ROBOTICS EDUCATION IN ECE: TEACHERS' OPINION AND WAYS OF INTEGRATION

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Abstract: *Educational robotics in Early Childhood Education is proven to empower children to understand the basic functions of technology and become digitally literate. The article investigates the current opinion of teachers about educational robotics at preschool level. The study takes them through several stages of questioning: from what they understand robotics to be at preschool level, if they consider the integration of robotics elements useful, how easy they find the integration of these elements and how quickly they can integrate practical robotics elements into games didactic. With a well-done PhD process Educational Robotics can have maximum effectiveness throughout its life. The natural curiosity and way of thinking of the new generation are advantages that must be exploited. Numerous studies have demonstrated the effectiveness of robotic education in the early education of children, although all we have to do is guide the specialists to integrate it into the teaching-learning process.*

The results of the quantitative analysis carried out with the help of teaching staff are presented by category and the significant differences that resulted are highlighted as well as recommendations for the integration of robotics elements in ECE activities.

Keywords: *educational robotics; early childhood education; programming skills.*

Introduction

Robotic education is more and more promoted due to the beneficiaries it brings. Robotic education is promoted as a valuable tool today that has multiple advantages even starting from the early education of children. Numerous researches have shown that a very good knowledge of technology and making innovations in this field leads to economic prosperity. This is actually the engine that influences the teaching process so that as many children as possible and as early as possible are digitally literate, so that they understand everything that is involved in programming bots and everything that is new in this field. Robotic education has developed and is developing in parallel with the state education system, as long as there is always a demand in the labor market for a robotic education or less (digital) in addition to the main skills of the targeted job. Therefore, computer-based education will be present at all levels, clearly with early education. These influences in education are gradually changing pedagogical concepts so that preschoolers and scholars develop specific skills for future jobs. Robotic education is more and more promoted due to the beneficiaries it brings. Robotic education is promoted as a valuable tool today that has multiple advantages even starting from the early education of children. Numerous researches have shown that a very good knowledge of technology and making innovations in this field leads to economic prosperity. This is actually the engine that influences the teaching process so that as many children as possible and as early as possible are digitally literate, so that they understand everything that is involved in programming bots and everything that is new in this field. Robotic education has developed and is developing in parallel with the state education system, as long as there is always a demand in the labor market for a robotic education or less (digital) in addition to the main skills of the targeted job. Therefore, computer-based education will be present at all levels, clearly with early education. These influences in education are gradually changing pedagogical concepts so that preschoolers and scholars develop specific skills for future jobs.

Literature review

Robotics education provides students with hands-on experience in technological and mechanical systems, adapting to complex environments and applying knowledge in real-world situations. Emphasizing STEM education, robotics aims to empower learners and provide authentic learning, allowing them to take initiative as co-constructors of learning. Educational robots come in a variety of shapes, sizes, systems and functions. These characteristics are crucial

in determining curricula, instructional activities, and learning objectives.

Robotics education utilizes educational robotics technologies to teach students about robotics or other subjects. Recent research has shown potential for young learners and proposed methods for developing and implementing a curriculum. However, research for young children is still in its early stages, with previous studies focusing on technological properties of educational robots or curricula. Comprehensive studies on how young children interact with educational robots and what they learn through robotics education are needed.

Educational robots are categorized into three types: robotics kits, social robots, and toy robots. Robotics kits enable students to design, construct, and program robots, while social robots, classified as Socially Interactive Robots (SIR) or Socially Assistive Robots (SAR), use artificial intelligence and autonomous behaviors for communication and interaction with students. Toy robots are commercially manufactured for entertainment and play.

