

THEORIZING A TECHNOLOGY ACCEPTANCE MODEL IN ECEC IN ROMANIAN PRESCHOOL TEACHERS

Dana Rad¹, Gavril Rad², Roxana Maier³, Sonia Ignat⁴

¹Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Work, Center for Research Development and Innovation in Psychology, Arad, B-dul Revolutiei, no.77, Arad, Romania, dana@xhouse.ro

²Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Work, Center for Research Development and Innovation in Psychology, Arad, B-dul Revolutiei, no.77, Arad, Romania, radgavrilarad@gmail.com

³Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Work, Center for Research Development and Innovation in Psychology, Arad, B-dul Revolutiei, no.77, Arad, Romania, roxanamaierpsiho@gmail.com

⁴Aurel Vlaicu University of Arad, Faculty of Educational Sciences, Psychology and Social Work, Center for Research Development and Innovation in Psychology, Arad, B-dul Revolutiei, no.77, Arad, Romania, soniabudean@yahoo.com

Abstract:

Given the current circumstances, we can argue that this epidemic, as well as the state of emergency declared from one day to the next, has resulted in a true educational experiment. Education systems all across the world must adapt to the circumstances and reinvent themselves. Millions of toddlers have been forced to stay at home due to the crisis, and preschool teachers have been compelled to shift their online activities, learning to utilize various digital tools and platforms to continue teaching and stay in touch with children. As a result, both preschool teachers and children were able to adjust to the new educational method and communication style. Technology Acceptance Model (TAM) is a theory of computer systems developed to be able to make predictions about technology acceptance. This model suggests that when users are introduced to a new technology, a number of factors influence their decision about how and when to use it. TAM is based on the causal relationship beliefs - attitude - intention - behavior, a relationship developed within the theory of motivated action. Our extended technology acceptance model in ECEC (TAM-ECEC) will take into consideration the following variables: Perceived ease of use, Perceived usefulness, Perceived enjoyment, Intention to use, Actual use, Compatibility, Attitude, Self-efficacy, Zoom fatigue and Perceived risk. Conclusions and implications are discussed.

Keywords: Technology Acceptance Model, Early Childhood Education and Care

1. Introduction to online education in ECEC

It is undeniable that Romanian society is constantly evolving, making a significant change in the educational system absolutely unavoidable. These modifications were pushed, albeit somewhat forcefully, by the setting of the pandemic time we were experiencing. Moving the educational act online has caught many children and instructors off guard, since they lack the necessary digital skills and resources. Many youngsters and instructors have had to make swift

adjustments, either via individual study or, in some cases, by enrolling in costly refresher courses.

If things are somewhat clearer at the primary, secondary, and high school levels, the aspect of online education in preschool education is slightly different, because, regardless of the form of activities, synchronous or asynchronous, the educational act is largely dependent on availability, support, and parental involvement.

Essentially, online education cannot be carried out without the use of digital tools; thus, a careful selection is required, taking into account not only the pedagogical values they provide: interaction, collaboration, communication, and evaluation, but also the group's needs, characteristics, and level of development.

Because the main activity in kindergarten is playing in all of its forms, almost all preschool teachers used digital tools in their group's teaching strategy to keep the sense of play, as well as to give them the opportunity to capture the children's attention and keep their interest on throughout the activity, combining the formative and informative aspects in a creative context, and aiming at the same time the creation of skills and competences specific to the proposed activity. Online gaming programs are pleasant and well-liked by youngsters, according to preschool teachers' experience.

Any program or tool can be used in the educational process in a creative way, but not excessively. Starting with the plethora of available digital tools, each instructor has the opportunity to pick based on their preferences and personal experience in order to provide coherence to the teaching act in this dynamic environment. The integration of new technologies in education aims to positively influence the results of the instructional-educational process and to enrich the performance of the education system, even if online education cannot fully replace traditional education but can play an important role as an extension of it.

Further, any pedagogical technique is the consequence of the interaction of various circumstances, and education will always be an art: the art of adapting the broad guidelines provided by methodology books to a specific scenario.

Remarkable advances in computers and microcomputers and, in parallel, the development of cognitive psychology have opened up the perspective of new training technologies: computerized information techniques, computer-assisted instruction and multimedia learning, based on the use of new information and communication technologies (Ionescu, 2011). The same author states that, it is not the use of computer and multimedia technologies, in itself, that has educational effects, but their integration into a well-thought-out training and self-training strategy (Ionescu, 2011).

