a clear link between learning style and improved academic outcomes. Additionally, 25.0% of respondents occasionally identify such associations. However, the variability in teachers’ perceptions and experiences underscores the need for rigorous analysis, as advocated by Pashler et al. (2008). Consequently, continued and comprehensive research is essential to validate the efficacy of assessing and adapting learning styles across diverse educational context.

In figure 9, which captures teachers’ responses to the question, “Have you identified specific learning strategies that pupils/students use on a regular basis?” we explore whether educators have observed students employing particular learning strategies consistently. The results reveal that 53.6% of teachers indicated that learners indeed utilize such strategies, while 21.4% reported occasional usage, and another 21.4% noted sporadic implementation. This outcome suggests heightened awareness and active application of diverse learning strategies, indicative of a responsive approach tailored to students’ learning needs and preferences. Notably, these observations underscore the integration of learning strategies by students, reflecting an understanding of the necessity to adapt instructional methods for optimal academic performance. These findings emphasize the importance of fostering a flexible learning environment that accommodates the diversity of learners’ styles and strategies (Jonker, H., et al., 2020).

The detailed analysis of figures 2, 8, and 9 underlines the importance of comprehending and acknowledging the diversity of learning styles within educational settings. These figures provide a clear insight into how pupils and students adeptly tailor their learning strategies to align with their individual preferences. These results serve as valuable guidelines for enhancing the personalization of the learning process, taking into account the unique requirements of each student.

The correlation between the findings presented becomes evident when examining pupils’ and students’ inclinations toward practical learning methods. figure 10 represents a specific question related to the teacher's opportunity to identify how pupils and students prefer to engage with course content, emphasizing the significance of practical knowledge application. The results indicate that a substantial proportion—67.9%—of teachers have observed that pupils and students favour consolidating

their understanding through hands-on exercises and laboratory experiences (Sri Nopia, S., Juanda, A., Gloria, R., Y., 2022).

This correlation emphasizes the consistent alignment between students' learning preferences and behaviours. The information derived from this data can inform educators in adapting and diversifying teaching methods (Melissa, S., et al., 2017) to more effectively address the unique needs and preferences of individual students. By leveraging this knowledge, educators can create a personalized and efficient learning environment (Beth A. R., et al., 2015), ultimately enhancing student engagement and academic performance.

Consequently, the hypothesis that teachers' identification of learning styles can enhance learners' academic outcomes finds support in both empirical data and existing literature. This assertion gains further validation from the consensus among educators that aligning teaching methods with predominant learning styles within the classroom positively impacts student performance. Moreover, a substantial proportion of teachers actively employ appropriate strategies to accommodate diverse learning styles.

The detailed analysis of pupils' and students' learning preferences and behaviours, along with their integration into the educational process by teachers, underscores the critical importance of recognizing and adapting to the multifaceted spectrum of learning styles within the educational environment. These findings advocate for a personalized approach to learning—one that holds the potential to elevate academic achievement and foster heightened student engagement in learning activities. It is therefore essential that education must continue to champion practices that embrace diversity and adaptability in teaching and learning methodologies.

#### **4. Conclusions**

Based on the findings from data analysis and a review of relevant literature, the significance of acknowledging and accommodating individual student preferences within the educational context becomes evident. This assertion gains further validation from the substantial percentage of teachers—75.0%—who recognize that aligning teaching methods with predominant learning styles in the classroom positively impacts student performance. This alignment resonates with Gardner's theory of multiple intelligences and underscores the imperative of comprehending the diverse array of learning styles in both teaching and learning.

The data also reveal that a significant proportion of teachers employ appropriate methods to address students' diverse learning styles, underscoring the importance of customizing instruction to individual student needs. This finding aligns with the 57.1% of teachers who adapt

their methods to accommodate pupils' varying learning styles. Furthermore, robust evidence supports the notion that adjusting teaching methods to align with students' learning styles enhances comprehension and information retention. Notably, students overwhelmingly favour auditory explanations. This alignment with established theories, such as Katz's work and Gardner's theory of multiple intelligences, reinforces the hypothesis that teachers' identification of learning styles can positively impact learners' academic outcomes. Thus, the hypothesis that the identification of learning styles by teachers can improve learners' academic outcomes is supported by both the data analysed and the literature. These findings emphasize the importance of tailoring the learning process to individual learners' needs to improve their academic performance and engagement in learning activities.

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Table 1. Questionnaire reliability coefficient

| Statistical reliability scale |                     |
|-------------------------------|---------------------|
|                               | Cronbach's $\alpha$ |
| scale                         | 0.827               |

Tabel 2. Questionnaire - Personalized approaches in education

Welcome to the questionnaire on "Exploring learning styles to achieve academic performance"!

The purpose of this questionnaire is to explore the relationship between teaching strategies and learners' learning styles in order to improve their academic performance, with a focus on your understanding and perceptions of the questionnaire topic.

Please be assured that all responses are anonymous and confidential, and we suggest you answer the questions honestly. It is important for us to understand your perspectives and beliefs as they will help to improve the learning process.

|                      |
|----------------------|
| <b>Personal data</b> |
| Initial name         |

| Nr. | Question  | Yes | No | Frequently | Occasionally | Rarely | Never |
|-----|---|-----|----|------------|--------------|--------|-------|
| 1.  | During lectures, do you notice that some pupils/students prefer auditory explanations, while others are more receptive to visual information.               |     |    |            |              |        |       |
| 2.  | Have you noticed that some pupils/students perform better when given clear and well-organized tasks?  |     |    |            |              |        |       |
| 3.  | Have you identified specific learning strategies that pupils/students use regularly?  |     |    |            |              |        |       |
| 4.  | During your courses, have you noticed that some pupils/students prefer to learn through practical application (exercises, laboratories)?                    |     |    |            |              |        |       |
| 5.  | Have you identified specific learning styles that are associated with higher academic performance?  |     |    |            |              |        |       |
| 6.  | Have you noticed categories of dominant learning styles in your group, such as auditory or visual?  |     |    |            |              |        |       |
| 7.  | Do you use appropriate methods to address students' different learning styles?  |     |    |            |              |        |       |
| 8.  | If you have identified your dominant learning style (VARK), have you built your teaching strategies according to these styles?                              |     |    |            |              |        |       |
| 9.  | Do you consider that the use of teaching methods appropriate to the dominant learning style in the classroom contributes positively to student performance? |     |    |            |              |        |       |
| 10. | After applying these methods, have you noticed a change in student performance?   |     |    |            |              |        |       |

Teaching methods play an important role in student achievement. Teachers should be flexible, understand students' preferences and learning styles and adapt strategies to maximize learning success.

|                                       |         |           |            |            |
|---------------------------------------|---------|-----------|------------|------------|
| What level of education do you teach? | Primary | Secondary | Highschool | University |
|---------------------------------------|---------|-----------|------------|------------|

Please be honest in choosing the answer that best represents you. Select only one answer for each question. Your answers will be used to analyse educational hypotheses and will be treated confidentially. Thank you!

Figure 1. Change in student performance after applying the methods

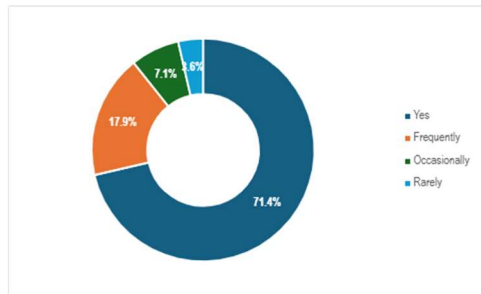


Figure 2. Learning preferences

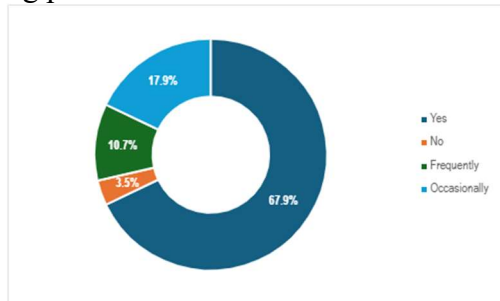


Figure 3. Dominant learning styles

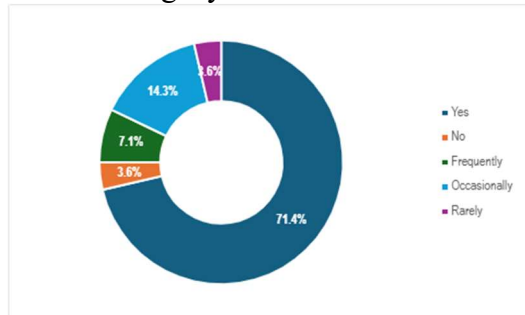


Figure 4. Teaching strategies according to learning styles

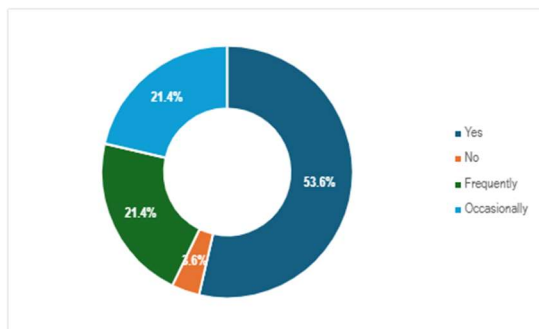


Figure 5. Clear and organized tasks



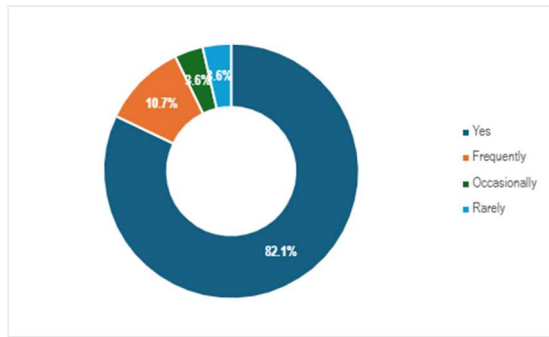


Figure 6. Suitable methods for different learning styles

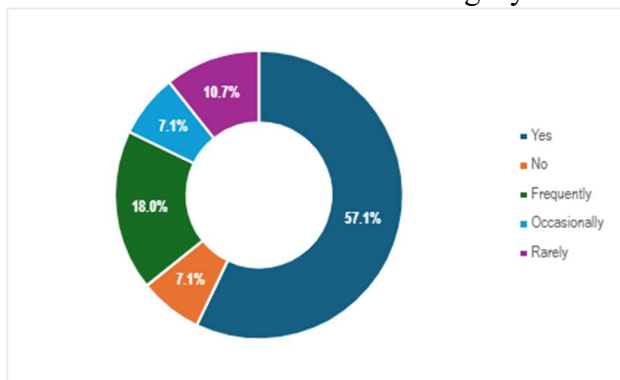


Figure 7. Impact of using appropriate methods

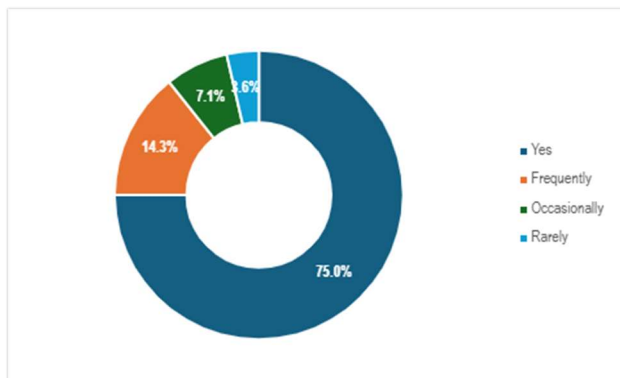


Figure 8. Learning styles associated with higher academic performance

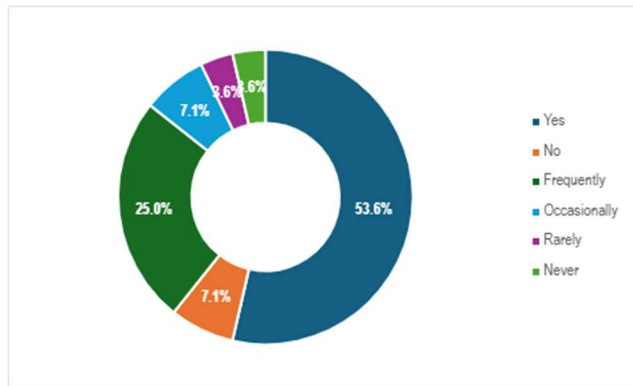


Figure 9. Learning strategies

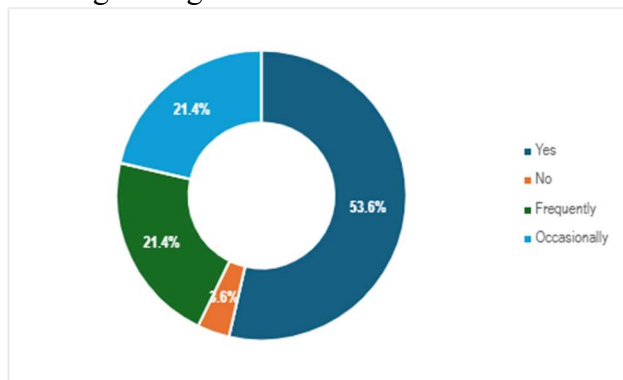
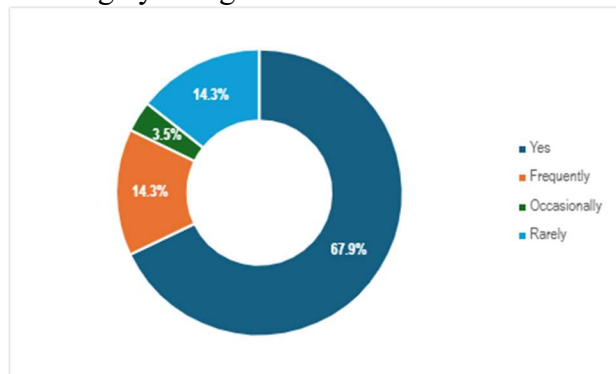


Figure 10. Learning by doing



## DIGITAL PLATFORMS AND APPLICATIONS USED IN ROMANIAN LANGUAGE AND LITERATURE CLASSES AT THE HIGH SCHOOL LEVEL

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**Abstract:** *It is well known that there is a continuous relationship of interdependence and reciprocity between education and digital technologies, as technological progress is driven by the evolution of education, while education utilizes these technological developments. Technology supports the education system by facilitating the teaching process. In this age of information and digitalization, we are witnessing significant transformations in how people interact with each other and with various institutions. Adapting to this new paradigm of remote interaction has become essential, especially in the educational context, where the teaching-learning process has undergone remarkable changes. Both students and teachers have faced considerable challenges in adapting to these rapid changes. In this context, the emphasis on lifelong learning has been reaffirmed by the support given to teachers by various entities that have developed training programs tailored to their needs, providing practical examples and suggestions, as well as interactive courses designed to stimulate student participation and interest in knowledge.*

**Keywords:** *new technologies; education; Romanian language and literature.*

### **The Impact of New Technologies in Pre-University Education**

The use of digital technologies in classrooms leads to a revitalization of traditional methodologies, bringing a modern and innovative aspect to education. The relationship between education and technology is becoming increasingly dynamic, as technology evolves day by day, requiring constant adaptation from those interacting with it. Simultaneously, this constitutes a necessity for the optimal functioning

of the educational system, keeping pace with current developments. The adoption of technologies in the teaching-learning process contributes to enhancing the quality of education, offering students multiple learning opportunities and fostering their growth. Additionally, limited access to information disappears, with resources becoming available to everyone, anytime, and in diverse and abundant forms. Teachers can utilize digital information and resources through new, engaging methods that captivate students and make them more involved in the educational process.

For teachers, there are numerous advantages as well. In addition to making lessons more interactive and attractive, digital resources offer ease of use and reduce workload time—for example, through digitalized assessment. To fully leverage the benefits of digital assessment, it is important for teachers to use technology creatively and strategically. For instance, they can use e-learning platforms to create interactive and challenging activities that encourage collaboration and critical thinking. Additionally, they can use online assessment tools to monitor students' progress and identify any gaps in understanding the material. The evolution of these tools and digital platforms is a consequence of their frequent use and demand from users, aimed at improving quality and continuous optimization.

Considering the use of these technologies in education, teachers need to possess a set of skills and knowledge for their correct implementation and use. "In other words, it is necessary to develop a certain level of computer literacy, understood not only as specialized knowledge and skills but also as a new orientation and approach to reality. Teachers must be able to identify both pedagogical situations and appropriate IT solutions with beneficial effects on education and training" (Nan, 2021, p. 164). The possibilities for presenting information in computer-assisted instruction are much more numerous compared to traditional teaching.

Ana Maria Marhan states in her work *The Psychology of Using New Technologies* that "Due to new technologies, our working environment is changing, and as a result, the skills we need to navigate through a highly information-saturated environment are also changing. However, what makes us intelligent—the ability to learn, think, adapt, and grow in the context in which we live—will never fundamentally change. On the other hand, information technology, from personal computers to mobile devices and the Internet, radically changes the way we understand the concept of intelligence necessary to function in the modern world" (Marhan, 2007, p. 6).

### **Applications Used in the Teaching Process**

It is well known that there are a multitude of interactive applications and platforms that can be used in the instructional-educational process to

improve learning outcomes, increase student engagement, and enhance information accessibility. The variety of these tools is a major benefit for the teaching process, facilitating learning. In addition to the significant advantages of using these applications, there are some limitations, the most common being the high cost of some of them. Unfortunately, many applications are only accessible after making a payment. Depending on the stage of the lesson, various applications and digital tools can be used. Below, we will illustrate some of them, categorized according to their role in the teaching process.

### **In the Online Environment**

The end of 2019 brought an atypical situation that affected several fields, including the education system. The outbreak of the pandemic caused by the Sars-Cov2 virus forced the world to adapt to limited social interaction. The teaching activity had to be reimagined, becoming a constant challenge. The key players in education faced various scenarios during this time, from online to in-person or hybrid formats, each with different particularities. "If online and 'traditional' teaching are the two extreme situations in terms of the learning relationship, the difficulty in hybrid teaching arises precisely from the need to harmonize these two scenarios. Hybrid teaching is a mix of the two approaches, aiming to maximize the benefits of each or at least minimize the disadvantages of both scenarios" (Andron, Kifon, 2021, p. 151).

The effort made by teachers to adapt to this situation brought numerous benefits to post-pandemic teaching, as many developed new skills in using computers and digital resources in their lessons. Many of the applications that can be used online are also useful in physical classroom teaching.

**LearningApps** is an educational app designed to support the learning and teaching process through interactive activities. "The app is easy to use and provides a variety of exercise types that teachers can use at any stage of the lesson, adapt, or create from scratch" (Andron, Kifon, 2021, p. 153).

Advantages include the creation of interactive and innovative resources for any part of the lesson. A notable limitation is the lack of a tool to track student progress during tasks, and the inability to filter resources, as anyone can create materials, making them public. Teachers need to be cautious when selecting them.

**Wordwall** allows "the creation of interactive educational games in digital format, which can be embedded into other learning platforms or shared via link and PDF resources related to the created games"(Andron, Kifon, 2021, p. 156).

Advantages include creating interactive resources accessible to any age

group. The major disadvantage is that the app limits the creation of materials to five free resources, with additional ones being paid.

### **At the Beginning of the Teaching Activity**

Regardless of the format of the class, whether physical or online, the beginning of a lesson involves capturing students' attention and introducing them to the topic of study. The methods used must be as engaging as possible, a principle that also applies to applications. There is no general rule for classifying digital applications based on the stage of the lesson, as some can be used in multiple phases. For example, the **Mentimeter** app can be used at the beginning of a lesson to introduce the topic for study, as this app energizes the presentation and sparks students' interest in the subject. "The Mentimeter app is widely used and allows for the creation of interactive presentations, interactive quizzes, competitions between students, and opinion polls. No account is needed, and it can be used with a Gmail account" (Andron, Kifon, 2021, p. 76). Another app that can be used in the teaching process is **Plickers**. This interactive tool allows for the creation of questions to which students can respond. It is easy to access, with a user-friendly interface. The teacher creates a virtual class and adds students to it. Each student receives a personalized card that they use to provide answers to questions projected by the teacher. After the teacher creates the questions, they project them using an interactive board. Students respond by raising their cards, with each position of the card representing a different answer. The teacher scans the answers to interpret the results, which are automatically recorded in the app, giving students a clear view of their scores.

Most games created in apps like **LearningApps**, **Wordwall**, and **Kahoot** can be used to capture students' attention. Additionally, videos accessed from **YouTube** or created using tools like **Loom**, **Screencast**, **Animaker**, **Clipchamp**, **Stupeflix Studio**, **Kizoa**, or **Renderforest** are digital resources that can help spark student interest in the topic being discussed in the lesson.

The most extensive part of a lesson is the actual teaching process. Numerous applications and digital platforms can be used during this stage, which must be adapted to the specific class and content being delivered. The range of applications is varied, and the choice of which to use depends on the objectives and competencies the teacher sets. A major disadvantage is that many of these applications involve a cost or limit the number of free resources available.

**StoryJumper** is a useful app that can be used during the teaching process. It allows for the creation of virtual books, which help develop linguistic and digital skills. "The app gives students the opportunity to write, create, and publish their own texts, drawings, insert audio/video

materials, and add photos from the internet or ones they took themselves" (Bauer, 2021, p. 2).

**GoConqr** is an app that allows the creation of concept maps, which highlight the logical connections between events, concepts, or ideas. "Concept maps allow for the logical organization of the teaching material, schematization, and systematization of concepts and their interrelations, either dynamically (if used during a presentation as the lecture unfolds) or as an overview of the taught content, clearly highlighting all correlations" (Andron, Kifon, 2021, p. 71).

**Liveworksheets** allows traditional worksheets to be transformed into interactive online exercises, offering immediate feedback on the exercises. These can be completed in class, replacing traditional worksheets, saving time, and being more environmentally friendly by reducing paper use. Sounds and videos can be included in these worksheets. The types of questions in the worksheets are varied, including objective, semi-objective, and subjective categories.