Robotic education can be a promising learning approach for the development of computational thinking (Papadakis, 2022; Papadakis and Kalogiannakis, 2019; Jung, Won 2018) so that the little ones can form certain thinking skills, as the specialists in the "computational thinking" field claim is a relatively new term in early childhood education that refers to a specific problem-solving thinking process involving various logical and analytical thinking skills" (Lee, Joswich, Pole, 2022), “computational thinking represents a type of analytical thinking that shares many similarities with mathematical thinking (e.g., problem solving), engineering thinking (designing and evaluating processes), and scientific thinking (systematic analysis)” (Bers, 2017) but also notions of computer programming (Otterborn, Schonborn, Hulten, 2019)

Robotics education has been shown to improve students' cognitive learning of STEM knowledge and problem-solving skills, soft skills such as teamwork and social skills, and affective domains such as attitudes and interests in STEM subjects and careers (Altin & Pedaste, 2013, Ching et al., 2019; Hudson et al., 2020). Because we are going through revolutions based on technology, teachers consider that robotics education, even in ECE, can develop:

- involvement and motivation through active participation in all kinds of activities;

- faster handling of objects through games with age-appropriate robotics parts;
- collaboration and social skills by participating in teams that build certain robots
- creativity and imagination expressed by creating your own robots (with recyclable materials, special cubes or other materials).

There are many reasons why robotics education is important to be developed from ECE, reasons that can be found in recent research on robotics education namely. The top skills of the 21st century are critical thinking, problem-solving, creativity, collaboration, communication, but also skills in fields directly related to technology such as programming, automation.

Robotic education is suitable in ECE because robots have attractive characteristics for children, they maintain their attention, concentration, which leads to a higher performance (Papadakis, 2022). Of course, the role of the teacher is also very important, because if they promote and are totally convinced of its advantages, then children who are trained by such staff will be much more inclined towards technology. Research has shown that teachers' negative attitudes towards technology also develop negative attitudes for children (Papadakis, Vaiopoulou, 2021). An increasing number of countries have clear policies and frameworks for the introduction of programming at an early age. For example, there are, for now, as an experiment, Scratch courses (Department of Preschool Education, University of Crete) in which future preschool teachers present a myth or other activities using programming languages. Thus, but understanding very well what programming means, they can promote programming languages and their elements at an early age (Kalogiannakis, 2019). The "powerful ideas" of computational thinking described by Bers (2017) and developed by KIBO Robotics Kids include: algorithms, modularity, control structures, representation, hardware/software, design process and debugging.

The promotion of mobile technology is another helpful step on the way to an advanced stage of technology. The integration of all kinds of mobile devices in kindergartens, schools and their use for an educational purpose is intensively promoted in many countries (Cheung, Hew, Chu, 2017). Robotics education helps children to understand the connection between cause and effect, develops their imagination and creativity, helps them to solve problems through the

logical thinking that it forms, the cognitive skills that take shape and that help them acquire more easily programming skills.

Materials and methods

Methodology

The type of research is quantitative and the questionnaire was used to collect the information necessary for the study.

Sampling

The sample resulting from the application of the questionnaire remained at 143 teachers who are currently active in preschool education. The sample comes from teachers from three counties

Instrument

The questionnaire starts with general questions about ER, the knowledge held in this field, experiences (if any), the way to integrate ER into preschoolers' activities, the frequency of ER integration, how much they want ER integration, what ideas they have for the future of ER, and at the end there are some questions from the category of personal information (age, the environment in which the kindergarten is located, seniority in education). The ***questionnaire*** starts with general questions about ER,

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Limitation of research

Parasite variables may also appear in the current research:

- because of the online environment and the opinions viewed there
- due to the underfunding of the system to reach the higher digital endowments supposed to be needed in the ER
- and because of the majority of respondents from the urban environment.

Results

Understanding the willingness of preschool teachers to adopt robotics education is crucial for evaluating its potential effectiveness and feasibility in early childhood education. This study aimed to explore the perceptions and beliefs of preschool teachers towards robotics education to gain insights into their readiness to incorporate it into their teaching practices.

The findings from the study revealed that a majority of the participants (79%) exhibited a positive attitude towards integration robotic education elements. These teachers expressed an openness to exploring and using robotics as an educational tool in their classrooms. This positive disposition suggests a willingness to engage with new teaching methodologies and integrate technology-based learning experiences into their curriculum.

However, it is worth noting that (14%) participants expressed uncertainty about the specific elements and components of robotics education. This uncertainty may stem from a lack of familiarity or limited exposure to robotics education in preschool contexts. It highlights the need for adequate training and professional development opportunities to enhance teachers' understanding and competence in incorporating robotics education effectively.