According to Ionescu (2011), far from being a simple trend in education, the incorporation of computerized information technologies and multimedia in training and self-training strategies now offers promising solutions for the implementation of cognitive psychopedagogy applications in educational practice. In fact, pedagogue Gaston Berger proposed, as a solution to reconcile the slow pace of change in education with the accelerated and continuous pace of change in society, the integration in education of technical means similar to those used outside of school, including mass media, which plays an important role in interpersonal and educational communication and serves as a true institutional catalyst.

The act of teaching in conventional didactics is unidirectional, that is, directed from the instructor to the child, and intended at imparting ready-made knowledge that the children were to passively internalize. Then there was a need to establish models in which education was no longer only the responsibility of the instructor, but also included the kid. As a result, in current

didactics, teaching is no longer regarded as a communication or knowledge transmission activity, but rather as an issue of learning process structure and management (Bocoş, Jucan, 2007).

Teaching is planning learning experiences that result in desired behavioral changes in children (Bocoş, Jucan, 2007). The following are the main stages of the teaching process: presentation of verbal material, organization and management of activities in which to capitalize the presented material, providing support to children to be able to observe, analyze, compare, extract the essential and, then fixing in notions, concepts, and reasoning, and operationalizing children's knowledge by designing and solving problems, theoretical and practical tasks (Bocoş, Jucan, 2007).

Given the current circumstances, we can argue that this epidemic, as well as the state of emergency declared from one day to the next, has resulted in a true educational experiment. Education systems all across the world must adapt to the circumstances and reinvent themselves. Millions of toddlers have been forced to stay at home due to the crisis, and preschool teachers have been compelled to shift their online activities, learning to utilize various digital tools and platforms to continue teaching and stay in touch with children. As a result, both instructors and children were able to adjust to the new educational method and communication style. Although there was willingness on the side of both teachers and children to carry out the online educational activity, there were some difficulties that some encountered. We cite the absence of a means of connection: laptop, tablet, phone, the lack of internet connectivity, and some parents' or instructors' lack of technological expertise. Thus, we may make some conclusions regarding the advantages of online teaching and traditional education by doing an analysis a few months after teaching and learning shifted to home school, for example what children have benefited from during this period and what they were lacking.

The children spent a lot of time in the family, together with their parents, they enjoyed their presence and support in carrying out their work tasks. They carried out their activity in a familiar environment, pleasant and without the noise and agitation in the classroom. Online activities did not start as early as preschool and they could enjoy an extra hour of sleep in the morning. The relationship between preschool and family had to be won, because the parents were able to directly observe the effort made by the teacher in the success of the teaching and learning process. This period favored the learning and development of new skills for parents through the use of tools and platforms on which children work. Online teaching has fostered the collaboration of teachers, by sharing new experiences, exchanging materials and ideas.

On the other side, during these months of home education, the toddlers missed the opportunity to interact and spend time with their peers the most. In the face-to-face activities organized, the teacher has a better control over maintaining the children's attention as well as directing the way in which individual work tasks are completed. By creating a stimulating educational environment, by using attractive teaching materials, by creating learning situations and concretizing them in learning experiences, the teacher allows the development of the child's creativity, as the kindergarten favors the development of the child's autonomy and independence, favoring their global development.

The situation we have all faced since COVID-19 pandemic has emerged, has been unique, and the measures taken have been extraordinary, necessitating urgent solutions and a shift in mindset among educators, as well as children and parents, since continuing education and communication is critical. In the future, it is hoped that a hybrid model of teaching will remain in all levels of education including ECEC, and that the lessons learned by teachers and children

during this period, as a result of the need to adapt, will add value to the educational system in our country.

In this regard, our theoretical approach of technology acceptance in ECEC envisages the preschool teacher as a change agent, and further presents an extension of the classical technology acceptance model, paying particular attention to the specificities of ECEC.

2. The Technology Acceptance Model (TAM) in Early Childhood Education and Care (ECEC)

Currently, there are few approaches in the country to quality assessment and or acceptance of computer applications using structural models: Balog (2006), Onaca et al (2008), Balog (2008) and only one case of application to e-learning systems (Balog, Pribeanu, 2010).