Presentations created using **Prezi**, **Google Slides**, or **PowerPoint** can serve as teaching materials. The information covered in the lesson can be synthesized into interactive presentations using these applications. Animations, transitions, and attractive designs can be incorporated to capture students' attention and stimulate their interest in engaging with the lesson.

### **For Feedback**

Evaluation is an important part of the teaching process and can take many forms, utilizing various tools and techniques. Evaluation not only aims to assess the level and quality of knowledge acquired but also focuses on formative aspects such as the skills and competencies being developed, which are equally or even more important than knowledge accumulation. "Continuous assessment involves checking after each teaching step how well the delivered knowledge was understood and assimilated, and the ability to apply this knowledge. Evaluation should identify not only the level of knowledge or quality of understanding but also the capacity to apply, analyze, synthesize, and evaluate" (Andron, Kifon, 2021, p. 103). Therefore, continuous assessment should provide as clear feedback as possible. Many of the methods, techniques, and applications used for teaching, such as **Mentimeter**, **LearningApps**, or **Wordwall**, can also be used for evaluation. Additionally, digital apps can be used to track student progress.

The **AnswerGarden** app can be used "to stimulate and identify real-time participation and engagement. It is useful for online brainstorming sessions, providing rapid feedback as mentioned earlier" (Andron,

Kifon, 2021, p. 103). The app offers several work modes: Brainstorming Mode, Moderator Mode, and Classroom Mode, each with different features. Responses can be limited or unlimited, and answers can be pre-approved by the creator. There are also control options based on a password. The final product allows the visualization of responses as a word cloud, based on their frequency.

**Quizizz** is "a free learning and assessment tool that any teacher can integrate into the teaching-evaluation system. The student progresses through the material either in the form of flashcards for learning or knowledge consolidation, or interactive quizzes, all at their own pace" (Andron, Kifon, 2021, p. 105). The advantages of using this app include: the integration of exercises from other apps, easy access to the platform, the ability to generate detailed reports on student progress, storing exercises in a public library accessible to teachers, editing existing resources to suit students' needs, and personalizing the feedback students receive after answering each question.

**Google Forms** is a tool for collecting and verifying student responses. The questions created in this app can serve as a way to record answers as well as evaluate them, as a certain score can be allocated to each question. Major advantages of this app include the ability to create various types of questions: objective, semi-objective, and subjective, with short answers. Additional advantages include unlimited forms, free access, quick feedback, the storage of responses, and the ability to interpret results as downloadable statistics.

**Kahoot** "can be used for reviewing and reinforcing previously learned knowledge as well as in evaluation, especially formative evaluation" (Andron, Kifon, 2021, p. 122). The app's user-friendly interface makes students perceive the test as a game, reducing the stress associated with assessment. A drawback of the app is the limitation to short answers in the free version. However, there are numerous resources with tests that can be adapted to meet the needs of students. These include the **Discover** page. The tests in this app are well categorized for efficient searching. The **Reports** page provides clear insights into the lesson with prompt feedback recorded.

The mini-research was conducted at the high school level, involving a sample of 150 subjects aged between 15 and 18 years. The initial hypothesis was that if multimedia technologies are used by the teacher during Romanian language and literature classes, students will better understand the concepts related to this subject. Several research tools were used in the experiment, including the survey method (questionnaire tool), the written test method (test tool), and the interview method.



### **Methodology**

The experiment was carried out over fourteen teaching activities. I selected four to five activities for each experimental class, during which I used digital tools, followed by a common activity involving all students from the classes included in the experiment. For the 9th-grade students, the experimental activity began with the thematic unit "Play and Games." I presented several contents from this unit, using multimedia technologies in their study. The first content was "Everyday Conversation," where students developed skills related to the correct and appropriate use of oral and written expression in various communication situations. These skills were formed with the help of digital tools. During this activity, I used games created in the LearningApps application, and the use of the Smartboard, which facilitated the application of digital technologies, proved to be particularly beneficial in conducting these interactive games. In this phase, digital applications were used both during the teaching activity and at its conclusion.

A second content studied within this unit, where multimedia tools were used, was the "Argumentative Text." In the introductory phase, I used a game created in the Wordwall application to review concepts regarding the structure of the argumentative text. The game contained paragraphs related to the structure of this type of text, and students were tasked with associating them with specific terms. Additionally, at the end of the activity, to collect feedback, I used a questionnaire created with Google Forms. Students appreciated this method of expressing their opinions about the activity, and the data was collected instantly, making it easier for the teacher.

In the unit "Love," I chose to use multimedia technologies for three different contents. The first was "Correspondence," where I aimed to develop the skill of analyzing the structural and expressive components of the literary texts studied and discussing their role in addressing themes. At the end of the activity, students were given a game created with the Mentimeter app, in which they synthesized key aspects of the lesson's content.

Another content covered in this unit was William Shakespeare's *Romeo and Juliet*. After noticing that the concepts were not being adequately understood by the students, I chose to integrate digital tools into their study. To capture their attention, I used a game in Wordwall. The students were eager to participate, finding the game very interactive. In the comprehension phase, I used an animated video to extract essential ideas, which were then associated with the text of the play. To enhance their understanding, I created a comic strip using the Storyboard application. This proved effective, as students gained a better grasp of the text and the play's subject matter, presented in a simpler, more engaging manner. The final content studied with the 9th-grade students

was Mihai Eminescu's lyric poem "Desire." In this lesson, I used various games created in LearningApps to help students identify the poem's theme, emotions, figures of speech, and prosody elements. Additionally, I replaced traditional worksheets with interactive digital ones, created using the Liveworksheets app.

For the 10th-grade students, I selected four contents where various digital applications were employed. In studying the fairy tale *The Story of Harap-Alb* by Ion Creangă, I used the Tool Animaker application to edit a video that highlighted a specific part of the studied tale. I also focused on diverse methods of understanding and interpreting the studied literary texts, and students created a mind map using the GoConqr application. The activity concluded with a game created in Kahoot.

For the study of Ioan Slavici's psychological novella *The Lucky Mill*, students created a Google Slides presentation summarizing key elements of interpreting the novella: identifying the narrative theme, temporal and spatial coordinates, and the conflict. The students worked in teams, showed great interest in the activity, and, most importantly, consolidated important notions about the structure of the novella.

The same students conducted an interview for the content titled *The Interview*, using various digital tools. Most of them recorded themselves using mobile phones, demonstrating that these devices can be useful for learning when used with an educational purpose. The last content where I applied games made with the Kahoot application and collected feedback using Google Forms questionnaires was I.L. Caragiale's *A Lost Letter*. Students demonstrated a better understanding of the subject matter of the dramatic text.

The 11th-grade students used various digital tools to study literary movements. For the topic *The Origin and Evolution of the Romanian Language*, they engaged in several interactive games. While studying specific words, they used online resources to learn how to explain the meanings of certain Latin phrases, classify terms based on their origin, and more.

For the study of Romanticism and Mihai Eminescu's *The Evening Star*, I used a video created in LearningApps, which included an animation based on Eminescu's text. The students were captivated by the video, as it illustrated all the key moments from each section of the poem, making it easier for them to understand the subject and identify the various personas of the lyrical self.

Symbolism was approached interactively through lessons created in Livresq. Additionally, the students created a website using Google Sites, highlighting key notions about this literary movement. In the study of Realism, lessons were created in Livresq, and the StoryJumper application was used to create stories reflecting the characteristics of the

interwar period.

The final activity, presented within the school's reading club, was a collaborative effort where students actively engaged, encouraged by the use of digital technologies.

The premise of the mini-research—that the use of digital tools and technologies in the educational process is a necessity—was confirmed throughout the conducted activities.

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## **IMPACT OF TEACHERS' MOTIVATIONAL STRATEGIES ON PERFORMANCE OF SECONDARY SCHOOL TEACHERS IN OSUN STATE, NIGERIA**

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**Abstract:** *This study investigated the impact of staff motivation on academic performance of secondary school students in Osun State. Two research questions and two research hypotheses were generated for the study. Sample of twenty (20) principals and two hundred (200) secondary school teachers was the respondents used. Structured questionnaire which has two (2) sections was duly validated and reliability value was 0.75. Same data collected through the research Instruments were analysed using frequency counts, descriptive statistics and T-test statistics. It was revealed that, there is influence of staff motivation on academic performance of secondary school students in Osun state: Teachers' rated all the motivational strategies used by the principals as good, they rated all the indices of staff performance as good, there was a significant difference in the motivational strategies used by the principals in secondary schools based on school types, there was a significant difference in the indices that aid staff performance in secondary schools based on school types. Major recommendations were enumerated as: Principal should recognize work done well by teachers to boost their ego to enhance their work performance; teachers should be highly praised and commended for maximum performance; ministry of education should make it a policy to provide all public secondary schools in the study area with necessary facilities to facilitate effective teaching and learning in schools; research should also be done on the head teachers' motivation of students, non-teaching and subordinate staff.*

**Key words:** *Teacher; Teacher Motivational Strategies; Academic Performance; Secondary Schools Student.*

**Background to the Study**

Some of the country's leading educational institutions have recently established teaching excellence centres fusing on supporting and improving learning materials to produce optimal teaching strategies and processes. Quality education is becoming a more critical concern in the educational world in recent years. Motivation is a person's desire to engage in an activity. A school with good motivation strategies can ensure harmony, prosperity, and increased student enrolment. Correspondingly, the teacher's positive behaviour related to teaching increases their level of understanding and interest, eventually improving their job performance (Kumari & Kumar, 2023).

Obviously, despite the leading roles teachers play in the classroom towards attaining educational objectives, their motivation has remained a very serious problem in Nigeria. Ndu (1998) opined that teachers' motivation has been very low, that the situation of teachers in the school system was so bad that it had reached "an intolerable low point". As a result, the societal image of a teacher has made the "noble" profession unattractive as being inadequate for meeting economic, social and psychological needs. Under this condition, teachers' welfare needs are hardly considered by different stakeholders in Nigerian educational system. But, rather every parent wants his children to acquire knowledge and skills, good morals and value without giving serious thought to how these would be transmitted without the teachers and more importantly, how teachers would perform without being motivated.

Among reasons for teacher low performance, Okoro (1998) observed that in spite of the roles teachers play in the education system, teachers were neglected in terms of support and welfare. Teachers were isolated from all other work force in terms of recognition, respect or recommendation for political post and welfare packages. So, when teachers are not treated fairly, they may not motivate the students to learn in order to improve the quality of our secondary students' performance. Teachers are most valuable resource available to secondary schools, hence, it is imperative that the government should device the best strategies to motivate them for the betterment and continued improvement for performance (Lyimo & Temba, 2022). In many instances some government secondary schools have experienced poor performance of students and a rapid turnover of their employees because of lack of motivation. Teachers can influence the teaching-learning outcome either positively or negatively because they determine the quality of instructional delivery and also influence quality education when it comes to implementation of the curriculum and educational policies (Onucha, 2020).

A well motivated teacher is crucial for a successful classroom. If

teachers in public secondary schools are well motivated, it is clear that they will look at teaching through a different lens, and, in doing so, motivate their students in their learning too. Motivation helps to energize, direct and sustain positive behaviour over a long period of time. It involves working the desire needed for students to want to learn more. Mustafa & Othman (2019) explain that teacher motivation is very important because it improves the skills and knowledge of teachers because it directly influences the students' achievement (Mahamood, 2019).

In government secondary schools, teachers can be motivated and their performance improved as a result of several factors which include the presence of accommodation, opportunity for career development, timely promotion and good remunerations according to the current market (Daneshkoham, 2019). Also, orientation to new teachers, skilled and supportive leadership, good relationship between the school and the community surrounding should be encouraged. The negative factors in teaching profession produce negative attitude towards the teaching profession and thus, make retention process to the teaching profession difficult (Ally, 2021).

The better performance of public secondary education system depends largely on motivation of teachers so that they may comfortably share the best experience in the classroom. When teachers are well motivated to work, the performance of students in government schools will be improved let alone the increased rate of enrolment. Teachers are required to be motivated so that they can increase efforts in the teaching process, hence better performance to their students (Mligo & Mshana, 2018).

The seriousness of the problem of lack of motivation for Nigerian teachers was supported by the result of a study of Ozigi (1992) who found out that the teachers were unhappy, frustrated, uninspired and unmotivated. He then concluded that the nation's educational system was doomed. Ukpong & Uchendu (2012) investigated motivational strategies and possible influence on secondary school teachers' teaching performance. The result revealed significant influence of motivational strategies on teachers' work performance and it was recommended that principals should recognize work done well by teachers to boost their ego to enhance their work performance; teachers should be highly praised and commended for maximum performance and ministry of education should make it a policy to provide all public secondary schools with necessary facilities to facilitate effective teaching and learning in school.

It is therefore important to note from the foregoing that when teachers are motivated, they will engage more enthusiastically in teaching-learning activities, it will increase their interest and they are likely to put more efforts even if not their best. This research therefore, seeks to

investigate the impact of teachers' motivational strategies on performance of secondary schools teachers in Osogbo and Atakumosa Local Government Areas of Osun State.

### **Statement of the Problems**

Motivation is a person's desire to engage in an activity. Motivation predicts performance and consequently determines students' academic performance as a poor process will definitely lead to poor result. A school with good motivational strategy can ensure harmony, prosperity and increase students' enrolment and performance. The teacher's positive behaviour related to teaching increases their level of understanding, interest and improves their job performance. This study therefore investigated the impact of teachers' motivational strategies on performance of secondary school teachers in Osogbo and Atakumosa Local Government Areas of Osun State.

### **Research Questions**

The following research questions were raised to guide this study:

1. Are there any impact of motivational strategies on teachers in secondary schools in Osogbo and Atakumosa Local Government Areas of Osun State?
2. What are the indices that aid performance among secondary school teachers in Osogbo and Atakumosa Local Government Areas of Osun State?

### **Research Hypotheses**

- HO<sub>1</sub> Is there any significant difference in the motivational strategies used by the principals in secondary schools based on school types?
- HO<sub>2</sub> Is there any difference in the indices that aid staff performance among secondary school teachers based on school types?

### **Method**

Descriptive survey research was adopted for this study because it involves collecting and analyzing data gathered from a sample considered to be representative of the population, and generalizing the findings. The population for this study comprised of principals and teachers in secondary schools in Osogbo and Atakumosa Local Government Areas of Osun State. The researchers employed simple random sampling technique to select twenty (20) Secondary Schools (Ten Public and Ten private) in Osogbo and Atakumosa Local Government Areas of Osun State. In each of the selected secondary schools, one principal and ten teachers were selected. In total two hundred and twenty (220) respondents were used for the Study. A validated self-developed questionnaire titled Impact of Motivational

Strategies on Teachers' Performance in Secondary Schools in Osogbo and Atakumosa Local Government Areas of Osun State was used to collect data. The questionnaire consisted of two sections. Section A comprises of 5 items addressing the demographic data of the respondents such as (gender, level and Age) while Section B comprises of 20 items. The questionnaire was structured along a four-point Likert rating scale of Strongly Agreed (SA) = 4 points, Agreed (A) = 3 points, Disagreed (D) = 2 points and Strongly Disagreed (SA) = 1 point. The questionnaire was validated by experts in Educational Management and Psychometrics. This is to determine the effectiveness and the appropriateness of the instrument at eliciting the right responses.

The instrument was subjected to test-retest method for a period of two weeks to ascertain its internal consistency. It was administered on twenty (20) respondents who were not part of the study sample after which the instrument was subjected to Pearson Product Moment Correlation (PPMC) analysis to establish the reliability of the instrument. Responses were statistically analysed using Cronbach Alpha. This gave a reliability index of 0.75 indicating that the instrument is reliable.

The researchers visited the selected schools to seek permission of the authorities of the schools for the consent of the respondents for the administration of the questionnaires. The questionnaire was administered by the researchers employing the help of two trained research assistants. The exercise lasted for a period of two weeks. The data collected was subjected to frequency counts, descriptive statistics and t-test statistical methods.

## Results

This section presents the frequency counts of the respondents' demographic variables. The analysis of data for each demographic variable is presented in the frequency distribution table.

Table 1: Gender distribution of respondents

| <b>Gender</b> | <b>Frequency</b> | <b>Percentage (%)</b> |
|---------------|------------------|-----------------------|
| Principal     | 21               | 9.8                   |
| Teacher       | 193              | 92.2                  |
| <b>Total</b>  | <b>214</b>       | <b>100</b>            |

Teachers and principal formed the research respondents. 90.2% of the respondents were teachers while 9.8% of them were principals.

Table 2: Qualification of respondents

| <b>Qualification</b> | <b>Frequency</b> | <b>Percentage (%)</b> |
|----------------------|------------------|-----------------------|
| N. C. E              | 40               | 18.7                  |
| B. Ed/B. Sc/B. Tech  | 151              | 70.6                  |
| M. Sc/M. Ed          | 23               | 10.7                  |
| <b>Total</b>         | <b>214</b>       | <b>100</b>            |



The table showed that 70.6% of the respondents had first degree certificates, 18.7% of them had NCE while 10.7% were masters degree holders.

Table 3: Teaching experience of respondents

| <b>Experience</b>     | <b>Frequency</b> |            |
|-----------------------|------------------|------------|
| <b>Percentage (%)</b> |                  |            |
| 0 – 5 years           | 16               | 7.5        |
| 6 – 10 years          | 66               | 30.8       |
| 11 – 15 years         | 69               | 32.2       |
| 16 and above          | 63               | 29.4       |
| <b>Total</b>          | <b>214</b>       | <b>100</b> |

The results in the table revealed that 29.4% of the respondents have been in service between 16 and their years of retirement. It further revealed that 32.2% of the respondents had been in the teaching profession between 11 and 15 years, 30.8% of the respondents had been in the profession between 6 and 10 years, followed by 16 years and above while the least of them (7.5%) had spent 5 and less years on the job.

**Research question 1:** Are there any impact of motivational strategies on teachers in secondary schools in Osogbo and Atakumosa Local Government areas of Osun State?

To answer this research question, teachers’ responses to items on motivational strategies or techniques used by heads of teachers in secondary school in Osun State were coded and subjected to descriptive statistics of mean. Decisions as to student factors that motivate teachers used by their heads in secondary schools in Osun State were based on the benchmark of 2.50. To achieve this, average of the numerical points for the response options were obtained as (4+3+2+1)/4. In which 4 stands for Strongly Agree, 3 stands for Agree, 2 stands for Disagree, and 1 for Strongly Disagree. Items with mean score of 2.50 and above were regarded as strong motivational strategies while items with mean score below 2.50 were regarded as weak motivational strategies. The results are presented in Table 4.4.

Table 4: Motivational strategies used by heads of teachers in secondary schools

| <b>Sn</b> | <b>I t e m s</b>                                 | <b>S D</b> | <b>D</b> | <b>A</b>  | <b>S A</b> | <b>Mean</b> |
|-----------|--|------------|----------|-----------|------------|-------------|
| 1         | The head motivate teachers to be more innovative | 2(0.9)     | -        | 31(14.5)  | 181(84.6)  | 3.83        |
| 2         | The head appreciate his teachers’ work openly    | 5(2.3)     | -        | 105(49.1) | 104(48.6)  | 3.44        |

|    |   |         |        |           |           |      |
|----|---|---------|--------|-----------|-----------|------|
| 3  | School head gives regular remuneration to teachers  | 10(4.7) | 2(0.9) | 73(34.1)  | 129(60.3) | 3.50 |
| 4  | The leader awards teachers with impressive titles   | 4(1.9)  | 9(4.2) | 97(45.3)  | 104(48.6) | 3.41 |
| 5  | The principal acknowledges the teacher's achievement  | 9(4.2)  | 4(1.9) | 70(32.7)  | 131(61.2) | 3.51 |
| 6  | Instructional facilities are provided to academic staff   | 13(6.1) | 2(0.9) | 101(47.2) | 98(45.8)  | 3.33 |
| 7  | The head involves his academic staff in decision making   | 12(5.8) | 1(0.5) | 88(41.1)  | 113(52.8) | 3.41 |
| 8  | The leader provides adequate chances for professional growth and research development/advancement | 12(5.6) | 2(0.9) | 101(47.2) | 99(46.3)  | 3.34 |
| 9  | The head establishes a good relationship with his/her teachers                                    | 11(5.1) | 1(0.5) | 103(48.1) | 99(46.3)  | 3.36 |
| 10 | Staff development programmes  | 21(9.8) | -      | 125(58.4) | 68(31.8)  | 3.12 |

The results revealed that the mean scores of the items ranged between 3.12 and 3.83. This implied that respondents rated all the motivational strategies been used by heads of teachers well because the mean scores were all above 2.50. However, items such as the head motivate teachers to be innovative had the highest mean score of 3.83, followed by acknowledgement of teachers' achievement with mean score of 3.51 and giving of regular remuneration to teachers with mean score of 3.50; while staff development programmes rated least among the motivational strategies used by heads of teachers in secondary schools.

**Research question 2:** What are the indices that aid performance among secondary school teachers in Osogbo and Atakumosa Local Government Areas of Osun State?

To answer this research question, students' responses to items on indices that aid staff performance in secondary schools in Osun State were coded and subjected to descriptive statistics of mean. Decisions as to indices that aid staff performance in Osun State were based on the benchmark of 2.50. To achieve this, average of the numerical points for the response options were obtained as  $(4+3+2+1)/4$ . In which 4 stands for Strongly Agree, 3 stands for Agree, 2 stands for Disagree, and 1 for Strongly Disagree. Items with mean score of 2.50 and above were regarded as strong indices that aid staff performance while items with mean score below 2.50 were regarded as weak indices that aid staff performance. The results are presented in Table 5.