Furthermore, (7%) teachers expressed doubts regarding the successful implementation of robotics education in preschool settings. This skepticism may arise from concerns about practical challenges, such as the availability of resources, technical support, and age-appropriate robotics tools for young children. It suggests a need for addressing potential barriers and providing the necessary support structures to ensure a smooth integration of robotics education in preschool classrooms.

To further explore the perspectives of preschool teachers on robotics education and address their concerns, future research could focus on conducting in-depth interviews or surveys to gather detailed qualitative and quantitative data. This would enable a comprehensive understanding of the factors influencing teachers' attitudes, the specific aspects of robotics education that need clarification, and potential strategies to support successful implementation.

Only a percentage (36%) of today's ECE teaching staff express their concern about RE, indicating its relevance and impact on their profession, while (64%) accept the change.

The study reveals that the teaching staff currently active in the preschool education system have encountered RE through various means. The majority (73%) have learned about RE through tangents, such as hearing or reading about it, while a smaller proportion (26%) have witnessed its implementation in experimental classes, Erasmus projects, or other contexts. Only a negligible percentage (1%) have not seen or do not possess knowledge about RE.

When it comes to integrating RE into teaching practices, the study indicates a strong desire among the teaching staff (89%). This integration primarily involves implementing new rules within didactic games and other activities.
However, of this total of 89 %, only a smaller percentage (9%) expresses interest in RE through physical robots, and an even smaller percentage (2%) focuses solely on computer programming or other devices, which is deemed more challenging to achieve within the ECE system.

The teaching staff widely recognizes the usefulness of RE for the future and related areas, with an overwhelming percentage (98%) acknowledging its potential benefits.
Consequently, a substantial proportion (87.3%) of the teaching staff aims to implement RE-related activities in the future, showing a proactive attitude towards incorporating RE into their teaching practices. Additionally, they are willing to undergo training courses to enhance their knowledge and skills in RE.

This scientific explanation highlights the significant interest and recognition among the ECE teaching staff regarding RE. It emphasizes their desire to integrate RE into their teaching practices, with a focus on incorporating it into didactic games and other activities. The findings also indicate a willingness to undergo training to effectively implement RE-related activities and a strong belief in the future usefulness of RE. It should be noted that these conclusions are based on our specialized research.

How to apply the elements of educational robotics
Robotic education can also mean activities without a computer or tablet for programming. This screen-free approach aims to encourage physical interaction and exploration, and cause-and-effect learning. Robotics education can promote interdisciplinary learning by combining elements of technology, engineering, arts, and mathematics. It encourages children to explore and create through stories, art and

imaginative play. Children can see the results of their programming directly in action. The robot can be customized with various artistic elements and can move, play sounds and interact with the environment based on the instructions it receives. Robotics education, at the early education level, emphasizes the development of skills such as sequencing, problem solving, creativity and collaboration.

The numerous activities that assume small steps towards robotics education and that support the fundamental skills for computational thinking such as pattern recognition, decomposition, algorithm design, abstraction, etc. can be supported through several activities:

Ask youngsters to arrange pictures or items in a certain order, reinforcing the concept of step-by-step instructions, have youngsters detect and make patterns out of shapes, colors, or objects, engage children in physical activities such as coding games, in which they follow instructions to navigate through a series of "commands" to reach a certain destination, introduce coding ideas to children using programmable robots such as the Bee-Bot, which allow them to build simple command sequences to move robots, assembling coding blocks, they may build interactive stories, animations, and games (visual programming language), introduces coding skills through puzzles, games, and interactive storytelling, guide a robot through numerous tasks using coding commands to learn logic and programming concepts (Lightbot is a puzzle game for children aged 4 and up).

Closer examples for early education would be: children to follow a sequence of two or three actions (jumping, clapping hands, raising arms); children to sit in the shape of a circle, square (the geometric figures required by the current curriculum for the small group); children to execute some commands "like robots" (one step back, one step forward); children to manage through a labyrinth, to build using only two colors, to play many traditional games from the logical-mathematical games category.

Research in the field of robotics education in ECE is still in development and significant new results have appeared this year. Certainly, the field will be much more developed because children need technology and a way of thinking adapted to it in all future jobs.

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