There is no consensus in the literature on the definition the concept of acceptance, most often it is referred to by various terms such as use (Davis, 1989), adoption or persistence. In the technology acceptance model (TAM), acceptance is defined as the user's decision on how and when to use technology (Davis 1989).

In the theory of diffusion of innovation developed by Everett Rogers (1962), adoption it is defined as the decision to use innovation in the best way possible. According to Rogers' theory, any innovation goes through a process spread among users over a period of time.

The process goes through several stages, as five types of users adopt (decide to use) that product or system. In the field of e-learning, Martinez (2003) defines acceptance by reference to persistence as being the action of continuity in achieving an educational goal. This one implies the idea of the temporal dimension and the presence of a goal to be achieved, which goes beyond the idea of use or adoption involved in innovation and innovation technology.

A common definition of acceptance is positive response to an offer (Succi, Cantoni, 2006). While the action makes acceptance effective, the other two components (knowledge and commitment) give rise together with the decision-making stage (preparatory phase) which supports the act itself and after making the decision.

A number of key variables and determinants are frequently used with reference to acceptance. Succi and Cantoni (2006) describe the phases of acceptance grouped into three categories: processing, action, and continuity (persistence). Preparation can be defined as any aspect that contributes to being ready for action and is dependent on the cognitive level. At this stage, learners form expectations about the new means of learning. They receive information about them, recall previous experiences, listen to the opinions of others, and update their own perceptions of this new means of learning. Action refers to the acceptance / adoption of behavior. Using the application, physical presence in class, or starting an activity is a time when learners need to adjust their initial expectations to the experience they are currently having. It is also the phase in which learners become familiar with the environment and encounter the first problems related to use. Persistence represents the total of events after the action phase and takes place at the meta-cognitive level. In this phase, an appreciation of the experience takes place and it is decided whether the action is worth repeating or not. At the same time, learners become involved in the processes, become more productive and can develop a creative attitude.

Technology Acceptance Model (TAM) is a theory of computer systems developed to be able to make predictions about technology acceptance. This model suggests that when users are introduced to a new technology, a number of factors influence their decision about how and when to use it. TAM is based on the causal relationship beliefs - attitude - intention - behavior, a relationship developed within the theory of motivated action (TRA). TAM postulates that two specific attributes, perceived ease of use and perceived usefulness, directly influence a person's

attitudes toward the use of technology (Davis et al, 1989). Perceived Utility (PU) is defined as the degree to which a person believes that using a particular system will improve their performance and activities. Perceived ease of use (PEU) refers to the degree to which a person believes they will put less effort into using a particular system. The TAM states that both perceived ease of use and perceived utility associated with the use of a particular system may be a basis for adequately explaining why users accept or reject technology.

Venkatesh et al (2003) propose an eclectic model, called the Unified Theory of Acceptance and Use of Technology (UTAUT), which postulates the importance of four constructs in determining the acceptance of technology: expected performance, expected effort, social influence, and facilitative conditions. Most TAM applications in online learning propose an integration of the model, introducing external variables as antecedents of perceived utility and perceived ease of use. Currently, there is a rapid diffusion of online learning systems at the level of educational institutions, which requires research on their acceptance and use. In the beginning, the problems related to the use of online learning systems are related to access to technology, connection and familiarity with the use of the Internet. As technology advances, issues shift to the level of the learner, the acceptance of the e-learning system, and user satisfaction.

Because of the COVID-19 epidemic, online education has become a popular response, requiring preschool instructors to adapt and use educational technology quickly. In light of this crucial situation, research on preschool teachers' usage of technology may give insight into how to motivate preschool instructors to utilize educational technology. In past study, the Technological Adoption Model (TAM) was widely utilized to evaluate the process of people embracing technology. The elements that influenced preschool teachers' usage of technology with individualized TAM were investigated in a recent study. According to the study, preschool instructors exhibited a moderate to high level of behavioral intention. Preschool instructors' perceived utility and simplicity of use are highly tied to their behavioral goals. Perceived usefulness is influenced by perceived ease of use and work relevance. Computer self-efficacy and perceptions of external control are two positive features of perceived ease of usage (Hong, et al., 2021).