Table 5: descriptive statistics of indices that aid staff performance

| S <sub>n</sub> | I t e m s | S D | D | A | S A | Mean |
|----------------|-----------|-----|---|---|-----|------|
|----------------|-----------|-----|---|---|-----|------|

|    |   |         |        |           |           |      |
|----|---|---------|--------|-----------|-----------|------|
| 11 | Encouragement for creativity and innovation by head leads to better performance                               | 3(1.4)  | -      | 54(25.2)  | 157(73.4) | 3.71 |
| 12 | Appreciation on genuine efforts motivate me to do even better   | 3(1.4)  | 1(0.5) | 134(62.6) | 76(35.5)  | 3.32 |
| 13 | The head provide regular payment of salary and other remuneration to enhance performance                      | 4(1.9)  | 5(2.3) | 57(26.6)  | 148(69.2) | 3.63 |
| 14 | Cooperation of the head enhances my performance   | 4(1.9)  | 1(0.5) | 131(61.2) | 78(36.4)  | 3.32 |
| 15 | Award with impressive title ensures the better performance of academic staff                                  | 11(5.1) | 3(1.4) | 68(31.8)  | 132(61.7) | 3.50 |
| 16 | Acknowledgement on achievement enhances my performance  | 3(1.4)  | 2(0.9) | 135(63.1) | 74(34.6)  | 3.31 |
| 17 | Provision of instructional facilities by the head augments my performance                                     | 13(6.1) | -      | 82(38.3)  | 119(55.6) | 3.43 |
| 18 | Participation in decision making about academic matters promote performance                                   | 8(3.7)  | 4(1.9) | 121(56.5) | 81(37.9)  | 3.29 |
| 19 | The management give adequate chances for professional growth and research advancement to increase performance | 10(4.7) | -      | 88(41.1)  | 116(54.2) | 3.45 |
| 20 | Relationship with the head enhances the performance of teachers   | 9(4.2)  | 3(1.4) | 131(61.2) | 71(33.2)  | 3.23 |

The results revealed that the mean scores of the items ranged between 3.23 and 3.71. This implied that respondents rated all the indices that aid staff performance well because the mean scores were all above 2.50. However, they rated “Encouragement for creativity and innovation by head leads to better performance” as the best index with a mean value of 3.71, followed by “Appreciation on genuine efforts motivate me to do even better” with mean value of 3.63 and “Award with impressive title ensures the better performance of academic staff” with mean value of 3.50 among others. While “Participation in decision making about academic matters promote performance” and “Relationship with the head enhances the performance of teachers” rated least among the indices with mean values of 3.29 and 3.23 respectively.

**Hypothesis 1:** There is no significant difference in the motivational strategies used by heads of teachers in secondary schools based on school types

To test this hypothesis, an independent t-test statistic was done and the result is presented in Table 4.6

Table 6: T-Test Statistic of school type differences in motivational strategies used by heads of teachers

| Sch. Type       | N    | MEAN        | SD   | t    | P |
|-----------------|------|-------------|------|------|---|
| <b>Decision</b> |      |             |      |      |   |
| Private         | 100  | 34.99       | 3.28 | 2.45 |   |
|                 | 0.02 | Significant |      |      |   |
| Public          | 114  | 33.58       | 4.88 |      |   |

Table 6 presents the t-test statistics of school type differences used by heads of teachers in secondary schools. It revealed that 100 respondents were from private schools with a mean score of 34.99 and SD of 3.28, 114 of them were from public school with a mean score of 33.58 and SD of 4.88 and t-value of 2.45. The result of independent t-test shows that there was a significant difference in the motivational strategies used by heads of teachers in secondary schools based on school types.

**Hypothesis 2:** there is no significant difference in the indices that aid staff performance among secondary school teachers based on school types

To test this hypothesis, an independent t-test statistic was done and the result is presented in Table 7.

Table 7: T-Test Statistic of school type differences in motivational strategies used by heads of teachers.

| Sch. Type       | N    | MEAN        | SD   | T    | P |
|-----------------|------|-------------|------|------|---|
| <b>Decision</b> |      |             |      |      |   |
| Private         | 100  | 35.02       | 2.92 | 2.98 |   |
|                 | 0.00 | Significant |      |      |   |
| Public          | 114  | 33.46       | 4.45 |      |   |

Table 7 presents the t-test statistics of school type differences of indices that aid staff performance in secondary schools. It revealed that 100 respondents were from private schools with a mean score of 35.02 and SD of 2.92, 114 of them were from public school with a mean score of 33.46 and SD of 4.45 and t-value of 2.98. The result of independent t-test shows that there was a significant difference in the indices that aid staff performance in secondary schools based on school types.

**Discussion**

Research Question one stated that are there any impact of motivational strategies on teachers in secondary schools in Osogbo and Atakumosa Local Government Areas of Osun State? To answer this research question, teachers’ response to items on motivational strategies or techniques used by the heads of teachers in secondary school in Osogbo and Atakumosa Local government area of Osun state, the findings presented motivational strategies used by heads of teachers in secondary schools. The results revealed that the mean scores of the items ranged

between 3.12 and 3.83. This implied that respondents rated all the motivational strategies been used by heads of teachers well. The finding is in agreement with Koontz (2008) that the instructive chief's (head educator) work isn't to control individuals yet rather to perceive what spurs individuals.

As indicated by sociologists, school conditions are reward scant and regularly appear to neutralize educators' best exertion to develop expertly and improve understudies' learning (Peterson, 2005). The findings also corroborate Frase (2010) that the best test analysts in training and school pioneers have confronted, is inspiring instructors to acquire undeniable degree of execution, and also found out that educator's remuneration including pay, benefits and enhanced pay, showed little connection to long haul fulfillment with instructing as a profession.

Research Question 2 stated that what are the indices that aid performance among secondary school teachers in Osogbo and Atakumosa Local Government Areas of Osun States? To answer this research question, teachers' response to items on indices that aid staff performance among secondary school teachers in Osun State was used. The results revealed that the mean scores of the items ranged between 3.23 and 3.71. The study rated encouragement for creativity and innovation by head leads to better performance, appreciation on genuine efforts motivates me to do even better and award with impressive title ensures the better performance of academic staff. This result supported the earlier work of Hasan (2011) who also mentioned that work motivation, school principal leadership, and organizational culture were predictors of teacher performance.

The findings is also in agreement with Bonard (2015) which revealed that success of a teacher's performance is certainly determined by the level or intervention of school principals or leadership in schools which is certainly mediated by variables such as self-efficacy, commitment, and job satisfaction. Leadership can be understood in the school environment as a process of influencing teachers and students through teaching and learning, conveying knowledge, skills, values, culture and ideas. The role given by schools through empowerment and enhancing teacher quality programs can also affect the performance, commitment, and behavior of their membership in schools. In addition, the organizational climate and collaboration of various parties that support the continuity of teaching are important factors in order to improve teacher performance.

Hypothesis 1 stated that is there any significant difference in the motivational strategies used by heads of teachers in secondary schools based on school types. The result of independent t-test shows school type

differences in motivational strategies used by heads of teachers; there is a significant difference in the motivational strategies used by heads of teachers in secondary schools based on school types. The finding is in agreement with Ukpong & Uchendu (2012), and Ekpoh (2003) which reported the motivation strategies used by public school head teachers is different from that of private schools.

Hypothesis 2 stated that is there any significant difference in the indices that aid staff performance in secondary school based on school types. The result of independent t-test show school type difference in motivational strategies used to aid staff performance; there is a significant difference in the indices that aid staff performance in secondary schools based on school types. The motivation of public secondary school teachers mostly come from the government which could spur the school head to double his commendation for teachers which could as well lead to recommendation and promotion but it is not always like that in private schools. There is limit to what can be done in private secondary schools when it comes to motivation from the school head, though not all private schools.

### **Conclusion**

Based on the findings obtained from this study, it could be concluded that the motivational strategies used by the heads of teachers in secondary schools in Osogbo and Atakumosa Local Government Areas of Osun State include acknowledgement of teachers' achievement and giving of regular remuneration to teachers among others; the indices that aid staff performance among secondary school teachers include encouragement for creativity and innovation by head leads to better performance, appreciation on genuine efforts motivate teachers to do even better and award with impressive title ensures the better performance of academic staff among others; there was a significant difference in the motivational strategies used by heads of teachers in secondary schools based on school types; and that there was a significant difference in the indices that aid staff performance in secondary schools based on school types.

### **Recommendations**

Based on the results of data analysis, it is hereby recommended that principals should recognize work done well by teachers to boost their ego and to enhance their work performance; teachers should be highly praised and commended for maximum performance; Ministry of Education should make it a policy to provide all public secondary schools in the study area with necessary facilities to facilitate effective teaching and learning in schools and research should also be done on the head teachers' motivation of students, non teaching and subordinate staff.

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## EFFECT OF ACTIVE REVIEW STRATEGY ON STUDENT'S ATTITUDE TO BASIC SCIENCE IN OYO STATE

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**Abstract:** *This study determined the effects of active review strategy on students' attitude to basic science. The study adopted the pretest-posttest control group, quasi-experimental design. 262 JSS II students from four co-educational schools in two Local Government Areas (LGAs) of Oyo state were randomly assigned to treatment and control groups. The instruments used were: Students Basic Science Attitude Scale ( $r=0.86$ ) and Teachers Instructional guides. Three questions and three hypotheses were formulated and tested at 0.05 level of significance. The data collected were analysis using descriptive statistic and analysis of covariance, the treatment had significant main effect on students' attitude to basic science ( $F(1, 254)=13.294; p<0.05$ , partial  $\eta^2=0.067$ ). Mean while there was no significant effect of gender and parental educational background on students' attitude to basic science. Based on the finding of this study, active review strategy is recommended to be adopted for the improvement of students' attitude to basic science among others.*

**Keywords:** *Active review strategy; attitude to basic science; gender and parental educational background.*

### **Introduction**

The relevance of basic science to technological development in Nigeria cannot be underestimate for the knowledge of the concepts in the subject

is a rudimentary pivotal to the scientific academic careers of students in the field of sciences in higher institutions. The role of science in this modern era of technology is wide and profound. In line with this reasoning, Oredein and Awodun (2013) emphasized the importance of scientific knowledge in boosting national prestige, military might, national income and international rating of the country. According to them, science gives birth to the production of micro-computers and their innovative applications which earned the developed countries such as the United States of America and Japan unparalleled national wealth, military potential and enviable national prestige.

The specific objectives to be achieved by basic science curriculum include the following among others: to enable the learners,

- Develop interest in science and technology;
  - Acquire basic knowledge and skills in science and technology
  - Apply scientific and technological knowledge and skills to meet contemporary societal needs;
  - Take advantage of the numerous career opportunities provided by science and technology;
  - Become prepared for further studies in science and technology.
- Revised, ( 2012)

In spite of the enormous role that basic science plays in national development and the efforts of government and other stakeholders in improving science education, science have not been encouraging. Many factors have been attributed to this ugly and unwholesome situation. This factors, include; students' negative attitude towards to science subjects, student' lack of interest in science subject, gender inequality and student study habits according to (Akanbi, 2014; Asikhia 2010; Macmillian, 2012). Ige and Arowolo (2011) asserted that only negligible sample of students made it to offer science courses at senior secondary schools and higher levels due to their recurrent mass failure in the junior secondary School Certificate Examination (JSSCE).

Consequently, students' poor performance has revealed by chief examiner reports might be because students develop negative attitude towards the science subject Adewumi & Ogundiwin (2021). Attitude is an emotional state of individual towards an object or situation. Oliver and Simpson (2008) stated that attitude is the extent (degree) at which learners'likes' science. Also, attitude is an inclination to reason, sense, and perform decidedly or contrarily in the direction of objects in our present environment.

Literature has also indicated that teachers attitude have exerted some influence on the academic achievement of students. For instance, Yara (2009) reported that teacher's attitude towards science has strong relationship with students science achievement as well as the students' attitude towards science while Amjad and Mohammed (2012) asserted

that one of the important factors in science teaching is the attitude which determines behavior while Olatoye and Aderogba (2012) was of the opinion that a person with good scientific attitude is free from superstition, unverified assumptions and many times from popular opinion that has no empirical basis and this in collaboration with Olasehinde and Olatoye (2014) that a person with scientific attitude is not necessarily a scientist but he or she consciously or unconsciously thinks, acts and demonstrates traits that are common to scientist. Instead of experiencing good outcomes in Basic Science through attitude, the result from different scientific researches on science has not been encouraging. The poor performance of students in basic science was not only attributed to attitude but also inappropriate methods of teaching mainly used by basic science teachers to teach the subject. Among the strategies that have been explored in previous researches are; Experiential strategy by Awolere (2015), Critical exploration strategy by Oloyede (2014), Puzzled Based Critical Thinking g Motivation Strategies by Ogundiwin (2013). In spite of all these strategies, students still experienced high rate of poor performance in the basic science especially, in the public examination such as junior secondary school certificate examinations conducted by state examination body and National Examination Council (NECO).

One of the active instructional strategies that had caught the attention of researchers is the Active Review Strategy. Active review strategy is a well-designed review strategy that help students organized the materials to be studied. Studies show, that, perhaps emphasis should be on total study time but not on the way students study (Gurung 2005). One way to reach more students in a review strategy would be to present the material in a different form than it was presented in class. If Power Point was the main form of presentation for example, then you should distribute or use overhead transparencies or handout or other graphic representation. Students could be encouraged to create their own concepts maps, or outlines that, will group and organize the materials in their minds cooperatively and showing active learning. One group was provided with basic questions and answers, on review strategy, the other in addition to time allotted for questions reviewed exam content in an outlined form. All the major concepts were discussed, and then time was allowed for questions; results showed that, the students who attended the second type of review strategy out performed those in the former. Jenson and Moore (2009) noted that, students who attended one or more review classes earned higher grades than those that did not.

In the course of focusing on the students' attitude, parental educational background and gender were factor in. Parent Educational background is also a factor affecting the learning outcomes of students in Basic Science. Studies carried out by Mok and Flynn (2008) showed that,

parents' level of education made a significant contribution to the achievement of the students. This is corroborated by Adodo (2007) that, showed, Parental Educational background affects learner's learning outcomes positively in terms of achievement in Basic Sciences while Yaya (2010) reported that children from broken homes and unstable marriage relations perform poorly in school. Steve, Guisepppe and Jim(2008) reported that, learners with high Parental Educational background status exhibit higher levels of achievement than those with low Parental Educational background and Gale, (2013) reveal that students whose parents have higher levels of education may have an enhanced regard for learning, more positive ability beliefs, a stronger work orientation and they may use more effective learning strategies than children of parents with lower levels of education while Chen (2009) concludes that, Parental Education is found as a key determinant to student's achievement.

Gender has also remained an important issue which is relevant to the field of education because it has been linked with students' success. Gender refers to the classification of human being on the basis of sex due to the roles they perform. Most studies show that on the average girls do better in school than boys (Adewumi, 2014). The study of Yuniskurin, Noviyanti, Mukti, Mahana, and Zubidah (2019) also show that female is better at spelling and perform better on tests of literacy, writing and general knowledge in education. In contrast, Okafor (2021) and Ekon and Eni (2015) showed that women were not only under-represented but their levels of achievement in the fields of sciences and technology were low compared to the males.

Many studies have explored different instructional strategies for the teaching and learning of basic science. For instance, mind mapping and concept mapping methods were researched by Adodo, (2013), inquiry method was investigated by Abd-Hamid, Campebell, Der, Packenham, & Wolf (2012). However, not much has been done using active review strategy for teaching basic science concepts in junior secondary school. It is this gap that this research work stands to fill. This research work seeks to find out the effect of active review strategy on student attitude to basic science. The study further determined the moderating effects of Parental educational background and gender.

### **Statement of the problem**

Basic Science is a compulsory subject offered at Junior Secondary Schools. In spite of the importance of the subject to the students, results from public examination bodies reveal that students' performance in the subject is not encouraging. Besides, the teaching and learning of Basic Science has not achieved the much desired goal among the educators. The poor performance has been traced to students' poor attitude to the

subject and inappropriate teaching strategies employed by the teacher does not encourage self-construction of knowledge and self-assessment among learners. Efforts to address these problems have led researchers to experiment with various instructional strategies. As a way out, scholars have suggested a shift in focus from teacher-centered teaching strategies to learner-centre such as active review strategy.

Researchers had shown that Parental Income affects learner's learning outcomes in terms of achievement in and attitude to Basic Sciences. Therefore, this study determines effects of Active Review strategy on students' attitude to Basic Science. The moderating effects of Parent Educational Background and Gender of students were also examined.

### **Purpose of the Study**

The purpose of this study was to investigate the effect active review strategy on students' attitude in basic science in Oyo State. Specifically, the study sought to;

1. Determine the difference between the attitude mean score of the students exposed to active review strategy in basic science and compare with their counterpart taught using conventional strategy.
2. Find out the effect of treatment and gender on students' attitude in basic science.
3. Find out the effect of treatment and parental educational background on students' attitude in basic science.

### **Research Question**

Three research questions were formulated to guide the study:

1. What is the difference between the attitudes mean score of the students exposed to active review strategy in basic science and compare with their counterpart taught using conventional strategy?
2. Is there any significant main effect of Gender on Students' Attitude to Basic Science?
3. Is there any significant main effect of Parental Educational Background on Students' Attitude to Basic Science?

### **Research Hypotheses**

To guide the study three null hypotheses were formulated and were tested at 0.05 level of significance:

**H<sub>01</sub>:** There is no significant difference in the attitudes mean score of the students exposed to active review strategy in basic science and compare with their counterpart taught using conventional strategy

**H<sub>02</sub>:** There is no significant main effect of Gender on Students' Attitude to Basic Science

**H<sub>03</sub>:** There is no significant main effect of Parental Educational Background on Students' Attitude to Basic Science

## Methodology

This study adopted the pretest-posttest control group quasi-experimental research design. The population consisted of all junior school students in kajola Local Government Areas of Oyo – State while the target population comprised all junior school students in JSS II. The choice of JSS II Basic science students was made because they have been exposed to introductory aspects of living and non-living things, chemicals, work, and power and types of energy in (JSS I) Basic science subject and JSS 1 Basic science which act as pre-requisites for the study of the chosen concepts. The students were likely to be more receptive to the teaching strategy as they were not under the pressure of preparing for external examination. The teaching of the concepts was appropriate to the scheme of work at this stage of their spiral curriculum.

Samples of 262 (126 male and 136 female) students were involved in the research study. Six instruments were used for data collections which are Students Basic Science Attitude Scale (SBSAS), the attitudinal scale consists of two sections, A and B. Section A seeks personal information on the students such as name of the school, class of student, sex, Parent Educational Background, and time allowed for the attitudinal scale while the section B consists of the attitudinal scale made up of 20 items It comprises of 20 items on a 4-point liker type scale ranging from: Strongly agree (4marks) Agree (3 marks) Strongly disagree (2 marks) Disagree(1 mark). Kr 20 was used in analyzing the data and of 0.86 was obtained as reliability coefficient. Teachers Instructional guides on Active Review Strategy and Conventional strategy, and Evaluation Sheet for Assessing Teachers Performance during Training. The draft of the Teacher's Guide on (Active Review Strategy and conventional Strategy) and evaluation sheet were given to five experienced Biology tutors in selected secondary schools. This was done in order to ensure the face, content and construct validity of the guide. These teachers are seasoned WAEC, NECO and NABTEB examiners, and based on their comment and suggestion necessary amendments were made. The researchers administered the instruments as pre-test and the student's scores were recorded. Thereafter, the researchers taught the experimental group and control group was taught with conventional strategy. The treatment lasted for eight weeks. The data collected were analyzed using descriptive statistics, Analysis of Covariance and Scheffe Posthoc test at 0.05 level of significance.

## Results

**Research Question 1:** What is the difference between the attitudes mean score of the students exposed to active review strategy in basic science and compare with their counterpart taught using conventional strategy?

Table 1: Descriptive Statistics of Attitude Associates with Treatment

| Parameter      | Attitudes Scores       |                       |
|----------------|------------------------|-----------------------|
|                | Active Review Strategy | Conventional Strategy |
| No of cases    | 126                    | 136                   |
| Pre-test mean  | 44.04                  | 41.29                 |
| Pre-test SD    | 1.85                   | 2.12                  |
| Post-test mean | 51.11                  | 25.28                 |
| Post-test SD   | 1.81                   | 2.17                  |
| Mean Gain      | 7.07                   | 3.99                  |

Table 1 shows the descriptive statistics of the students’ attitude scores. The mean gain score for active review strategy was 7.07 while that of conventional strategy was 3.99. The highest mean gain contribution was obtained by students exposed to active review strategy and the least was from student taught with conventional strategy. Thus, active review strategy had higher mean gain than conventional strategy.

**Research Question 2:** Is there any significant main effect of Gender on Students’ Attitude towards Basic Science?

Table 2: Descriptive Statistics of Attitude Associates with Gender

| Parameter      | Attitudes Scores |        |
|----------------|------------------|--------|
|                | Male             | Female |
| No of cases    | 120              | 142    |
| Pre-test mean  | 43.19            | 44.58  |
| Pre-test SD    | 21.06            | 17.15  |
| Post-test mean | 49.37            | 50.60  |
| Post-test SD   | 2.11             | 1.95   |
| Mean Gain      | 6.18             | 6.02   |

The descriptive statistics of the students’ attitude scores with gender in Table 2 indicate improvements for male students (6.18) over the female students (6.02).

**Research Question 3:** Is there any significant main effect of Parental Educational Background on Students’ Attitude towards Basic Science?

Table 3: Descriptive Statistics of Attitude Associates with Parental Educational Background

| Parameter   | Attitude Scores |        |      |
|-------------|-----------------|--------|------|
|             | Low             | Medium | High |
| No of cases | 90              | 45     | 25   |

|                |       |       |       |
|----------------|-------|-------|-------|
| Pre-test mean  | 43.35 | 43.77 | 44.59 |
| Pre-test SD    | 1.59  | 1.29  | 3.07  |
| Post-test mean | 49.78 | 50.66 | 49.51 |
| Post-test SD   | 1.63  | 1.33  | 3.15  |
| Mean Gain      | 6.43  | 6.94  | 4.92  |

Table 3 displays the Descriptive Statistics of the Students' Attitude scores associate with Parent Education Background of the students. The mean gain scores is as follow; medium parent educational qualification had higher mean gain (6.94) than the high parent educational background (6.92), while high parent educational background had higher mean gain than low parent educational background (6.43).

**H<sub>01</sub>:** There is no significant difference in the attitudes mean score of the students exposed to active review strategy in basic science and compare with their counterpart taught using conventional strategy.

**Table 4: 3x3x2 ANCOVA of Post-test Attitude scores of students by treatment, Parent Educational Background and Gender.**

| Source                         | Sum of Squares   | DF         | Mean Square     | F             | Sig.         | Eta Square  |
|--------------------------------|------------------|------------|-----------------|---------------|--------------|-------------|
| Main Effect:                   | <b>9164.051</b>  | <b>16</b>  | <b>572.75</b>   | <b>10.539</b> | <b>.000</b>  | <b>.339</b> |
| Pretest                        | <b>3746.660</b>  | <b>1</b>   | <b>3746.660</b> | <b>77.561</b> | <b>.000</b>  | <b>.1</b>   |
| Attitude to Basic Science      | <b>1284.342</b>  | <b>1</b>   | <b>1284.342</b> | <b>13.294</b> | <b>.000*</b> | <b>.067</b> |
| Treatment groups               | <b>88.909</b>    | <b>2</b>   | <b>44.454</b>   | <b>.920</b>   | <b>.399</b>  | <b>.005</b> |
| Parent Educational Background  | <b>21.901</b>    | <b>1</b>   | <b>21.901</b>   | <b>.453</b>   | <b>.501</b>  | <b>.001</b> |
| Gender                         | <b>230.636</b>   | <b>2</b>   | <b>115.318</b>  | <b>1.194</b>  | <b>.313</b>  | <b>.013</b> |
| 2-way Interactions:            | <b>55.935</b>    | <b>1</b>   | <b>55.935</b>   | <b>.579</b>   | <b>.561</b>  | <b>.003</b> |
| Treatment group x PEB          | <b>141.910</b>   | <b>2</b>   | <b>70.955</b>   | <b>1.469</b>  | <b>.232</b>  | <b>.008</b> |
| Treatment group x Gender       | <b>82.360</b>    | <b>4</b>   | <b>20.592</b>   | <b>.426</b>   | <b>.790</b>  | <b>.005</b> |
| Treatment group x PEB x Gender | <b>9164.051</b>  | <b>256</b> | <b>35.797</b>   |               |              |             |
| 3-way Interaction:             | <b>17873.204</b> | <b>254</b> | <b>70.366</b>   |               |              |             |
| Treatment group x PEB x Gender | <b>27037.254</b> | <b>262</b> |                 |               |              |             |



|           |   |
|-----------|---|
| PEB       | x |
| Gender    |   |
| Explained |   |
| Residual  |   |
| Total     |   |

\*Significant at P<0.05

Table 4 Revealed that there was significant effect of treatment on student’s attitude towards Basic Science ( $F(1,254) = 13.294; P < .05; \eta^2 = 0.067$ ). The effect size of 6.7% was fair. On this basis, hypothesis 1 was rejected. This means that the difference between the attitudes score of students exposed to treatment group was significant. To find out the magnitude of mean scores of the group performance, the Table 5 is presented as follows;

**Table 5: Estimated Marginal Means of Attitude score of students According to treatment group.**

|              |                    | Mean  | Std. Error | Upper Bound | Lower Bound |
|--------------|--------------------|-------|------------|-------------|-------------|
| Active group | Reviews            | 51.11 | 1.89       | 52.13       | 50.09       |
|              | Conventional group | 45.28 | 2.17       | 46.52       | 44.04       |

Table 5 Revealed that students in the active review strategy group had the highest adjusted posttest mean Attitude scores ( $\bar{x}=51.11$ ) while students in the Conventional Strategy group had the least adjusted mean Attitude scores ( $\bar{X}=45.28$ ). Further, the source of the significant difference obtained was also traced using Scheffe Post hoc test in table 6

**Table 6: Scheffe Post-Hoc of Attitude score of students According to treatment group.**

| Treatment      | N   | Mean  | Active review | Modified Conventional |
|----------------|-----|-------|---------------|-----------------------|
| Active Reviews | 126 | 51.11 |               | *                     |
| Conventional   | 136 | 45.28 | *             |                       |

The result from post-hoc analysis in Table 6 revealed that attitude mean scores of students in Active review strategy (51.11) was significantly better than Conventional Strategy (45.28) in their mean attitude scores, these revealed that the direction of increasing effect of instructional strategy (treatment) on attitude was that Conventional Strategy did not perform better than Active Review Strategy.

**H<sub>02</sub>:** There is no significant main effect of Gender on Students’ Attitude towards Basic Science.

Table 4 revealed that there was no significant main effect of gender on

the attitude of the students towards basic science. ( $F(1,254) = .453$ ;  $P > 0.05$   $\eta^2 = .001$ ). Hence hypothesis 2 was rejected

**Table 7 Estimated Marginal means of post test attitude score by Gender.**

|        | Mean  | Std. Error | Upper Bound | Lower Bound |
|--------|-------|------------|-------------|-------------|
| Male   | 13.75 | 0.70       | 14.68       | 12.82       |
| Female | 14.48 | 0.64       | 15.36       | 13.60       |

From table 7, Female students had higher mean  $\bar{X} = 14.48$  while the male students had a lower mean of  $\bar{X} = 13.75$ , but the differences in there means was not significant.

**H<sub>03</sub>:** There is no significant main effect of Parental Educational Background on Students' Attitude towards Basic Science

Table 8 reveal that there was no significant main effect of Parent Educational Background on students Attitude towards Basic Science ( $F(2,254) = .920 > 0.05$ ,  $\eta^2 = .005$ ) the effect size of 0.5 was negligible hence hypothesis 2 was not rejected

**Table 8: Estimated Marginal means of post test Attitude score by Parent Educational Qualification Group.**

|        | Mean  | Std. Error | Upper Bound | Lower Bound |
|--------|-------|------------|-------------|-------------|
| Low    | 49.78 | 1.63       | 50.78       | 48.78       |
| Medium | 50.66 | 1.33       | 53.64       | 47.68       |
| High   | 49.51 | 3.15       | 50.87       | 48.15       |

From table 8 Students with the Medium Education Background has the highest mean  $\bar{X} = 50.66$  followed by low parent educational background  $\bar{X} = 49.78$  while the least was from High Parent Educational Background  $\bar{X} = 49.51$ .

## Discussion

The result obtained in this study showed that, there was a significant main effect of treatment on student's attitude to Basic Science. Active review was more effective than the conventional strategy. The Active Review Strategy was found to be more effective than the conventional strategy, this may be as a result of the fact that the teacher monitor the students progress in active review, provides support, feedback and scores are awarded to each group which can serve as reinforcement to them thus change the attitude towards Basic Science. This is in line with the study of Duron, Limbach, and Waugh (2006), and Gurung (2005).

However, this finding is opposed to Brenda (2003) who argued that the conventional lecture method could not be totally ignored. The result support the work of Ogundiwin (2013) and Adewumi (2021) whose found that, attitudes tended to vary significantly in relation to research strategy used. Teachers that, are undertaking student centered strategy tended to be more positive about their student's attitude towards the subject (80.6% positive. Attitude towards science varied in relation to specific subjects taught. The result of the finding showed that gender does not have any significant effect on performance of students in basic science. This shows that sex may not be a determinant factor in the method of teaching. This is supported by the finding of Adewumi (2023) that no significant interaction effect on students' gender as far as academic performance is concerned. Adodo (2004) corroborates this outcome that both sexes when equal encouragement to use their intellectual gifts fully, that both sexes are not differ in their studies. He said further that gender does not affect students' learning of basic science and their performance.

#### Conclusion

Base on the findings, it is concluded that with the use of Mind active review strategy students' performance can be improved upon in basic science in Junior secondary school. Also gender does not in any way affect on the student attitude to basic science. Active review strategy allows teachers to monitor student's attitude to basic science. The strategy enhances the development of creativity and problem solving ability in student. Hence, the teachers should adopt it as a strategy for teaching Basic Science in junior secondary schools.

#### Recommendations

From the results obtained and the discussion made, the following recommendations are therefore made:

1. Active review strategy should be adopted as effective and viable strategies for teaching basic science concepts.
2. Biology teachers should develop activities that will give room for learners to actively participate in the teaching and learning process.
3. Students can therefore be encouraged to transfer the knowledge and the approach gained to study other subjects to balance up with the technological status of developed countries like China, Taiwan, Japan.

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**SOCIAL LEARNING ENVIRONMENT AND PROBLEM -  
SOLVING SKILLS AS CORRELATES OF STUDENTS’  
PERFORMANCE COMPETENCE IN CHEMISTRY**

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**Abstract:** *The study investigated on social learning environment and problem-solving skills as correlates of students’ performance competence in chemistry in Ogidi education zone of Anambra state. The study used correlation research design. The population of the study comprised of all the 2,840 senior secondary school two (SS2) Chemistry students in the zone. The sample size of the study was made up of 1420 students (530 males, 890 females). The sample was drawn using multistage sampling procedure. Five purpose of study, five research questions and five hypotheses guided the study. Three instruments were used for the study namely Social Learning Environment Questionnaire (SLEQ), Problem Solving Skill Inventory (PSSI) and Students Academic Performance Test (SAPT). The data collected were analysed using Pearson’s Product Moment Correlation for both research questions and hypotheses which were tested at .05 level of significance. The results revealed a low negatively relationship between students’ perception of social learning and academic performance competence in Chemistry. Hence a no significant in relationship between students’ perception of social learning and academic performance competence in Chemistry. Secondly, the result also revealed a low negatively relationship between male and female students’ perception of social learning and academic*

*performance competence in Chemistry. Hence, no significant difference in relationship between male and female students' perception of social learning and academic performance competence in Chemistry. Thirdly, the study revealed low positive relationship between students' problem- solving skill and performance scores in Chemistry. Hence, there was no significant difference in relationship between students' problem-solving skill and performance scores in Chemistry. Fourthly, the study revealed a low positive relationship between male and female students' problem- solving skill and performance scores in Chemistry. Hence, there was no significant difference in relationship between male and female students' problem- solving skill and performance scores in Chemistry. Finally, a low positive relationship between secondary school students' perception on social learning environment scores, problem solving skills scores and performance competence scores in Chemistry scores. Hence, there was no significant difference in relationship between secondary school students' perception on social learning environment scores, problem solving skills scores and performance competence scores in Chemistry scores. From the findings recommendations and conclusions were made.*

**Key words:** *Science; Chemistry; Social Learning Environment and Problem- Solving Skills.*

## **Introduction**

Science is the concerted human effort to better understand the history of the natural world and how the natural world works with observable physical evidence, as the basis of the understanding. It is a knowledge acquired through observation of natural phenomena, and experimentation that tries to simulate natural processes under controlled conditions (Driel & Jone, 2021). Science has many branches and can be seen in various areas of life. The branches of science, according to Okoye and Igboabuchi (2017) include earth and space, social sciences, life science and physical science. This study is interested in a branch of physical science known as Chemistry.

Chemistry is a branch of science that deals with the study of nature, composition and properties of matter, as well as the changes matters undergone under different conditions. Chemistry deals with the study of our environment and things that are happening around it. According to Chukwu (2015), Chemistry does not only explain the environment but also offers a lot of useful and important knowledge to humanity. Examples are in the area of industrial production of fertilizer, insecticides, food and drinks, clothing and textile materials and many



other useful ideas and application. Chemistry also contributes to the theoretical base for the production of ammunitions for defence, security, building, medicine and many more (Obikezie et. al., 2023).

In as much as Chemistry is important to man and his environs, students' performance in Chemistry in secondary schools is still a thing to worry about. Over the years, research studies (Alabi, 2014; Copriady, 2015) have indicated that academic performance of students who enroll in Chemistry has not been encouraging. The poor performance of students in science subjects, particularly in Chemistry, has assumed a serious dimension as reported by the West African Examinations Council (WAEC) Chief Examiner's report on Chemistry 2015 to 2019. From the reports, candidates have the following weaknesses: inability to understand the demands of the questions, exhibited poor communication skill, wrote trivial names instead of formulae, application of theoretical approach to practical questions among other weaknesses. All these point to the fact that secondary school students offering Chemistry lack problem-solving skills. This lack of problem-solving skills could be attributed to the school social learning environment Chemistry learners found themselves (Obeka, 2016).

Social learning environment is a destination where people come together to co-create content, share knowledge and learn from one another. According to Nubunga (2020), social learning environment combined social learning elements like networking, tagging, files sharing microblogging to create a safe space in which to work and learn collaboratively as in a learning environment setting. As opined by Usman and Mandulili (2019), social learning environment encompasses learning resources and technology, means of teaching, mode of learning, and connections to societal and global contexts through use of problem solving skills (Nabunga 2020).

Problem solving skills (PSS) refers to the ability to identify a problem, determine its cause and figure out all possible solutions to solve the problem. According to Kim et. al., (2018), PSS is the ability to use appropriate methods to tackle unexpected challenges in an organized manner. Kim et. al further asserted that PSS have been proven to be one of the key factors for success in organization and personal career that are related to science activities in a related manner. Copriady (2015), opined that PSS exist in a volatile manner which requires a systematic approach. According to Dubicks and Sarkene (2017), problem-solving skills are defined in a number of studies which exist in technology based industry of teaching and learning. For Akujieze and Ifeakor (2017), PSS consist of using generic or adhoc method in an orderly manner to find solution to difficulties which when learned will affect the attitude of the learner positively towards materials that were learned to show a high level in performance competence in science subjects like Chemistry.

Academic performance competence is the extent to which a student, teacher or institution has attained their short or long-term educational goals (Kapor,2018). Performance competence depicts how much students own their learning. A lot of factors affect students' academic performance competence in Chemistry and they include; truancy by the students, poor social learning environment, incompetent teachers, poor teaching method and others. These factors bear so much influence on the academic performance competence of Chemistry students that over the years, Chemistry and science students do not show much interest in Chemistry subject, they see the subject and other related science subjects as unattainable task, with that most of them have obnoxious notion about Chemistry and other science subjects due to their social learning environment (Kapor,2018).

Some authors have also attempted to resolve the issue of casual relationship between social learning environment, problem solving skills and academic performance competence in students. Indeed, Iweka (2017) revealed a low mean perception and low negative perception between students' performance competence and classroom environment with no significant difference in integrated science. More so, Wordu (2014) observed that a well-equipped and conducive learning environment with qualified teachers influence mechanical student's academic performance competence especially male and female students at high extent with no significant difference in gender group's opinion do to equal perception on problem solving skills the students.

Mandina and Ochinogor (2018) observed statistically significant difference in correlation between students' performance competence and problem-solving skills in Mathematics. More so, Ariniezca and Ikhsan (2020) who reported that students had a moderate positive relationship between attitude, performance and problem process skills in Chemistry while Kanmani and Nagarathinam (2017) reported that problem-solving skill of the higher secondary student was found to be on average and there was a high positive correlation and inter relationship between problem-solving skill, social learning and performance competence in Mathematics.

Some authors have also attempted to resolve the issue of significant difference in correlation among students' perception of social learning environment, problem-solving skills and academic performance competence. Kanmani and Nagarathinam (2017) observed a low positive relationship between students' academic performance competence and their social learning environment using socio-cultural theory (SCT) by Vygotsky. The authors further asserted that there is no significant in relationship between students' academic performance competence and social learning environment in some secondary school science subject. While Ariniezca and Ikhsan (2020) reported that a

moderate positive relationship exists between students' academic performance competence and their perception in problem solving skills in Chemistry. The authors further asserted that there is no significant difference in relationship between students' academic performance competence and their perception in problem solving skill in Chemistry using problem-solving skill theory (PSST).

It appears the question of whether relationship exists or does not exist between social learning environment, problem-solving skills and students' performance competence in Chemistry has not been concisely answered because both the theoretical and empirical studies reviewed in this study have produced diverse and contradictory results either it talks about the relationship between social learning environment and students' performance competence or relationship between perception of problem solving skill and students' performance competence. Non seems to address the issues of the three variables. Similarly, the issue of gender difference in social learning environment, problem-solving skills and performance competence in secondary school Chemistry has not been resolved and therefore subject to further investigation. Thus, this study was focused on social learning environment and problem-solving skills as correlates of male and female students' performance competence in Chemistry.

Consequently, to guild the study there emerge five purpose of study: One, "relationship between secondary school students' perception of social learning environment and academic performance competence in Chemistry". Second, "relationship between secondary school students' perception of social learning environment and performance competence in Chemistry when moderated with gender". Third, "relationship between secondary school students' problem solving skills and performance competence in Chemistry". Fourth, "relationship between secondary school students' problem solving skills and performance competence in Chemistry when moderated with gender". Fifth, "correlation among secondary school students' perception of social learning environment, problem solving skills and performance competence in Chemistry". The purpose of the study is to be achieved. Therefore, the purpose of the study which forms the research questions are unknown. Perhaps the outcome of this study would provide concise answers to the under listed research questions.

1. What is the relationship between secondary school students' perception of social learning environment and academic performance competence in Chemistry?
2. What is the relationship between secondary school students' perception of social learning environment and performance competence in Chemistry when moderated with gender?

3. What is the relationship between secondary school students' problem solving skills and performance competence in Chemistry?
4. What is the relationship between secondary school students' problem solving skills and performance competence in Chemistry when moderated with gender?
5. What is the correlation among secondary school students' perception of social learning environment, problem solving skills and performance competence in Chemistry?

### **Hypotheses**

The study tested the following null hypotheses at 0.05 level of significance:

1. There is no significant relationship between secondary school students' perception of social learning environment and academic performance competence in Chemistry.
2. There is no significant relationship between secondary school students' perception of social learning environment and performance competence in Chemistry when moderated with gender.
3. There is no significant relationship between secondary school students' problem solving skills and performance competence in Chemistry.
4. There is no significant relationship between secondary school students' problem solving skills and performance competence in Chemistry when moderated with gender.
5. There is no significant correlation among secondary school students' perception of social learning environment, problem solving skills and performance competence in Chemistry.

### **Method**

The design of the study was correlation survey. Correlation design is used to investigate relationship between two or more variable without the researcher controlling or manipulating any of them. The area of the study was Ogidi education zone of Anambra state Nigeria. The population of the study comprised of all the 2,840 senior secondary school two (SS2) Chemistry students in the zone. The sample size of the study was made up of 1420 students (530 males, 890 females). The sample was drawn using multistage sampling procedure involving different techniques was used to draw the sample size. First, purposive sampling technique was used to select 26 coeducational schools from 40 schools in Ogidi Education Zone. Coeducational schools were purposely selected in that they have greater number of schools in the study area and the researcher also wants to observe males and females in the same

learning environment, having comparable learning environment and large population size. Finally, stratified random sampling techniques were used to select five schools from each of the local government areas that make up the zone. In all, fifteen coeducation schools were used for the study with a sample size of 1,420.

### **Instrument**

Three instruments were used for the study namely Social Learning Environment Questionnaire (SLEQ), Problem Solving Skill Inventory (PSSI) and Students Academic Performance Test (SAPT). SLEQ was adapted by the researchers from “What is happening in the classroom questionnaire” (WIHICQ), by Myint SweKhine (2001). It consists seven (7) clusters namely; students’ cohesiveness, teachers’ support, students’ involvement, investigation, task orientation, cooperation and equity. Five-point scale response format was used which ranging from almost never (1 point), seldom (2 points), sometimes (3points), often (4 points) and always (5 Points).

The second instrument was The PSSI was adapted by the researcher from social learning inventory-revised (SPSI-R:D’ Zurilla et al., 2002 [www.sax.sagepub.com](http://www.sax.sagepub.com)). The following adaptations were made in the problem-solving skill inventory: Section A containing items eliciting information on biodata of the respondents and Section B which contains items eliciting information on problem-solving skills was modified and scale introduced ranging from Strongly Disagree (SD), Disagree (D), Agree (A), Strongly Disagree (SD) with weight of 1,2,3,4 and 4,3,2,1 for negative and positive responses respectively. Items on the instrument were reduced from 52 to 32 based on the validator’s recommendations. For the third instrument which is students’ academic competence, Student’s termly results were obtained from the promotion result for 2021/22 academic session, which comprises first, second and third term respectively. And the results recorded in a preformat was validated by the experts from the zone and the Head of Department of Chemistry in the selected schools. Since is a standard instrument, the reliability was not tested.

Similarly, SLEQ and PSSI where validated by three experts. Two from Department of Science Education and one from Education Foundation (Measurement and Evaluation) all from Nnamdi Azikiwe University Awka. To test the consistency and reliability of the two instruments adapted, SLEQ and PSSI where administered to 60 students at Nawfia which is in Awka education outside the area of study and reliability of .71 and .73 where yielded using Cronbach alpha. Pearson product moment correlation was used to answer both research questions and to test the hypotheses at .05 level of significant.

**Ranges of scores**

**Decision**

±0.80 – ± 1.00 High positive or negative relationships  
 ±0.31 – ± 0.79 Moderate positive or negative relationship  
 ±0.00 – ± 0.30 Low positive or negative relationship

In interpreting the null hypotheses, the decision rule is that when P-value is less than or equal to 0.05 ( $P \leq 0.05$ ) the null hypotheses was rejected. On the other hand, when P-value is greater than the alpha level 0.05 ( $P \geq 0.05$ ), the null hypotheses was not rejected (accepted).

**Result**

The result of this study was presented in line with the research questions and the hypotheses as follows.

**Research Question 1**

What is the relationship between secondary school students’ perception of social learning environment and academic performance competence in Chemistry?

**Table 2: Pearson Correlation Coefficient for the Relationship between Social Learning Environment and Academic Performance Competence in Chemistry**

| Variables   | N    | r     | R <sup>2</sup> | Magnitude & Direction     | Sig |
|---|------|-------|----------------|---------------------------|-----|
| Decision  |      |       |                |                           |     |
| Not   |      |       |                | Low negative relationship |     |
| 0.876 <sup>b</sup> Significant SPSLE Performance in Chemistry | 1420 | -0.03 | 0.00           |                           |     |

Key: R<sup>2</sup> = coefficient of determination

Table 1 reveals correlation coefficients of the relationship between students’ perception of social learning environment and academic performance competence in Chemistry as -0.03. This means there was a low negatively relationship between students’ perception of social learning and academic performance competence in Chemistry. The coefficient of determination (0.00) also known as the relationship value means that 0% or non of students’ perception in social learning

accounted for the variation in students’ academic performance competence in Chemistry.

**Research Question 2**

What is the relationship between secondary school students’ perception of social learning environment and performance competence in Chemistry when moderated with gender?

**Table 2: Pearson Correlation Coefficient for the Relationship between Social Learning Environment and Performance Competence in Chemistry when Moderated by Gender**

| Variables                      | N    | r     | R <sup>2</sup> | Magnitude & Direction | Sig |
|--------------------------------|------|-------|----------------|-----------------------|-----|
| Decision                       |      |       |                |                       |     |
| Not                            |      |       |                | Low                   |     |
| 0.653 <sup>c</sup> Significant |      |       |                | negative              |     |
| SPSLE                          | 1420 | -0.02 | 0.00           | relationship          |     |
| Performance in Chemistry       |      |       |                |                       |     |

Key: R<sup>2</sup> = coefficient of determination

Table 2 reveals correlation coefficients of the relationship between secondary school students’ perception of social learning environment and academic performance competence towards Chemistry when moderated by gender as -0.02. This means there was a low negatively relationship between male and female students’ perception of social learning and academic performance competence in Chemistry. The coefficient of determination (0.00) also known as the relationship value means that 0% of male students’ perception in social learning accounted for the variation in their academic performance competence in Chemistry.

**Research Question 3**

What is the relationship between secondary school students’ problem solving skills and performance competence in Chemistry?

**Table 3: Pearson Correlation Coefficient for the Relationship between Social Learning Environment and Performance Competence Score in Chemistry**

| Variables<br>Decision | N    | r    | R <sup>2</sup> | Magnitude<br>& Direction | Sig         |
|-----------------------|------|------|----------------|--------------------------|-------------|
| Not                   | 1420 | 0.03 | 0.001          | Low<br>positive          |             |
| 0.653                 |      |      |                | relationship             | Significant |
| SPSS                  |      |      |                |                          |             |
| APC                   |      |      |                |                          |             |

Key: R<sup>2</sup> = coefficient of determination

Table 3 shown that correlation coefficients of the relationship between students' problems solving skill and academic performance competence scores in Chemistry as 0.03. This means there was a low positive relationship between students' problem- solving skill and performance scores in Chemistry. The coefficient of determination (0.001) also known as the relationship value means that 0.1% of students' problem-solving skill accounted for the variation in performance competence of students in Chemistry.

**Research Question 4**

What is the relationship between secondary school students' problem solving skills and performance competence in Chemistry when moderated with gender?

**Table 4: Pearson Correlation Coefficient for the Relationship between Problem-Solving Skill and Performance scores in Chemistry when Moderated by Gender**

| Variables<br>Decision          | N    | r    | R <sup>2</sup> | Magnitude<br>& Direction | Sig |
|--------------------------------|------|------|----------------|--------------------------|-----|
| Not                            | 1420 | 0.08 | 0.003          | Low<br>positive          |     |
| 0.655 <sup>c</sup> Significant |      |      |                | relationship             |     |
| SPSLE                          |      |      |                |                          |     |
| Performance in Chemistry       |      |      |                |                          |     |



Key:  $R^2$  = coefficient of determination

Table 4 shows correlation coefficients of the relationship between secondary school students' problem-solving skills scores and performance competence scores in Chemistry when moderated by gender as 0.08. This means there was a low positive relationship between male and female students' problem-solving skill and performance scores in Chemistry. The coefficient of determination (0.003) also known as the relationship value means that 0.3% of male and female students' problem-solving skill accounted for the variation in performance competence of students in Chemistry.

**Research Question 5**

What is the correlation among secondary school students' perception of social learning environment, problem solving skills and performance competence in Chemistry?

**Table 5: A Model Summary of Students' Perception on Social Learning Environment, Problem Solving Skills Scores and Performance Competence Scores in Chemistry**

| Model                | N    | r                 | $R^2$ | Magnitude    | Sig               |
|----------------------|------|-------------------|-------|--------------|-------------------|
| Decision & Direction |      |                   |       |              |                   |
|                      |      |                   |       | Low positive | Not               |
| Significant          | 1420 | 0.03 <sup>a</sup> | 0.001 | relationship | 0.58 <sup>b</sup> |

Key:  $R^2$  = coefficient of determination

Table 5 reveals how much of the overall variance of students' performance competence in Chemistry is explained by the variables (students' perception on social learning environment scores and problem solving skills). Results showed that the relationship of the independent variables and the criterion variable was 0.03 and the coefficient of determination ( $R^2$ ) was 0.001. This means there was a low positive relationship between secondary school students' perception on social learning environment scores, problem solving skills scores and performance competence scores in Chemistry scores. The table that explained 1% of the total variance of students' performance in

Chemistry. This also means that 1% of students' performance competence in Chemistry is accounted for by the variables (social learning environment scores and problem solving skills scores).

### **Hypotheses**

**H<sub>01</sub>:** There is no significant relationship between secondary school students' perception of social learning environment and academic performance competence in Chemistry.

Table 2 revealed the Pearson correlation coefficient for the relationship between secondary school students' perception of social learning environment and performance score in Chemistry. A low negative correlation was found  $r(1420) = -0.03$ ,  $p = 0.00 > 0.05$ ) indicating a no significant relationship between the two variables. The null hypothesis which stated that there is no significant relationship between secondary school students' perception of social learning environment scores and performance scores in Chemistry was therefore not rejected. The inference drawn was that there is no significant relationship between secondary school students' perception of social learning environment scores and performance scores in Chemistry.

**H<sub>02</sub>:** There is no significant relationship between secondary school students' perception of social learning environment and performance competence in Chemistry when moderated with gender.

Table 2 revealed the Pearson correlation coefficient for the relationship between secondary school students' perception of social learning environment and performance in Chemistry when moderated with gender. A low negative correlation was found  $r(1420) = -0.02$ ,  $p = 0.00 < 0.05$ ) indicating no significant relationship between the two variables. The null hypothesis which stated that there is no significant relationship between secondary school students' perception of social learning environment and performance in Chemistry when moderated with gender was therefore not rejected.

**H<sub>03</sub>:** There is no significant relationship between secondary school students' problem solving skills and performance competence in Chemistry.

Table 3 revealed the Pearson correlation coefficient for the relationship between secondary school students' problem solving skills and performance score in Chemistry. A low positive correlation was found  $r(1420) = 0.03$   $p = 0.00 > 0.05$ ) indicating a no significant relationship between the two variables. The null hypothesis which stated that there is no significant relationship between secondary school students' problem solving skills and performance in Chemistry was therefore not rejected. The inference drawn was that there is no significant relationship between secondary school students' problem-solving skills and performance in Chemistry.

**H04:** There is no significant relationship between secondary school students' problem solving skills and performance competence in Chemistry when moderated with gender.

Table 4 revealed the Pearson correlation coefficient for the relationship between secondary school students' problem-solving skills and performance in Chemistry when moderated with gender. A low positive correlation was found  $r(1420) = 0.08$  ( $p=0.00 > 0.05$ ) indicating a no significant relationship between the two variables in chemistry when moderated with gender. The null hypothesis which stated that there is no significant relationship between secondary school students' problem-solving skills and performance in Chemistry when moderated with gender was therefore not rejected. The inference drawn was that there is no significant relationship between secondary school students' problem-solving skills and performance in Chemistry when moderated with gender.

**H05:** There is no significant correlation among secondary school students' perception of social learning environment, problem solving skills and performance competence in Chemistry.

Table 5 revealed the Pearson correlation coefficient among secondary school students' perception of social learning environment, problem solving skill and performance in Chemistry. A low positive correlation was found  $r(1420) = 0.03$  ( $p=0.00 > 0.05$ ) indicating a no significant relationship between the three variables. The null hypothesis which stated that there is no significant correlation among secondary school students' perception of social learning environment, problem solving skill and performance in Chemistry was therefore not rejected. The inference drawn was that there was no significant correlation among secondary school students' perception of social learning environment, problem solving skill and performance in Chemistry.

### **Discussion of Findings**

The finding revealed a low negatively relationship between students' perception of social learning and academic performance competence in Chemistry. Hence there was no significant relationship between students' secondary school students' perception of social learning environment scores and academic performance competence scores in Chemistry. The result is in line with Iweka (2017) who revealed a low mean perception and low negative perception between students' performance competence and classroom environment with no significant difference in integrated science but not in line with Kanmani and Nagarathinam (2017) who observed a low positive relationship between students' academic performance competence and their social learning environment using socio-cultural theory (SCT) by Vygostsky with no significant difference. The no significant relationship between

secondary school students' perception of social learning environment scores and performance scores in chemistry could be as a result that students most times they are some non stable situations in learning environment example playing around and been more interested in extracurricular activities than Chemistry learning.

The result revealed a low negative relationship between male and female students' perception of social learning and academic performance competence in Chemistry. Hence, there is no significant relationship between secondary school students' perception of social learning environment and performance competence in Chemistry when moderated with gender. The result is support of Wordu (2014) findings who observed that a well-equipped and conducive learning environment with qualified teachers influence mechanical student's academic performance competence especially male and female students at high extent with no significant difference in gender group's opinion. By virtue of this finding, this research has joined the school of thought that relates a low negative relationship between male and female students' perception of social learning and academic performance competence in Chemistry and no significant relationship between secondary school students' perception of social learning environment and performance competence in Chemistry when moderated with gender.

The finding also shows a low positive relationship between students' problem-solving skill and performance competence scores in Chemistry. Hence, there was no significant relationship between secondary school students' problem-solving skill scores and performance competence scores in Chemistry. The finding was not in consonance with Ariniezca and Ikhsan (2020) who reported that students had a moderate positive relationship between attitude, performance and problem process skills in Chemistry. The results also not in line with Kanmani and Nagarathinam (2017) who observed that problem-solving skill of the higher secondary student was found to be on average and there was a high positive correlation and inter relationship between problem-solving skill, social learning and performance competence in Mathematics and in collaboration with Ariniezca and Ikhsan (2020) who reported that a moderate positive relationship exists between students' academic performance competence and their perception in problem solving skills in Chemistry.

The finding is also not in line with Mandina and Ochinogor (2018) who observed a statistical significant difference in correlation between students' performance competence and problem-solving skills in Mathematics. The low positive relationship between students' problem-solving skill and performance competence scores in Chemistry and no significant relationship between problem solving skill and academic performance competence in Chemistry secondary school students, could

be as a results of problem solving skills being impetus to success.

The result shows a low positive relationship between secondary school students' problem-solving skills scores and performance scores in Chemistry when moderated by gender. Hence, there is no significant relationship between secondary school students' problem-solving skills and performance in Chemistry when moderated with gender. The finding is in consonance with Ariniezca and Ikhsan (2020) who observed a no significant difference in relationship between students' academic performance competence and their perception in problem solving skill in Chemistry using problem-solving skill theory (PSST) and that of Wordu (2014) who observed no significant difference in gender group's opinion do to equal perception on problem solving skills the students.

The data from the study shows low positive relationship between secondary school students' perception on social learning environment scores, problem solving skills scores and performance competence scores in Chemistry scores. The inference drawn there is no significant relationship between secondary school students' perception of social learning environment, problem solving skill scores and performance competence scores in Chemistry. The findings of this result is not in line with the report of Kanmani and Nagarathinam (2017) who reported that problem-solving skill of the higher secondary student was found to be on average and there was a high positive correlation and inter relationship between problem-solving skill, social learning and performance in mathematics. By virtue of the finding, this study has joined the school of thought that postulated a no significant difference in relationship between secondary school students' perception of social learning environment, problem solving skill scores and performance competence scores in Chemistry.

### **Recommendations**

Based on the findings of the study, and the conclusion drawn, the following recommendations are made:

1. Students should constantly make use of the available social learning environment, apply the problem-solving skills in their everyday problems to enable them have more insight to skills.
2. Chemistry teachers should endeavour to create and inculcate right problem solving skills to students to enable them have right attitude towards good academic performance competence.
3. Governments should provide adequate counseling services in schools to monitor students' academic performances competence towards their subjects.

### **Conclusion**

It can be concluded among others that low negative relationship exists

between students' perception of social learning and academic performance competence in Chemistry but the relationship was not significant. Secondly, a low negative relationship between male and female students' perception of social learning and academic performance in Chemistry was concluded but no significant in relationship.

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**EXTRAVERSION AND GENDER AS CORRELATES OF  
SCIENCE PROCESS  
SKILLS ACQUISITION IN CHEMISTRY QUALITATIVE  
ANALYSIS**

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**Abstract:** *The study investigated extraversion and gender as correlates of science process skills acquisition in Chemistry qualitative analysis among senior secondary school students in Enugu State, Nigeria. The study was guided by two research questions and two hypotheses. A correlational research design was adopted for the study. The population of the study comprised 5,754 senior secondary school three (SSIII) Chemistry students in 292 public secondary schools in Enugu State. A sample size of 360 SSIII Chemistry students in 2021/2022 academic session drawn using multi-stage sampling procedure was used for the study. Students' extraversion inventory (SEI) and Chemistry qualitative analysis skills rating scale (CQASRS) were the instruments used for data collection. The two instruments were face validated by five experts and construct validity was done on SEI using factor analysis. The reliability coefficient of SEI items was established using Cronbach Alpha method as 0.85. The reliability estimate of CQASRS was established using Kendall's Co-efficient of concordance ( $w$ ) as 0.92. The research questions and hypotheses (tested at 0.05 level of significance) were answered using Correlation coefficients ( $r$ ) of Pearson, ANOVA of linear regression and Hayes Process Analysis. Findings of the study revealed that the relationship between students' extraversion*



*and their science process skills acquisition in chemistry qualitative analysis was moderate, positive and significant. The moderating influence of gender on the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis was high, positive and not significant. Based on the findings of the study, it was recommended amongst others that, students should be encouraged to undergo self-assessment of their extraversion personality in the way they view and interpret Chemistry qualitative analysis.*

**Keyword:** *Extraversion; Gender; science process skills (SPS); Chemistry*

### **Introduction**

Through society's efforts in natural world to satisfy their needs, Chemistry had broadened their knowledge of methods of water purification and food preparation, varying materials for construction of industries, roads, automobile and home in addition to solving problems resulting from human interaction with the environment (Emendu, 2014). It exposes students to skills which enable them to perform experiments and learn to observe, record, calculate precisely and make intelligent inferences (McDonnel, 2017). Chemistry is an experimental science which relies primarily on the harmony between theory and practice and, therefore, should be taught as such. Understanding the concepts of practical Chemistry, therefore, will assist in enhancing students' understanding and acquisition of skills in Chemistry (Henry, 2017). This is in line with the objectives of senior secondary school Chemistry curriculum in Nigeria. The objectives of senior secondary school Chemistry curriculum include to help students to develop interest in the subject of Chemistry; enable students to acquire basic theoretical and practical knowledge and skills; help learners to acquire basic STM knowledge and skills; among others (FME, 2009, P. ii-iii). These objectives could be achieved through practical Chemistry.

Practical Chemistry at the senior secondary school level consists of two major aspects namely quantitative analysis and qualitative analysis. Quantitative analysis is the estimation of quantity of substances such as acids, bases and salts (Ugwuanyi, 2015). Qualitative analysis deals with identification of various species (cations, anions and functional groups) present in a mixture of species without bothering on the quantity. It answers the question of what is present or not? It consists of the following: preliminary test; cation test and its confirmatory test (metal ions); anion test and its confirmatory test (acid radicals or anions); functional group test and test for starch, proteins, fats and oils.

According to Muhammad (2015), it is aimed at demonstrating proficiency in making reasonable, acceptable and accurate inferences from experimental observations. Qualitative analysis activities stimulate students and teachers' interest when properly carried out. It also, helps students to acquire basic Chemistry knowledge and skills needed to provide positive contributions to the global society through series of tests during practical activities. By this means, students can acquire various science process skills through a systematic series of tests being carried out.

In spite of the valuable benefits of Chemistry qualitative analysis, students' achievement scores at senior secondary school level have been unsatisfactory. This situation has been reported by researchers such as Omiko (2015) and Banjoko, et al. (2018), who observed that students achieved poorly in secondary school science subjects especially Chemistry. Similarly, secondary school students' achievements in Chemistry in Nigeria as reported by the statistics section of West African Examination Council (WAEC) office (2017) from 2007 to 2016 fluctuated. In addition, analysis of reports from the Chief examiners' of WAEC, 2017-2021 showed that mean achievement scores of students in Chemistry practical fluctuated. The poor achievement of students in Chemistry in general, and qualitative analysis aspect of Chemistry paper 3 in particular, were attributed to some factors as reported by WAEC Chief Examiners. For instance, the WAEC Chief Examiner in these years commented on the strengths of the students in their ability to carry out tests and identify the gases evolved. But the factors that affected their poor achievement include inability to record observations, carrying out test on solid sample instead of solution, inability to identify colours and give logical inferences. The above weaknesses contributed to their low achievement in Chemistry qualitative analysis.

From the above reports, it could be deduced that the poor achievement in Chemistry qualitative analysis could be attributed to low Chemistry practical skills acquisition. These reports are in agreement with Ugwuanyi (2015), who revealed that students had low level of acquisition of science process skills (SPS) in Chemistry qualitative analysis in Enugu State. This unsatisfactory situation if not checked would have adverse effect on the students such as students' low interest and enrolment in Chemistry and society in general, such as shortage of manpower in professions like medicine, pharmacy and nursing amongst others. Considering the consistent poor achievement of students in Chemistry, researchers have investigated on different factors that have constituted to the ugly state apart from low level of acquisition of SPS as stated above. Other factors include class size and gender (Jack, 2018), classroom environment and interest (Ezike, 2018), extent of use of practical activities (Okorie & Ugwuanyi, 2019) amongst others. Despite

these efforts made by these researchers, the issue of poor academic achievement evidenced by poor acquisition of SPS among students still persists.

Science process skills are among the skills acquired during Chemistry practical activities. Aydogdu (2015) defined science process skills as mental and physical abilities and competencies which serve as basic tools required for the effective study of science and technology as well as problem solving for individual and societal development. These skills can be referred to as the 21<sup>st</sup> century skills that are needed in Science, Technology, and Engineering and Mathematics (STEM) subjects to improve the technological advances. The American Association for the Advancement of Science (AAAS, 1967) classified the science process skills into fifteen which consist of basic and integrated skills. The skills include; observing, measuring, classifying, communicating, predicting, inferring, using number, using space/time relationship, questioning, controlling variables, hypothesising, defining operationally, formulating models, designing experiment and interpreting data. The basic process skills are suitable set of skills introduced in science learning for primary school and junior secondary school levels and provide a foundation for learning the integrated skills. While the integrated process skills are more suitable for senior secondary and tertiary school levels (Seetee, et al. 2016). Hence, both basic and integrated science process skills are relevant and appropriate at the senior secondary school level in Nigeria. The acquisition of process skills by studying Chemistry as course enables students to understand the concepts of Chemistry easily, promote positive attitudes towards Chemistry among students. Despite the importance of science process skills, there is a serious educational gap in this area as evidenced by Jack (2018) both in bringing these skills into the classroom and in the training of teachers to use them effectively which results in low acquisition of the skills. Irwanto, et al. (2018) also revealed that low level of students' acquisition of SPS in terms of some variables in Chemistry, results to poor achievement in Chemistry. Researches into the factors that could cause students' low acquisition of science process skills attributed them to factors among which include personality (Ezike, 2017), gender (Jack, 2018), self-efficacy (Oyelekan, et al. 2019) amongst others.

The way people interact in a group varies greatly from one person to another. Some people are open and relaxed. They easily talk to others and enjoy social interaction and contributing in groups. Others are reserved and find it difficult to communicate in a group. Such individuals avoid contributing in social settings. These personality types are known as extraversion and introversion respectively (Ramyashilpa, 2020). Individual acquisition of science process skills in chemistry qualitative analysis may be greatly influenced by an individual's

personality type, hence, it is important to find out whether the extraversion aspect of personality and students' acquisition of science process skills are related. Personality refers to individual differences in the way they feel, think and behave that make individuals similar to and/or different from each other (Nyarko, et al. 2016). Though the dimensions of personality are beyond one's control, they strongly influence one's attitudes, expectations, assumptions and behaviour. John and Srivastava (1999) identified a popular and extensively used personality constructs model known as Five Factor Model (FFM) which extraversion is a facet of it. Extraversion refers to the ability of the students to be assertive, exciting, positive emotions, enthusiastic, engagement, action-oriented individuals and are often perceived as full of energy. Extroverts are outgoing and sociable, whereas introverts are more solitary and dislike being the centre of attention (Friedman & Schustack, 2016). According to researchers such as Chen and Lai (2015), Mkpanang (2015), Taiwo and Amadi (2019) that extraversion was positively and significantly correlated with achievement. The studies by Mahmuda (2017), Khan, et al. (2018) and Shaka (2020) revealed no significant correlation between extraversion and academic achievement among school students.

The extraversion of individuals may differ in males and females. In other words, gender may be a moderating variable on students' extraversion. According to Eyi (2019), gender is culturally and socially constructed roles, responsibilities, privileges, relations and expectations of women, men, boys and girls. The concept of gender in any society determines the existence of ways of life of the members in the society. Gender differences have historically been held responsible for divergence in academia and career success. The influence of gender on students' extraversion and their science process skills acquisition has continued to attract the attention of the educators and researchers. Some studies have been carried out to find out the influence of gender on students' extraversion or their science process skills acquisition. For instance, Zeidan and Jayosi (2015) and Khan (2020) reported that there was no significant difference on attitudes to science and extraversion on academic performance with regards to gender among students respectively. The studies by Kusnierz, et al. (2020) and Olowookere, et al. (2020) found significant difference on the effect of gender and students extraversion on educational performance. The above studies indicated that there are inconsistent results with respect to influence of gender on extraversion and acquisition of SPS. Therefore, the researchers deemed it important to contribute to the academic debate on influence of gender on extraversion and SPS acquisition due to contradictory results.

**Statement of Problem**

In spite of the valuable contributions of Chemistry to the society, Chemistry students' achievement at senior secondary school level has been unsatisfactory. This situation has been reported by researchers and WAEC Chief Examiners. The average percentages of students' achievements in Chemistry in Nigeria as reported by WAEC Chief Examiners from 2007 to 2021 revealed that achievement of students in Chemistry has been relatively low, fluctuating and unsatisfactory. The reports also showed that the students' poor achievement in Chemistry qualitative analysis contributed to their overall poor achievement in Chemistry. This is because students' achievement in qualitative analysis forms part of their overall assessment in Chemistry. This might have resulted from the students' poor acquisition of science process skills in Chemistry qualitative analysis.

The knowledge of process skills in science and chemistry in particular is very important for proper understanding of concepts, which allow students to conduct investigation and reach conclusions in chemistry qualitative analysis. In spite of these importance of science process skills, research reports have revealed students' low acquisition of skills which has become more evident in students' poor achievement in Chemistry. Researches have shown that the acquisition of science process skills could be affected by some factors such as; personality, gender and self-efficacy amongst others.

Available studies revealed that extraversion has been associated with academic motivation and achievement. From studies reviewed, there is no evidence to the best knowledge of the researchers whether students' extraversion relates to acquisition of SPS in Chemistry qualitative analysis or not. In addition, there are still conflicting results and inconclusiveness on the moderating influence of gender on students' extraversion or acquisition of science process skills. The problem of the study, put in form of a question therefore is: what is the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis using gender as moderating variable?

**Purpose of the study**

In line with the problem of the study, the purpose of the study was to examine extraversion and gender as correlates of senior secondary school students' science process skills acquisition in Chemistry qualitative analysis in Enugu State. Specifically, the study intends to:

1. find out the relationship between students' extraversion and their science process skills acquisition in Chemistry qualitative analysis.

2. find out the moderating influence of gender on the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis.

### **Research Questions**

The following research questions guided the study

1. What is relationship between students' extraversion and their science process skills acquisition in Chemistry qualitative analysis?
2. What is moderating influence of gender on the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis?

### **Hypotheses**

Based on the purpose of the study, the following null hypotheses were formulated and tested at 0.05 level of significance.

1. There is no significant relationship between students' extraversion and their science process skills acquisition in Chemistry qualitative analysis.
2. There is no significant moderating influence of gender on the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis

### **Methodology**

The study adopted a correlational survey research design. The study was carried out in secondary schools in Enugu State, Nigeria. The population of the study comprised 5,754 senior secondary school three (SSIII) Chemistry students in 292 public secondary schools in Enugu State. A sample size of 360 SSIII Chemistry students consisting of 184 males and 176 females, in 2021/2022 academic session from fifteen (15) schools drawn using multi-stage sampling procedure was used for the study. Students' extraversion inventory (SEI) adapted from (John and Srivastava, 1999) and Chemistry qualitative analysis skills rating scale (CQASRS) adapted from (Ugwu, 2014) were the instruments used for data collection. The SEI and CQASRS consisted of two sections –A and B. Section A dealt with personal information of the students such as students' identification number and gender. While section B of SEI contains items statements on students' extraversion facet of personality. The instrument contains both positive and negative statements. The scale is SA-4 points, A-3 points, D-2 points and SD-1 point for positive statements and vice versa for negative statements. Section B of CQASRS consisted of items statements of Chemistry qualitative analysis under the ten science process skills. The rating scale points are: Excellent (E) – 4 points, Good (G) - 3 points, Fair (F) - 2 points and Poor (P) - 1 point.

The two instruments were face validated by five experts and construct

validity was done on SEI using factor analysis. The reliability coefficient of SEI items was established using Cronbach Alpha method as 0.85. The reliability estimate of CQASRS was established using Kendall's Coefficient of concordance ( $w$ ) as 0.92. After rating students on CQASRS by the researchers during the qualitative analysis activities and the administration of SEI to the students, the scores of the two instruments were converted to percentages to standardize them since the number of items in both instruments are not equal. The research questions and hypotheses (tested at 0.05 level of significance) were answered using Correlation coefficients ( $r$ ) of Pearson, ANOVA of linear regression and Hayes Process Analysis. The degree of the relationship was interpreted in accordance with Okoye (2015) as follows:  $r = 0.00$ , no relationship,  $r = 0.00$  to  $\pm 0.20$ , very low relationship;  $r = \pm 0.20$  to  $\pm 0.40$ , low relationship;  $r = \pm 0.40$  to  $\pm 0.60$ , moderate relationship;  $r = \pm 0.60$  to  $\pm 0.80$ , high relationship and  $r = \pm 0.80$  to  $\pm 1.00$ , very high relationship.

## Results

**Research Question One:** What is the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis?

**Table 1: Pearson's Product Moment Correlation Coefficient ( $r$ ) and Coefficients of Determination ( $R^2$ ) of the Relationship Between Students' Extraversion and their Acquisition of Science Process Skills in Chemistry Qualitative analysis.**

| Variables                                | $N$ | $\bar{X}$ | $SD$ |
|--|-----|-----------|------|
| $r$ $R^2$                                |     |           |      |
| Students' extraversion<br>0.45      0.20 | 360 | 44.86     | 5.95 |
| Science process skills                   | 360 | 55.67     | 8.68 |

**KEY:**  $N$  = Number of respondents,  $r$  = Correlation coefficient,  $R^2$  = Coefficient of determination.

Result in Table 1 shows the relationship between students' extraversion and their acquisition of science process skills (SPS) in Chemistry qualitative analysis. The result indicates that the correlation coefficient ( $r$ ) obtained between students' extraversion and their acquisition of SPS in chemistry qualitative analysis was 0.45. This shows that there is a moderate positive correlation between students' extraversion and their acquisition of SPS in Chemistry qualitative analysis.

**Hypothesis One:** There is no significant relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis.

**Table 2: Regression ANOVA test of Significant Relationship Between Students’ Extraversion and their Acquisition of Science Process Skills in Chemistry Qualitative Analysis**

| Model      | Sum of Squares    | df  | Mean Square | F |
|------------|-------------------|-----|-------------|---|
| Sig.       | Dec               |     |             |   |
| Regression | 5524.192          | 1   | 5524.192    |   |
| 91.901     | .000 <sup>b</sup> |     |             |   |
| 1 Residual | 21519.472         | 358 | 60.110      |   |
| Total      | 27043.664         | 359 |             |   |

$\alpha = 0.05$ , S = significant, NS = not significant

Result in Table 2 shows that an f-ratio of ( $F(1, 359) = 91.901, p = 0.00$ ) was obtained for the relationship between students’ extraversion and their acquisition of science process skills (SPS) in Chemistry qualitative analysis. Since the associated probability ( $p$ ) value of 0.00 is less than 0.05 level of significance at which the result is being tested, the null hypothesis one ( $H_{01}$ ) which states that there is no significant relationship between students’ extraversion and their acquisition of SPS in Chemistry qualitative analysis is, therefore, not accepted. Hence, inference drawn is that, the relationship between students’ extraversion and their acquisition of SPS in Chemistry qualitative analysis is statistically significant. This implies that students’ extraversion made a significant association with their acquisition of SPS in Chemistry qualitative analysis.

**Research Question Two:** What is moderating influence of gender on the relationship between students’ extraversion and their science process skills acquisition in Chemistry qualitative analysis?

**Table 3: Andrew Hayes Macro Process Analysis of the Moderating Influence of Gender on the Relationship Between Students’ Extraversion and their Acquisition of Science Process Skills in Chemistry Qualitative Analysis.**

| Model | Interaction           | N   | r     | R <sup>2</sup> | SE   |
|-------|-----------------------|-----|-------|----------------|------|
| t     | P                     | Dec |       |                |      |
| 1     | Extraversion × gender | 360 | 0.667 | 0.44           | 8.14 |
| 1.88  | 0.06                  | N   |       |                |      |

The result in Table 3 shows the relationship between students’ extraversion and the acquisition of science process skills (SPS) as moderated by gender. The result shows that the correlation coefficient ( $r$ ) of 0.667 was obtained. This means that there is a high positive relationship between students’ extraversion and acquisition of SPS as moderated by gender.



**Hypothesis Two:** There is no significant moderating influence of gender on the relationship between students' extraversion and their acquisition of science process skills in Chemistry qualitative analysis.

The result as shown in Table 3 on the significance different in the moderating influence of gender on the relationship between students' extraversion and their acquisition of SPS in Chemistry qualitative analysis indicates that a t-value of 1.88 with associated probability value of 0.06 was obtained. Since the probability value of 0.06 is greater than 0.05 set as the level of significance, the null hypothesis seven ( $H_0$ ) which states that there is no significant difference in the moderating influence of gender on the relationship between students' extraversion and their acquisition of SPS in Chemistry qualitative analysis is accepted. Inference drawn is that, the moderating influence of gender on the relationship between students' extraversion and their acquisition of SPS in Chemistry qualitative analysis is not statistically significant.

### **Discussion**

The findings of the study revealed that the relationship between students' extraversion and their acquisition of science process skills (SPS) in Chemistry qualitative analysis is moderate, positive and significant. This could be so since extraversion individuals are action-oriented. Hence, it could be reasonable to expect students who possess moderate level of extraversion to be active in Chemistry qualitative analysis activities which ultimately could lead to improve acquisition of SPS. It also implies that, there is proof that students who are outgoing and interacts with others, learn a lot in the course of their relationship, especially in the academic environment. Those who are introverts and less sociable have the tendency of missing the learning opportunities in social interactions. The finding is in agreement with Chen and Lai (2015), Mkpang (2015), Taiwo and Amadi (2019) who found that extraversion was positively and significantly correlated with achievement. These findings indicate that, the level of education or class of a person may not influence the outcome of association between students' extraversion and their acquisitions of SPS. However, it disagreed with Mahmuda (2017), Khan, et al. (2018) and Shaka (2020) who found out that there was no significant correlation between extraversion and academic achievement among school students. The disparity between the present study and the previous studies could be because of differences in subject areas, quality of education of countries involved, domain of education objectives tested in the study which might have activated some differences in terms of concepts and exposures.

The analysis of research question two and the corresponding hypothesis two

revealed that there was a high, positive and significant moderating influence of gender on the relationship between students' extraversion and their acquisition of SPS in Chemistry qualitative analysis. This could be true since both male and female students were taught by same teacher in the same environment, hence, they are expected to possess the same attributes in the same phase. This implies that extraversion is personal and individualistic and not necessarily a product of person's gender, hence no significant difference. The finding is in accordance with Zeidan and Jayosi (2015) and Khan (2020) who reported that there was no significant difference on attitudes to science and extraversion on academic performance with regards to gender among students respectively. The relationship between the previous findings and the present study might have resulted from same personality facet, instrument used for data collection and influence of gender on science process skills with the same level of education. The finding is not in agreement with Kusnierz, et al. (2020) and Olowookere, et al. (2020) who found significant difference on the effect of gender and students' extraversion on educational performance. The disparity between the present study and the previous studies could be due to differences in level of education, sample size and quality of education between the countries.

### **Conclusions**

Based on the findings and discussions of the study, the researchers concluded that students' extraversion positively and significantly associated with their acquisition of science process skills (SPS) in Chemistry qualitative analysis. This implies that students should be encouraged to avoid high level of extraversion which could impact negatively on their acquisition of SPS. In addition, the moderating influence of gender on the relationship between students' extraversion was positive but not significant correlate of their acquisition of SPS in qualitative analysis. The finding of this study dismisses the notion of gender disparity in students' extraversion and achievement in academic achievement or acquisition SPS in chemistry qualitative analysis.

### **Recommendations**

Based on the findings of the study, the following recommendations were made:

1. Students should be encouraged to undergo self-assessment of their extraversion aspect of personality to avoid high level which could impact negatively on the way they view and interpret Chemistry qualitative analysis.
2. Chemistry teachers are expected to identify the extraversion facet of personality of students to render necessary academic help to avoid high level which could lead to low acquisition of skills in chemistry qualitative analysis.

3. The government through Post-Primary School Management Board (PPSMB) is expected to allocate necessary budget, arrange training, seminar and workshop on the issue of students' personality.
4. Parents should exhibit a set of emotional and behavioural patterns worthy of emulation to avoid high extraversion which would affect their acquisition of skills.

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## THE IMPACT OF LIMITED ACCESS TO CULTURAL RESOURCES ON THE SOCIAL DEVELOPMENT OF RURAL CHILDREN AND EDUCATIONAL SOLUTIONS TO OVERCOME THIS OBSTACLE

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**Abstract:** *Access to cultural resources plays a key role in children's social and cognitive development, but children in rural areas often face significant limitations in this regard. This study explores the impact of reduced access to culture on social development and interest in authentic values among primary school children in rural areas. Based on applied research in a rural school, the article presents a series of educational interventions aimed at compensating for the lack of cultural resources, including virtual visits to cultural institutions, creative workshops, and collaborations with local artists. The results show an increase in students' interest in culture, an improvement in social skills and a greater level of connectivity between students. The conclusions suggest that the large-scale implementation of these educational solutions can contribute to reducing inequalities in access to culture and to the harmonious integration of students in the community.*

**Key words:** *access to culture; cultural education; social development; rural inequality; educational interventions.*

### **Theoretical foundation**

Access to culture is a crucial factor in the social and educational development of children, having profound implications for the formation of their identity, values and integration capacities. Culture, defined in an educational sense, represents not only a patrimony of values and knowledge, but also a dynamic process through which individuals are formed and integrated into society (Bourdieu, 1988). In an educational context, culture is understood as a "frame of reference", through which children learn both social norms and relational and critical thinking skills (Bocoş & Jucan, 2008).

The literature shows that exposure to cultural activities contributes significantly to the cognitive, emotional and social development of children. According to Gardner (2005), culture facilitates what we call "multiple intelligence", providing children with opportunities for creative expression, empathy and understanding of diversity. For example, recent studies emphasize that children's participation in cultural activities, such as visual arts, music, or theater, improves communication and collaboration skills (Hanna, 2019).

Cultural education is often defined as an essential component of the modern curriculum, as it promotes fundamental values, such as respect for diversity, critical reflection and creativity (UNESCO, 2020). This approach supports the idea that education must be centered on authentic values, which contributes to the well-being and integral development of children (Cucoş, 2018). In addition, cultural education develops children's ability to reflect on their own culture, but also on other cultures, thus promoting a deeper understanding and openness to cultural diversity (Seligman, 2011).

Seligman (2011) argues that cultural education is a vector of emotional and social development, promoting aspects such as commitment, optimism and connectivity – essential elements for long-term well-being. According to the study conducted by Ronen and Bachar (2019), children who are involved in cultural activities demonstrate a greater capacity for adaptation and social resilience, being better able to collaborate and communicate effectively. Cultural activities also stimulate critical thinking and creativity, forming young people capable of actively contributing to the life of the community (Antonesei, 1996). Another important aspect is the influence of cultural education on emotional intelligence. As Roman and Balaş (2010) argue, children who participate in cultural activities demonstrate increased emotional intelligence, being able to manage emotions and adapt more easily in various social situations. Culture thus contributes not only to intellectual development, but also to the formation of essential skills for life in society.

The inequality of access to cultural resources between rural and urban areas is a problem that accentuates educational and social disparities. Studies show that limited access to cultural institutions and lack of infrastructure affect the development of children in rural areas, limiting their opportunities to experience and learn from cultural activities (OECD, 2021). In Romania, children in rural areas often have limited access to museums, theatres and libraries, and this affects their cognitive and social development (Eurostat, 2020).

The literature emphasizes that unequal access to culture can reduce children's interest in education and culture, accentuating the tendency of social isolation. According to a study by the European Commission

(2020), cultural disparities lead to a decrease in social connectivity and a sense of belonging among children in rural areas. These factors contribute to difficult social integration and poorer preparation for adult life (Păun & Potolea, 2002).

Living conditions and limited resources in rural areas hinder children's access to cultural activities, with lack of transport and long distances being major obstacles (Roman & Torkos, 2019). In the absence of innovative and adapted educational solutions, children in rural areas risk being deprived of the formation of a cultural identity and the social skills necessary for a harmonious integration into society.

To reduce these disparities, educational interventions adapted to the rural context are essential. Cultural education can provide children in rural areas with formative experiences, such as virtual tours of museums or cultural workshops held in schools. Collaboration with local artists and access to online cultural resources are examples of solutions that can help compensate for rural deprivations (Gardner, 2005; UNESCO, 2020).

Thus, in order to ensure the social and cultural development of children, formal education must include strategies to capitalize on culture adapted to the specificity of the rural environment, providing access to cultural activities that stimulate creativity, empathy and emotional intelligence.

### **Research:**

The purpose of this study is to explore the impact of limited access to cultural resources on social development and interest in authentic values among children in rural areas. The study examines to what extent the lack of access to cultural institutions affects the formation of social skills and openness to cultural diversity, proposing educational solutions adapted to this context.

The main hypothesis is that limited access to cultural resources negatively affects children's interest in culture and the formation of social skills. Through innovative and culturally interactive educational activities, children in rural areas can develop essential social skills, improving their social connectivity and interest in cultural diversity.

The study was conducted in a rural school, with primary school students aged between 9 and 10 years old. The research uses a quasi-experimental method, with pre- and post-intervention measurements to identify changes in students' attitudes and social skills.

The research sample includes 30 students from a rural school in Romania, selected based on accessibility to cultural activities and availability to participate in educational interventions.

The assessment tool was the CASEL-SEL questionnaire (*Collaborative for Academic, Social, and Emotional Learning – Social and Emotional Learning*) which has been adapted to assess social and emotional



competences, including communication, collaboration and adaptability. CASEL-SEL is used to measure social interaction skills and is flexible for various educational contexts, being able to provide a clear picture of changes in children's social development.

The intervention program included a series of innovative cultural activities, carried out over six months, aimed at developing students' interest in culture and collaborative skills. These activities have been adapted to the specifics of the rural environment, using available resources and interactive technological means. The proposed activities were:

### **1. "Culture through my eyes" project**

The students were involved in an activity of documenting local traditions and customs. They interviewed members of the community and took photos and videos about unique aspects of life in the village. This project had the role of developing their communication skills and strengthening their sense of belonging to the local community. Through this approach, the children were encouraged to become explorers of their own culture, learning to appreciate local values and pass them on.

### **2. Creating a Virtual Exhibition**

After the completion of the project, the students' works were presented in a virtual exhibition, accessible to parents and other members of the community. This format gave students the chance to see their work publicly appreciated and increase their confidence in their own abilities. The virtual exhibition was a way to bring the community closer to educational activities and to emphasize the importance of local culture.

### **3. Digital storytelling workshops**

Students learned to create digital stories using text, images, and sound to illustrate moments in their lives or community history. This innovative method stimulated creativity and helped children express their ideas in a personal way. The digital stories were an opportunity for students to develop essential technical skills and express themselves in an accessible and attractive format.

### **4. Heritage exploration through augmented reality**

Using augmented reality (AR) applications, the students had the opportunity to explore objects from the Romanian cultural heritage, such as famous monuments and works of art. This technology allowed them to virtually "visit" museums and discover art objects in detail, stimulating their curiosity and interest in national culture. Augmented reality has opened up new cultural horizons for students, providing them with an immersive and modern learning experience.

### **5. Role-playing games on historical themes**

The students participated in role-playing sessions, in which they played characters from the history and culture of Romania. These activities have been designed to develop empathy and critical thinking, engaging students in understanding historical and cultural contexts through active participation. Role-playing fostered collaboration and strengthened students' social skills, helping them to better understand the role that culture plays in their lives and that of the community.

The intervention was structured in three distinct stages, aimed at assessing and developing students' social and emotional skills through innovative cultural activities. Each stage had a well-defined role within the programme, ensuring both the initial assessment and the monitoring of progress and the analysis of the changes that occurred following the intervention.

The first stage, the initial phase, consisted of the application of the CASEL-SEL questionnaire, a tool specially adapted to assess the socio-emotional competences of students. This questionnaire provided an overview of the students' communication, collaboration, empathy and adaptability skills before the intervention began. The application of this tool was intended to identify strengths and areas for improvement, establishing a basis for comparison for subsequent evaluations. Thus, the data collected at this stage allowed an in-depth understanding of the initial level of socio-emotional competences, providing a starting point for measuring progress.

The second stage, the intervention phase, was the core of the program and took place over a period of six months. During this period, the students were involved in various innovative activities, each of which had specific personal and cultural development objectives. The activities were carefully monitored by the teachers, who had the role of observing and documenting the students' reactions and progress in each activity. The involvement of the students in the proposed activities – from the creation of virtual exhibitions and digital storytelling projects, to role-playing games inspired by cultural themes – stimulated a series of fundamental social and emotional competences. During this stage, teachers provided continuous support, encouraging students to actively participate and express themselves freely, ensuring a safe and stimulating environment for their development.

The last stage, the final stage, was intended to evaluate the progress made by the students following the intervention. The CASEL-SEL questionnaire was reapplied to analyse changes in students' social and emotional competences, assessing the impact of the activities on their communication skills, collaboration and interest in cultural values. The results of this phase provided a clear comparison between the initial and final level of skills, highlighting the improvements achieved. This stage allowed a reflection on the effectiveness of the intervention and

highlighted the aspects that contributed the most to the development of the students.

By carrying out these three stages, the intervention created a complete framework for evaluation and development, providing both an initial diagnosis and active monitoring and a final assessment of progress. Structuring the intervention in these stages facilitated a well-organized approach adapted to the needs of the children, contributing to the creation of an educational program with a significant impact on their socio-emotional and cultural development.

### **Results:**

The results of this intervention showed significant changes in the development of students' social skills and cultural interest, highlighting the positive impact of the innovative cultural activities carried out during the six months. The comparative analysis of the data collected through the CASEL-SEL questionnaire before and after the implementation of the program, together with the teachers' observations, highlighted the students' progress in terms of communication, collaboration, empathy and openness to cultural diversity.

One of the most notable results was improved communication and collaboration skills. Activities that involved interaction with peers and community members, such as the "Culture through my eyes" project and the digital storytelling workshops, encouraged students to express themselves more openly and communicate more effectively. As a result of these activities, many of the students demonstrated a greater ability to express their ideas and feelings, as well as a more confident attitude towards their peers and teachers. The data from the questionnaire confirmed a significant increase in the scores on the items related to communication and adaptability, highlighting the effect of these activities on students' openness to social interaction.

Also, activities to explore cultural heritage through augmented reality and role-playing games on historical themes have contributed to the development of critical thinking and empathy. These activities, which encouraged students to explore and identify with characters and cultural contexts, stimulated their curiosity and developed their ability to understand different perspectives. The observations made by the teachers indicated an increase in empathy and the desire to collaborate with colleagues, the students becoming more aware of the importance of collaboration and respecting the opinions of others.

Another significant result was the students' increased interest in local and national culture, demonstrated by their active involvement in the documentation projects and in the virtual exhibition. The activities of documenting local traditions aroused the interest of the students in the cultural heritage of their community, they expressed a greater openness

to cultural values and a desire to participate in similar initiatives in the future. This change was also reflected in the results of the CASEL-SEL questionnaire, where an improvement in the scores related to interest in cultural activities and openness to new experiences was observed.

The overall analysis of the collected data and observations demonstrates that the intervention had a positive impact on the social and cultural development of students, providing them with learning opportunities that complemented formal education. The children became more open, more empathetic and more able to collaborate, and their interest in cultural values intensified, creating the premises for a harmonious development and easier integration into their community.

### **Conclusions:**

The educational intervention implemented demonstrated that, through innovative cultural activities, children from rural areas can develop essential social skills and develop a genuine interest in local and national culture, even in the absence of direct access to traditional cultural institutions. The results of this study emphasize that cultural education has a vital role in the formation of socio-emotional competences and in the development of a cultural identity in primary school students.

The proposed activities, such as cultural documentation projects, digital storytelling and heritage exploration through augmented reality, proved effective in increasing communication and collaboration skills, but also in stimulating critical thinking and empathy. The children were encouraged to express themselves freely, share their ideas and collaborate with their peers, contributing to an open and collaborative learning atmosphere. This experience gave them the opportunity to connect with the values of the community and their cultural identity, thus increasing their sense of belonging.

The observations and data collected during the three phases of the intervention showed that the integration of interactive and digital cultural activities within the school can compensate, at least partially, for the lack of direct access to physical cultural resources. The results of this study can be a starting point for the implementation of similar programs at national level, which reduce the disparities in access to culture between urban and rural areas, thus contributing to the harmonious development of all children.

In conclusion, cultural education adapted to the specificity of the rural environment not only offers children valuable learning opportunities, but also contributes to the development of essential skills for community life. The widespread implementation of such initiatives could support children's integration into society, while developing their respect for diversity and a greater openness to authentic values. These initiatives should be supported by educational policies that promote collaborations

between schools, local communities and cultural institutions, thus ensuring equitable access to cultural and social education for all students.

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## THE CONTRIBUTION OF SPORT TO THE DEVELOPMENT OF EMOTIONAL INTELLIGENCE AMONG ADOLESCENTS: AN EDUCATIONAL PERSPECTIVE

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**Abstract:** *Sport is an important vector in the development of adolescents' emotional intelligence, contributing to the formation of social and emotional skills that are essential for their harmonious integration into society. This study explores the educational role of sport in developing self-control, empathy and collaboration skills in adolescents. During a six-month intervention in an urban school, sports activities were organized in such a way as to promote interaction, cooperation and management of emotions. The results indicate a significant improvement in the emotional intelligence of the participants, with a focus on relationship skills and adaptability, confirming the importance of sport as an educational tool for socio-emotional development. The findings suggest that sport should be integrated more frequently into school curricula, having a positive impact on adolescents' emotional and relational health.*

**Key words:** *sport; emotional intelligence; social skills; adolescents; education; collaboration; self-control.*

### **Theoretical foundation**

Sport represents a holistic development environment for adolescents, having a significant impact not only on physical well-being, but also on socio-emotional and cognitive development. Recent studies confirm that sport promotes the formation of emotional intelligence and social skills, providing adolescents with unique contexts to learn to manage their emotions, collaborate and develop harmonious relationships with those around them.

Emotional intelligence (EI) is defined as the ability to recognize,

understand, and manage one's own emotions as well as those of others (Petrides, 2011). In the sports environment, adolescents are often put in situations of competition and cooperation that require self-control, resilience and empathy, thus contributing to the development of emotional intelligence. According to a study by Laborde et al. (2016), regular sports have a positive correlation with EI, demonstrating that adolescents involved in sports develop their ability to manage their emotions and react constructively to challenges.

In a recent study, Taks and Scheerder (2019) found that adolescents who play sports show increased development of emotional regulation and resilience skills, due to constant exposure to situations that require adaptability and perseverance. This is a central dimension of EI, and sport provides an ideal framework to develop and strengthen this skill.

Sport offers many opportunities to develop social skills, which include communication, collaboration and compliance with collective norms. According to research conducted by Jones and Lavalée (2009), sports activities stimulate adolescents' social skills, making them more likely to collaborate, share resources and develop a positive attitude towards their peers. Team activities also encourage relationships based on respect and mutual support, being recognized for lasting benefits on the development of character and interpersonal skills (Fraser-Thomas et al., 2020).

In addition, sports help teenagers develop leadership skills and improve their self-confidence. As the study by Holt et al. (2019) shows, adolescents who regularly participate in team sports develop a proactive attitude and greater adaptability in the face of challenges, essential skills for adult life.

Empathy and self-control are essential skills of emotional intelligence, and sport is an ideal environment to develop them. By participating in sports activities, adolescents are exposed to contexts that require understanding the emotions of others, providing support and respecting differences between peers (Jowett & Shanmugam, 2016). According to a study by Harwood et al. (2021), adolescents involved in sports activities show a greater capacity for empathy and emotional resilience, being able to manage conflicts and cooperate effectively in a team.

In addition, sport provides an environment for practicing self-control, as young people learn to manage their emotions in times of stress and intense competition. The study by Crane and Temple (2015) shows that adolescent athletes show an increased ability to control their emotional reactions, self-control becoming a transferable skill in different social and educational contexts. These skills, once formed through sport, remain a valuable long-term resource, supporting adolescents in social integration and personal development.

Given the significant benefits of sport on emotional intelligence and

social skills, its integration into formal education would make important contributions to the training of young people. According to a UNESCO report (2018), physical education should be an essential component of the school curriculum, having an essential role in the holistic development of adolescents. Recent studies, such as the one conducted by Bailey and Howells (2020), argue that physical and sports education programs that are structured to develop emotional and social skills can contribute to the formation of balanced and empathetic young people, capable of collaborating and managing conflicts in a constructive way. In conclusion, sport offers a complex educational framework, ideal for the development of emotional intelligence and social skills, having a lasting impact on the socio-emotional health of adolescents. By integrating sport into formal education, schools can contribute to the formation of young people capable of harmonious relationships and emotional balance, thus facilitating an easier transition to adult life.

**Research:**

The purpose of this study is to explore the role of sports activities in the development of emotional intelligence and social skills of adolescents. The study aims to investigate to what extent sport contributes to the formation of self-control, collaboration, empathy and resilience skills. By regularly participating in sports activities, adolescents can develop a series of social and emotional skills essential for a harmonious integration into the community and for personal balance.

The main hypothesis of the study is that adolescents involved in structured sports activities will significantly improve their level of emotional intelligence and social skills, compared to those who do not participate in such activities. Sports activities are expected to stimulate collaboration, respect for others and emotion management skills in high-intensity contexts.

The study was carried out over six months in an urban school, with adolescents from the eighth and ninth grades, aged between 13 and 15 years, as participants. The method used is quasi-experimental, with pre- and post-intervention assessments, to measure students' progress in the field of emotional intelligence and social skills.

The research sample included 40 adolescents, divided into two groups: an experimental group (20 students involved in the proposed sports activities) and a control group (20 students who did not participate in additional sports activities).

For the assessment of emotional and social competences, the SEI-YV questionnaire (Social and Emotional Intelligence - Youth Version) was used, a tool validated and adapted to measure the dimensions of emotional intelligence in adolescents. SEI-YV assesses skills such as



self-control, empathy, collaboration, and adaptability, making it ideal for analyzing the changes that occur as a result of participating in sports activities.

During the six months of intervention, the adolescents in the experimental group participated in a series of structured sports activities organized in the form of training and team games. These activities have been selected to foster collaboration, self-control and the ability to work effectively in a team, as well as to encourage respect for colleagues and perseverance.

During the six months of intervention, the adolescents in the experimental group were involved in various sports activities, structured to stimulate collaboration, self-control and the ability to work effectively in a team. These activities have been specifically designed to contribute to the development of empathy and resilience, providing adolescents with real contexts for emotional and social learning.

A central component of the intervention was regular participation in team games, such as football, basketball and handball, aimed at developing the spirit of collaboration and empathy. The teenagers were put in the situation of cooperating to achieve a common goal, learning to respect the rules, to show fair play and to manage conflict situations in a constructive way. After each game session, the students were invited to reflect on their experiences, discussing how collaboration and respect for other colleagues contributed to the success of the team and the cohesion of the group.

To develop the capacity for self-control and resilience, the adolescents participated in training and physical exercises that involved endurance and self-control challenges in moments of intense effort. These sessions gave them the opportunity to learn how to manage their emotions in stressful situations and respond positively to difficulties. Following each training, the teenagers had the opportunity to discuss the moments when they felt their limits, reflecting on how they managed to overcome them and the strategies they used to control their emotions.

Teambuilding activities were another essential component of the intervention, being designed to improve communication and collaboration skills. The adolescents participated in collaborative tasks that required good organization and the ability to solve problems together, each participant having a well-defined role in the activity. These exercises gave them the opportunity to practice conflict resolution in an effective way, encouraging them to be patient, actively listen and respect the opinions of other members of the group.

Also, teenagers were involved in friendly sports competitions and athletics competitions, which stimulated perseverance and mutual respect, regardless of the final result. Each competition was followed by a reflection session, in which the students discussed how they managed

the pressure of the competition and how they managed to collaborate to support the team, regardless of victory or defeat. These activities allowed the adolescents to understand the importance of joint effort and to develop a positive attitude towards their peers and towards themselves.

Through these structured activities, the teenagers had the opportunity to practice and develop their emotional intelligence and social skills in an authentic and progressive way. Sport has provided them with a safe and stimulating environment that has allowed them to manage their emotions, collaborate effectively, and appreciate the diversity of roles and personalities within the group.

Prior to the implementation of the program, the SEI-YV questionnaire was applied to assess the social and emotional competencies of adolescents in both groups, establishing a basis of comparison for measuring further progress.

During the six months, the experimental group participated in the mentioned structured sports activities, under the supervision of specialized teachers. Each session was documented and monitored, observing the developments and reactions of the adolescents to the emotional and social challenges during the activities.

At the end of the program, the SEI-YV questionnaire was reapplied to assess changes in adolescents' emotional and social competencies by comparing pre- and post-intervention outcomes. The data collected was analysed to determine the impact of sports activities on emotional intelligence and social skills.

### **Results:**

The results of the study showed a significant improvement in the social and emotional skills of adolescents involved in sports activities, confirming the positive impact of sport on the development of emotional intelligence. The comparative analysis of the data collected through the SEI-YV questionnaire, applied both before and after the intervention, highlighted notable progress in terms of self-control, collaboration and empathy skills.

One of the most important results observed was the increase in adolescents' capacity for self-control and adaptability. Following their participation in training and team games, they learned to manage their emotions in stressful situations and to respond in a balanced way to the challenges of competitions. The reflection sessions after each activity contributed to the development of this competence, with students reporting greater confidence in their abilities to cope with pressures and control their reactions. Data from the SEI-YV questionnaire indicated a significant increase in scores on the dimensions of self-control and emotional resilience, confirming the effectiveness of the program.

Also, collaborative activities and team competitions had a positive impact on communication and empathy skills. Direct observations from teachers indicated an improvement in the way adolescents interacted with their peers, making them more open, patient and willing to provide support. After the team games and teambuilding sessions, the students showed an increased ability to actively listen, respect the opinions of others and resolve conflicts in a constructive way. The data from the questionnaire confirmed an increase in scores on the empathy and collaboration dimensions, highlighting the beneficial effect of these activities on social skills.

Regarding adolescents' interest in sports and team activities, a much more positive attitude towards physical and collaborative activities was observed, as well as a greater desire to continue participating in such activities. The fact that the teenagers were able to express their emotions and collaborate in a safe and stimulating environment helped to strengthen their self-confidence and develop a positive attitude towards sport as a means of personal and social development.

The overall analysis of the data and observations shows that the intervention had a significant impact on the emotional and social development of adolescents. They demonstrated a clear improvement in self-control, collaboration and empathy skills, confirming the role of sport as an essential vector in the formation of socio-emotional competences. The results suggest that the integration of structured sports activities into educational programs can bring important benefits for the development of emotional intelligence and social skills of adolescents.

### **Conclusions:**

The present study demonstrated that structured sports activities have a significant impact on the development of emotional intelligence and social skills of adolescents. Regular participation in team sports and training geared towards collaboration and self-control provided students with genuine opportunities to learn how to manage their emotions, communicate effectively, and collaborate with others. These results confirm the essential role of sport as an educational tool for the formation of socio-emotional skills.

One of the notable outcomes of the intervention was improved adolescents' ability to control their emotions and respond constructively to challenges. Training and teambuilding activities have provided them with a safe environment to practice self-control, thus developing emotional resilience and the ability to cope with stress. At the same time, team games and sports competitions favored the development of empathy and communication skills, teenagers learning to listen, collaborate and respect their peers.

The results obtained support the idea that sport can be a valuable

component of socio-emotional education and that, by integrating it into the school curriculum, adolescents can benefit from a stimulating environment that supports their personal development. Sport not only improves the physical condition of students, but also contributes to the formation of essential skills for a harmonious social integration and good adaptability in the face of challenges.

In conclusion, sport is a particularly effective educational tool for the development of emotional intelligence and social skills in adolescents. The integration of structured sports activities into educational programmes can support the formation of balanced, empathetic young people capable of effective collaboration. In the long term, these skills contribute to their emotional health and better integration into the community, suggesting the need to support sport as an integral part of formal education.

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## TRAITS OF COPARENTAL ALLIANCES. IMPLICATIONS ON PARENTAL EDUCATION PROGRAMS

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**Abstract:** *In recent years, the issue of co-parenting has become a particularly discussed topic in the educational environment, perhaps due to the increase in the number of disorganized, separated families, or changes, etc. He is currently talking about joint parental management (Feinberg, 2002). And about the impact it has on the child in all dimensions of his life. Using the method of narrative review of academic literature, the study aims to identify the characteristics of the coparenting process and the main concerns in the field of coparenting. The work also aims to emphasize the importance of knowing the characteristics of coparenting by teachers in order to support the education and prevention of problems related to the relations between parents and children. 34 relevant researches from the databases available on Scholar were evaluated. The results indicate a complicated dynamic of parental relations both in intact families and in separated families, single-parent families, etc.*

**Key words:** *coparenting, coparenting alliance, education, family, dissonance, shared parenting*

### **Introduction**

Co-parenting, or the co-parental unit as the "executive subsystem" of the family (Minuchin, 1985) is an increasingly discussed concept in today's society that refers to the sharing of the responsibility of raising a child between parents, usually in the situation where the couple is separated (Eira et al., 2021); parenting is a complex activity that leads to the formation of the child, working both individually and together to influence the child's results (Baumrind, 1991). Mangelsdorf, Laxman, Jessee, (2011) believes that the most comprehensive and inclusive definition of co-parenting is provided by Talbot and McHale (2004): an enterprise built by two or more adults who work together to raise a child for whom they share responsibility. Other authors emphasize that coparenting means much more than this shared responsibility between the two parents:

It also happens in families where fathers are not effectively involved in raising the child (Khazan, et al., 2002) including where the father does not live with the mother and children (Maccoby, Depner and Mnookin, 1990), or in families where fathers do not exist (McHale, Kuersten-Hogan, Rao, 2004). Academic literature describes several patterns of coparenting: cooperative, conflictual, autonomous, mixed (Waller, 2012) and Van Egeren and Hawkins (2004), capture several particularities of coparenting that involve structure: who can be coparents?, when does coparenting begin? and where does it take place?

Van Egeren (2001) discussed five dimensions of coparenting:

- (a) perceptions of partner support;
- (b) self-reported coparenting strategies
- (c) observed coparenting behaviors;
- (d) differences in child-rearing philosophies;
- (e) sharing of childcare.

Co-parenting education is important for several reasons, with the aim of improving relationships between parents and creating a favorable environment for child development. Some reasons why education on this topic is necessary are the well-being of the child, prevention of conflicts, promotion of effective communication, well-being, high level of functionality.

- Educating parents on co-parenting equips them to handle challenges more effectively and prioritize the child's well-being, promoting healthy development (McHale & Lindahl, 2011).
- Co-parenting programs provide tools to manage and minimize conflict, helping parents communicate constructively and collaborate despite differences. Reduced conflict can lower risks of stress and anxiety for children (Mangelsdorf, Laxman & Jessee, 2011).
- After separation, co-parenting education guides parents in building a respectful, cooperative relationship, essential for effective parenting even without a partnership.

### **Education regarding co-parenting**

Calasanti, Bailey (1991) observes that the differential involvement of the two partners in parenting may be due to the conventional benchmarks

about motherhood and fatherhood that have been constructed since primary socialization. He believes that, by virtue of some solid beliefs and convictions, some couples still manage to build equality through intense and constant negotiations, avoiding decisions based on pegen and making professional choices and arrangements for the benefit of the family (Ehrensaft, 1990). It has become a certainty that parental education is absolutely necessary for any social category of parents (Guryan, Hurst, Kearney, 2008), but current studies focus on what its content and structure should be (Pettersson, Pettersson, Håkansson, 2004). In general, researchers suggest that the implementation of parental education programs and the inclusion of a large mass of parents has a strong positive impact on solidarity in parental alliances (Fokkema, Ter Bekke, Dykstra, 2008; Galdiolo, Roskam, 2016; de Gaulle, 2016).

### **Purpose**

We propose to identify in the specialized literature the essential features of coparental alliances

### **Method**

The method used is the narrative review of the specialized literature that by applying search strategies, critical analysis, critical analysis and synthesis of the literature in an organized manner (Zoltowski, Costa, Teixeira and Koller, 2014). Thus, in order to achieve the objectives, five steps were outlined, namely: formulation of research questions, location and selection of studies, critical evaluation of studies:

- extraction of essential data
- data analysis and presentation

### **Search strategy**

The study was carried out by accessing the databases PubMed, Scopus, Google Scholar to identify the international specialized literature that researches co-parenting. The selection of articles was limited to articles published in English. The search terms used were *co-parenting, parenting, family, parental couple*.

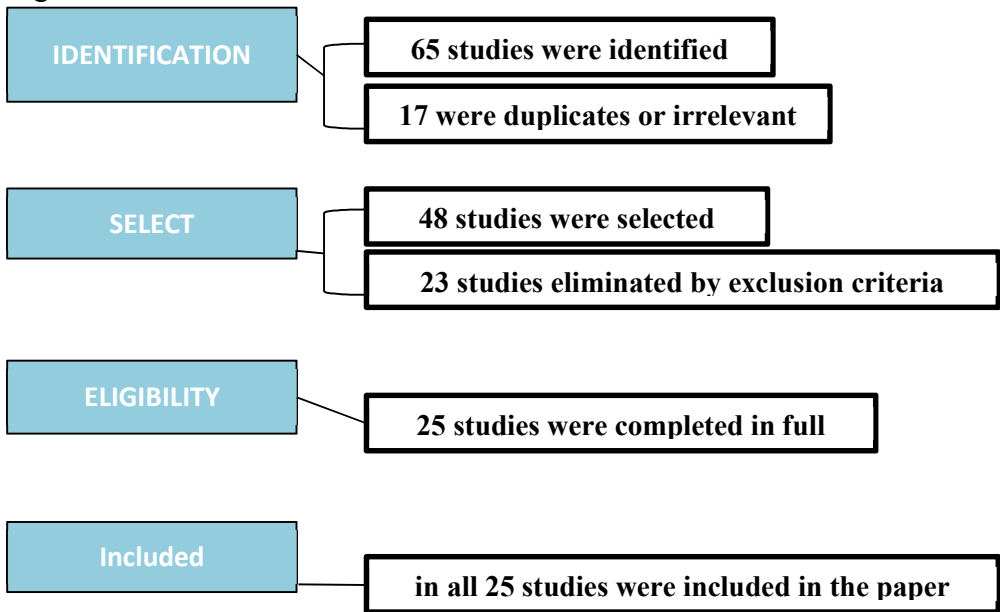
Regarding the selection process of relevant scientific articles, 65 were initially identified, 17 of which were irrelevant or far removed from the scope of this study. 48 studies were selected, of which 23 were eliminated by exclusion criteria (relevance to the topic, etc.). The result was a number of 25 works that were included in the present study.

Below is a graphic representation of the PRISMA flow chart (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which is



frequently used in systematic reviews.

Figure 1. Flowchart for identification of selected articles.



## Findings

The literature has explored various aspects of coparenting, highlighting a wide range of meanings for this concept. In this regard, we present a narrative approach that provides a comprehensive perspective of the topic. Of course, within this particular methodological approach, the selection process tends to be subjective. However, the present study has significant value by clarifying the concept of coparenting and the areas it impacts. This recognition underscores the need for a nuanced understanding and interpretation of the data collected, ensuring an analysis that captures the complexity of coparenting dynamics.

### Essential features of coparental alliances

The degree of solidarity and support between co-parenting partners

Solidarity is the key ingredient in effective coparenting and is in itself a characteristic of coparenting that highlights the affective and enduring quality of growing together as parents and the formation of a unified executive subsystem. Supportive alliances between coparental adults based on unity and solidarity are the premise for a high level of children's adaptability (Schoppe-Sullivan et al., 2004), and not only that; the harmonious development, their mental health, the representations about life and relationships are shaped according to the model of the alliance of the two parents. A huge share of researchers in this field focuses on

the evaluation and identification of indicators of solidarity in the parental alliance (McHale, Khazan, et. al., 2002; Schoppe-Sullivan, Mangelsdorf, Frosch and McHale, 2004; Stright and Neitzel, 2003).

Several methods can be used to assess coparenting solidarity. McHale (1995) believes that expressions of warmth and positive emotion between partners during interaction with or about the child are an important indicator of solidarity; Frank, Jacobson, and Avery (1988) suggest that it is evident in partners' reports of "growing up together" or "closeness" as a result of co-parenting. In another work, McHale (1997) sees solidarity in parental efforts to promote the feeling of a strong coparental dyad in the absence of the partner by speaking positively about him in front of the child; or parents' reports of sharing child-rearing values with their partner. Belsky et al., (1995) is of the opinion that these distinctive measures represent in part elements of the sense of unity that underlies a functional coparenting relationship. It can also be defined as a set of strategies and actions that support and expand the partner's efforts to achieve certain goals in raising the child (Westerman & Massoff, 2001). Within the triadic interaction, coparenting support can generate a progressive series of inventive and cooperative interactions as each parent relies on the other's cues. Alternatively, coparenting support can simply take the form of helping the other parent play with the child. However, co-parenting support takes some effort; passivity without intervening while the partner interacts with the child or makes decisions regarding the child's upbringing does not constitute coparenting support.

Grandparents' intervention in taking care of their grandchildren, or taking over the parental role when the parents cannot assume it, constitutes a reality of our days (Giarrusso et al., 1996). Solidarity in this context manifests itself in a different sense, but it involves the same mechanism of training resources, effort and decision-making. The subject of solidarity in coparenting brings with it the problem of the ideal parent. According to Darling (1999), these traits include warmth and responsiveness, clear expectations, open communication, consistent discipline, adaptability, unconditional love. McHale, Kuersten-Hogan, Rao, (2004) analyze the effects of solidarity and cohesion in parental couples on children's psychological development; Feinberg, (2003) discusses the importance of a strong and stable parental alliance for children's emotional health. Solidarity has also been studied in terms of

its role in building family cohesion (Cabrera, Tamis-LeMonda, 2013) or in the development of children's socio-emotional competence (Van Egeren, Hawkins, 2004), this article highlights the importance of solidarity and clarifying roles in parental alliances (McConnell, Kerig, 2002).

### **The degree of dissonance and antagonism between coparental partners**

Dissonance in the coparenting alliance refers to the conflicts, disagreements, or lack of harmony between parents regarding the upbringing and education of their children. The coparenting alliance generally describes how parents work together to fulfill parenting roles and provide an emotional and educational support structure for the child. A healthy coparenting alliance is characterized by mutual support, cooperation, and agreement on values and rules for the child. When there is dissonance in the coparenting alliance, parents may have different views and methods of dealing with issues related to the child, which can lead to tension and conflict. This can negatively affect the child, who may feel confused, insecure, or even caught between the parents in conflicts beyond their understanding. Dissonance between co-parenting partners can be the expression of the lack of solidarity between the two and can have a strong impact on the children (McHale, Fivaz-Depeursinge 2010).

Dissonance consists of strategies and actions that hinder the partner's attempts to achieve childrearing goals, or criticism and disrespect for the partner's childrearing decisions (Belsky et al., 1995). During interaction, as with coparenting support, coparenting undermining cannot occur through passive means. Studies show that dissonance in coparenting deeply affects children (Thullen, Bonsall, 2017). They can develop emotional (anxiety, stress, insecurity) and behavioral (adjustment difficulties, aggression, isolation) problems (Choi, et al., 2013). Conflict between parents sends children conflicting messages and can make them feel caught between their parents' preferences. Research shows that in families with strong coparental dissonance, children are more likely to develop behavioral disorders and emotional regulation difficulties.

Undermining actions can be overt and hostile, such as criticism or insults, but are more likely to be subtle and harmless, such as one parent interrupting the other to say something to the child (Westerman & Massoff, 2001). Undermining actions can also occur when the partner is

absent, such as when the parent makes an offensive remark about the child's partner or excludes the child from a desired activity (McHale, 1997). Parents identify undermining strategies, including criticizing, giving advice, and intervening in child matters in their own way, as well as feelings of humiliation when child-rearing decisions are ignored (Van Egeren, 2003). The relevant issue is partner interference. We address the parent's experiences of partner undermining rather than his or her contributions to undermining actions or feelings. The effect of parental dissonance on children's well-being has been studied (Grych, Fincham, 1990; Feinberg, 2002). and the important impact on the child's emotional state was discovered (Cummings, Davies, 2010), on the relationship of the marital and parental couple (Cowan, Cowan, 2012; Katz, Gottman, 1996).

### **Shared parenting**

Shared parenting is the broadest of these dimensions and, among other things, is an attempt to move the division of labor from a separate space to a more concrete and accessible model. In addition to the sharing of care work, which is typically assessed by asking parents to identify the percentage of time they and/or their partner spend on care tasks, shared parenting is characterized by the degree to which one or the other the parent is responsible for setting boundaries and for each partner's sense of the fairness of how responsibilities are shared. During interaction, shared parenting can be assessed in at least two ways. Balance of involvement describes the degree to which each partner is involved with the child relative to the other partner (McHale, 1995); this can be represented by a differential score in the involvement of each parent with the child and is the exception to the rule that states that co-parenting elements must refer explicitly to the partner. Mutual involvement is the extent to which both partners are simultaneously involved with the child. Family arrangements, the understandings of the parental couple about their roles in raising the child were addressed in the works of Margolin, Gordis, John (2001) who emphasize their impact on family stability or the studies of Belsky (1984), Feinberg, Kan, (2008) and McHale, (1995) which focuses on how structured coparenting influences family relationships and children's development. A representative work for the field is that of (Minuchin, 1985) which emphasizes the importance of well-organized co-parenting.

## **Conclusions**

Solidarity between parents is an essential pillar in parenting, providing the child with an example of cooperation and stability. When parents show their solidarity, the child benefits from a stable, predictable and supportive environment, fundamental elements for his emotional and social development. This parental consensus contributes to the formation of a climate of emotional security, where the child feels supported and understood. Parenting programs could emphasize the importance of solidarity in coparenting by providing parents with strategies to cultivate mutual support and harmony in child-rearing decisions. At the same time, dissonance in coparenting can have destabilizing effects, generating confusion and stress for both the child and the parents. Training programs can include dissonance management techniques and methods of negotiating differences, supporting parents in building a unified approach.

Shared co-parenting encourages equal involvement of both parents and promotes equitable collaboration in educational decisions and daily support for the child. These fundamental characteristics of coparenting, each having a direct impact on parenting and child development, can form the building blocks of parenting, providing a valuable platform for strengthening solidarity, managing dissonance, and promoting balanced involvement.

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## **THE IMPACT OF COMPUTER-AIDED DESIGN (CAD) ON THE EDUCATION AND TRAINING OF STUDENTS IN FOOD ENGINEERING, TOURISM, AND ENVIRONMENTAL PROTECTION**

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**Abstract:** *Computer-Aided Design (CAD) is an essential technology in the teaching and training of students in technical and artistic disciplines, including food engineering, tourism, and environmental protection. This literature review examines the influence of CAD utilization in student preparation, emphasizing its advantages, including the enhancement of design skills, creativity, and analytical abilities, which are vital for cultivating proficient and versatile experts. Research indicates that CAD utilization enables the simulation of technical processes, the design of tourism infrastructure, and the modeling of ecosystems, hence enhancing practical learning and the applied comprehension of academic concepts. Nonetheless, the integration of CAD in education presents problems, such as the substantial expense of software and the necessity for specialized training for educators. The report suggests strategies for enhancing CAD utilization in educational settings, highlighting the significance of accessibility and industry partnerships to mitigate cost barriers and secure essential resources for effective student training.*

**Key words:** *Computer-Aided Design (CAD); Technical education; Food engineering; Sustainable tourism; Environmental protection.*

### **Introduction**

Computer-Aided Design (CAD) is essential in the teaching and training of students in diverse technical and artistic disciplines, such as Food engineering, tourism, and environmental protection. CAD provides a comprehensive array of tools for the creation, modification, analysis, and optimization of digital designs, equipping students to visualize intricate concepts and cultivate practical skills vital for their future professions (Chis R et al., 2024). CAD is a prevalent technology in

industry, essential for equipping students to face real-world professional issues. Its incorporation into education enables a transition from conventional, theory-centric learning methodologies to interactive and practical techniques (Rad, D et al., 2023). This cultivates critical thinking, creativity, and technical skills, all vital for solving practical issues across several domains (Smetanka et al., 2024). In food engineering, CAD facilitates the simulation of production processes and the design of equipment necessary for food processing. Utilizing CAD, students can get an enhanced comprehension of machinery operations, process optimization, and engage in the development of virtual prototypes. This prepares them for a progressively competitive employment market that necessitates technical expertise and inventiveness. In the realm of tourism, CAD enhances the design and construction of tourism infrastructure. Students may construct 3D models of hotels, resorts, and various tourist attractions, examining elements such as spatial design, landscaping, and environmental impact. This enables them to cultivate a comprehensive viewpoint on tourism development, incorporating sustainability and aesthetic considerations into their designs. In environmental protection, CAD is utilized to model ecosystems and evaluate the effects of human activity on the environment. Students can utilize CAD to envision various scenarios and assess the impacts of development projects on the environment, allowing them to suggest more effective strategies for conserving and safeguarding natural resources (García-García et al., 2023;). Consequently, CAD fosters the cultivation of experts who comprehend the effects of human activities on the environment and are capable of formulating creative strategies to alleviate this influence (Lee et al., 2024; García-García et al., 2023). The advantages of CAD in education are apparent, although there are also accompanying obstacles. The elevated expenses of software and requisite equipment present an obstacle for several educational institutions, especially in underdeveloped nations (Dughi, T et al., 2023; Czmocho & Pekala, 2014). The deployment of CAD necessitates sufficient training for educators, who must be proficient in these tools and capable of effectively incorporating CAD into instructional activities (Eadie et al., 2014; Kehinde, 2016). The application of CAD in education signifies a crucial advancement in modernizing the learning process, equipping students with the essential capabilities to meet the growing complexities of industry and society.

This critical analysis seeks to examine the effects of CAD utilization in the teaching of students in food engineering, tourism, and environmental protection, emphasizing both the advantages and obstacles faced in the adoption of this technology. Through the examination of existing literature, we aim to ascertain methods for optimizing CAD utilization

in educational settings to enhance student benefits and address prevailing challenges.

### Methodology

This review reviewed scientific publications, reports, and case studies published in the past decade. The sources were chosen for their pertinence to the application of CAD in the education and training of students in food engineering, tourism, and environmental protection. The literature selection process involved identifying pertinent articles from databases including Scopus, Web of Science, and Google Scholar, removing duplicates, and performing qualitative and quantitative assessments of the chosen studies (Chen et al., 2022; Copolovici, 2021; Hajj-Hassan et al., 2024). A flowchart was employed to depict the literature selection procedure (Figure 1).

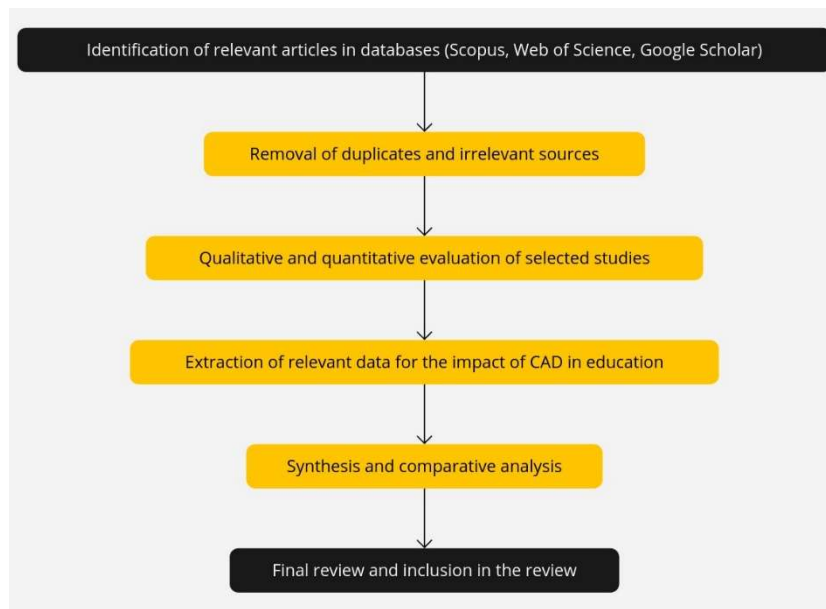


Figure 1: Flow diagram of the specialized literature selection process

- ✓ Identification of pertinent items inside databases

The preliminary search was performed in prominent scientific databases including Scopus, Web of Science, and Google Scholar, utilizing pertinent keywords such as "CAD in education," "CAD in food engineering," and "CAD in environmental protection." (Halevi et al., 2017). Filters were applied to refine the results to publications published during the last decade and pertinent to the areas of interest.

- ✓ Elimination of redundancies and extraneous sources

Upon identifying the articles, duplicates were eliminated to prevent the analysis of the same source repeatedly. An first assessment of the titles and abstracts was performed to exclude papers that were not pertinent to the subject of CAD's impact on education.

- ✓ The qualitative and quantitative assessment of the chosen studies

The qualitative evaluation encompassed an analysis of methodological rigor, the validity of conclusions, and relevance to the unique educational setting (Dagman & Wärmefjord, 2022; Tracey & Hutchinson, 2016). The quantitative assessment entailed examining the provided statistics and data, in addition to contrasting the outcomes across other studies to ascertain their coherence.

- ✓ Extraction of pertinent data regarding the influence of CAD in schooling

The data extraction concentrated on the advantages, obstacles, and effects of employing CAD in the education of students within the specified disciplines (Dagman & Wärmefjord, 2022; Hajj-Hassan et al., 2024). Extraction sheets were employed to systematically organize pertinent information from each trial, ensuring data coherence and comparability.

- ✓ Synthesis and Comparative Analysis

The retrieved data were synthesized and categorized thematically, including the advantages of CAD, implementation obstacles, and the effects on learning (Chen et al., 2022). A comparative analysis was performed across many research to discern trends and deficiencies in the specialist literature (Chen et al., 2022; Hajj-Hassan et al., 2024).

### **Results**

Following data synthesis, the chosen articles were re-evaluated to verify their pertinence and ascertain the quality of the information incorporated in the review (Chen et al., 2022;).

#### **The Application of CAD in food engineering education**

The reviewed research indicates that the application of CAD in food engineering enhances comprehension of technological processes. CAD enables students to see material flow and manufacturing processes interactively, enhancing their comprehension of processing equipment functionality. CAD facilitates innovation by generating virtual prototypes of equipment and refining them before actual manufacture.

Research conducted by Ries (1999) demonstrates that incorporating CAD into the food engineering curriculum improves students' design capabilities, enabling them to engage in real projects and get practical experience pertinent to the food business. Table 1 delineates the primary advantages and obstacles recognized in literature

(Ries, R. 1999.).

| <b>Benefits</b>  | <b>Challenges</b>   |
|--|---|
| <b>Enhanced design skills</b><br>(Dagman & Wärmefjord, 2022) | High software costs   |
| <b>Improved visualization of processes</b>                   | The need for additional training for teachers (Dagman & Wärmefjord, 2022) |
| <b>Facilitates prototyping</b>                               | Teachers' resistance to change (Gonzalez et al., 2021)                    |

**Table 1:** Benefits and challenges identified in the literature on the use of CAD in food engineering.

Table 1 delineates the primary benefits and obstacles related to the application of CAD in food engineering education. On one hand, CAD markedly boosts students' design abilities by promoting superior visualization of processes and allowing the development of virtual prototypes. These elements are crucial for comprehending and enhancing intricate food manufacturing processes (Dagman & Wärmefjord, 2022). Conversely, the adoption of CAD poses numerous problems. Elevated software costs and equipment expenditures are significant challenges for numerous educational institutions. Moreover, educators necessitate specialized training to proficiently integrate CAD into their instruction, as insufficient competence may impede its efficient application in educational settings (Dagman & Wärmefjord, 2022). Educators' resistance to embracing new technology exacerbates the challenges of widespread CAD adoption in educational environments (Gonzalez et al., 2021).

**The application of CAD in tourism education**

In tourism, CAD is utilized for the formulation of infrastructure designs, encompassing hotels, resorts, and recreational facilities (Dimopoulos, 2024; Mandić et al., 2018). Research indicates that the application of CAD enhances students' creativity, enabling them to develop intricate models of tourist destinations and mimic landscape configurations (Carbonell-Carrera et al., 2019; Martin, S. C et al., 2018). Utilizing CAD enables students to cultivate vital competencies in the design and management of tourism projects, encompassing the evaluation of environmental impact and the analysis of economic feasibility (Candia & Pirlone, 2022; Sanjeev & Birdie, 2019; Chiş et al., 2024; Demeter et al., 2024; Dughi et al., 2023; Roxana et al., 2024). Recent studies

illustrate the application of CAD in tourism education for the planning of sustainable infrastructure, landscape design, and environmental impact assessment. This method enables students to acquire practical skills in the design of tourist attractions while taking into account sustainability and ecological considerations (Kwak et al., 2021; Chiş-Junior et al., 2014; David et al., 2014).

| <b>Application</b>                     | <b>Example</b>                    |
|--|-----------------------------------|
| <b>Tourism infrastructure design</b>   | Planning of tourist resorts       |
| <b>Landscaping</b>                     | Creating sustainable green spaces |
| <b>Environmental impact assessment</b> | Biodiversity impact analysis      |

**Table 2:** Main applications of CAD in the education of students in the field of tourism.

Table 2 delineates the principal applications of CAD in educating students in the domain of tourism. Computer-Aided Design (CAD) is a crucial instrument for developing tourism infrastructure, enabling students to construct intricate models of hotels, resorts, and various tourist amenities. This exercise fosters creativity and aids students in comprehending the aesthetic and functional elements essential to tourism design (Kwak et al., 2021). Furthermore, CAD facilitates landscape design, allowing students to devise sustainable green places that enhance environmental sustainability and resilience (Kwak et al., 2021). Moreover, CAD plays a crucial role in environmental impact assessment, assisting students in evaluating and alleviating the adverse effects of infrastructure on biodiversity.

The application of CAD in environmental conservation

In environmental protection, CAD is extensively utilized for ecosystem modeling and evaluating the environmental impact of diverse development initiatives. Research indicates that CAD-based ecosystem modeling facilitates the visualization of intricate relationships among various ecosystem components, thereby aiding students and professionals in comprehending the potential ecological consequences of infrastructure developments (Steffen & von Thenen, 2024; Ritchie, 2020). CAD modeling enables students to simulate pollution situations, identify sources of pollution, and offer methods to alleviate their impacts, thereby enhancing their comprehension of environmental management (Ries, 1999). Moreover, CAD is employed in the design of waste management systems, facilitating evaluations that account for both human health and environmental sustainability. This methodology aids in cultivating specialists who are more equipped to tackle contemporary environmental issues via digital visualization and

simulation techniques (Steffen & von Thenen, 2024).

| IMPACT   | EXAMPLE   |
|--|---|
| Modeling ecosystems (Steffen & Von Thenen, 2024) | Environmental impact assessment (Anderson, 2020)        |
| Development of analytical skills (Ritchie, 2020) | Analysis of pollution scenarios (Robinson et al., 2018) |
| Design of waste management systems (Ries, 1999)  | Human health impact assessment                          |

**Table 3:** Impact and examples of CAD applications in environmental protection education.

Table 3 illustrates the influence and instances of CAD applications in environmental protection education. CAD serves as an essential instrument for modeling ecosystems, facilitating environmental impact assessments and enhancing students' comprehension of intricate ecological interconnections (Steffen & von Thenen, 2024). Furthermore, CAD fosters the enhancement of analytical skills, enabling students to simulate pollution situations, identify sources, and investigate mitigation solutions (Ritchie, 2020). Additionally, CAD is utilized in the design of waste management systems, aiding in the evaluation of effects on human health and the environment, thereby offering students practical insights into sustainable waste management (Ries, 1999).

### Conclusions

The application of CAD in the education and training of students in Food Engineering, Tourism, and Environmental Protection significantly enhances the development of design, creativity, and analytical skills (Dagman & Wärmefjord, 2022). CAD enhances comprehension of intricate processes, promotes innovation, and enables the practical application of academic knowledge. Nonetheless, issues concerning the elevated expenses of software and the necessity for educator training must be resolved to optimize the advantages of this resource (Dagman & Wärmefjord, 2022). This research highlights the necessity for educational policies that enhance access to CAD technology and mitigate budgetary obstacles, particularly for institutions in developing nations. Collaborations between universities and software industry firms may mitigate these expenses and furnish essential resources for student training (Chen et al., 2022; Hajj-Hassan et al., 2024). Such initiatives could facilitate the sustainable and accessible incorporation of CAD into education.

Integrating CAD into the educational curriculum necessitates specialized training for educators. Ongoing training and the

enhancement of pedagogical skills in utilizing CAD are crucial for providing a high-quality educational experience (Eadie et al., 2014; Kehinde, 2016). The implementation of CAD necessitates accompanying teacher training programs to enable educators to effectively and innovatively incorporate these technologies into their instructional activities (Chen et al., 2022). Furthermore, subsequent research should concentrate on assessing the influence of CAD on academic achievement and the cultivation of non-technical competencies, including collaboration, analytical reasoning, and problem-solving skills. CAD must extend beyond the enhancement of technical abilities to also serve as a catalyst for the development of a diverse array of competencies pertinent to the labor market (Steffen & von Thenen, 2024; Kwak et al., 2021). CAD is a crucial technology for enhancing education and equipping students in several technical disciplines. The advantages are seen in the enhancement of design, visualization, and analytical competencies. To fully leverage CAD's potential in education, a systematic approach is essential, encompassing accessibility, educator training, and effective curricular integration. Consequently, CAD can serve as an effective instrument for teaching future professionals, fostering the development of adept and innovative specialists equipped to tackle present and forthcoming difficulties in business and society.

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