In regards to the theoretical argumentation presented, our extended technology acceptance model in ECEC (TAM-ECEC) will take into consideration the following dimensions:

1. Perceived ease of use refers to how easy an individual believes it is to utilize technology without exerting effort or, in other words, how simple it is to use (Davis, 1986; Bong et al., 2019; Mostaghel, Oghazi, 2017; Chiu et al., 2017; Dogruel et al., 2015).
2. Perceived usefulness is the degree to which a person believes that the use of technology would increase their job performance (Bong et al., 2019; Mostaghel, Oghazi, 2017; Chiu et al., 2017; Dogruel et al., 2015; Lekjaroen et al., 2016; Hsiao, Tang, 2015).
3. Perceived enjoyment is the degree to which the action of utilizing a certain system is perceived to be pleasurable in and of itself, independent of any performance outcomes associated with system use (Dogruel et al., 2015; Park et al., 2021).
4. Intention to use represents willingness to use the technology in the future (Hsiao, Tang, 2015; Lekjaroen et al., 2016).
5. Actual use represents willingness to use the technology in present (Dogruel, Joeckel, Bowman, 2015).
6. Compatibility refers to the degree to which an innovation is perceived as being consistent with the existing values, needs and past experiences of potential adopters (Chiu, et al., 2016; Rogers, 1995).

7. Attitude refers to a physical tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor (Bong et al., 2019; Chiu et al., 2017; Lekjaroen et al., 2016; Hsiao, Tang, 2015).
8. Self-efficacy relates to people's perceptions of their own effectiveness or capacity to do a certain activity successfully (Bong, et al., 2019; Dogruel, et al., 2015, Bandura, 1986).
9. Zoom fatigue is defined as a generalized feeling of exhaustion from participating in video conference calls (Fauville, et al., 2021).
10. Perceived risk is viewed as the likelihood that a technology assisted educational activity will not be as efficient as expected (Li, Huang, 2009).

An individual's overall assessment of technology is a crucial factor in determining their attitudes toward technology (Zhang, et al., 2012; Zhang, et al., 2008).

3. Conclusions and implications

We live in a time where things are always changing: education is moving online, and employees are being pushed to work from home. For parents, children, and instructors who are impatiently anticipating the start of the preschool year, it is a rapid transition at an unknown pace. What are the responsibilities of the home and preschool in children's education in this setting, and how are they changing? With patience, compassion, and support, time spent at home, as well as the notion of an online preschool, may be used to build the critical family-school relationship for children's future success.

Preprimary schools aren't just for academics, they represent important agents for developing social and emotional skills, interacting with others, and providing social support. If the online education challenge is not met, the consequences will be felt throughout life, both socially and economically, on children, young people, families, communities, and society as a whole. Even if this is not the first time that education has gone digital, the problems that teachers still face still need to be addressed:

- Lack of methodologies in emergencies such as pandemics
- Lack of infrastructure to facilitate online teaching (technologies)
- Lack of experience with online working methods and digital pedagogy
- Changing the teaching environment and adapting to experiential teaching
- Changing the schedule

As a result, education necessitates a strong family-school-community cooperation. Even if many parents are overwhelmed and unable to cope because they either have no one to leave their children at home during the day or work from home and are unable to monitor their children at the same time, instructors adapt to digital pedagogy and learn alongside their pupils. That is why, in the current environment and in the new normal, it is critical that the functions of the family and the preschool complement one other rather than being mutually exclusive. Teachers learn from parents about the children's needs, passions, and interests, as well as their moods and emotions. On the other hand, parents may determine when and how their children want assistance and encouragement in order to succeed and develop positive behavior.

Members of the community are also needed in their partnership to ensure personal and social development, as well as physical and emotional health, through a variety of means, including counseling, guidance, development programs, health services, school partnerships, especially during the pandemic. This aspect is mainly important due to the fact that children are unable to regulate their anger and emotions because they have not been taught how to do it. Isolation from friends, peers, and preferred pastimes can aggravate them, while spending time

with their parents might leave them feeling confused, furious, apathetic, nervous, agitated, and dependent. If there are frequent disputes in the parent-teacher connection, like the lack of communication, differing viewpoints, monopoly on educational decisions, the crisis might be an exciting chance for a good development.

As a result, the new paradigm must reflect the fact that time spent on devices is no longer a problem, but rather a means of surviving in the pandemic. If limiting the amount of time spent in front of screens was a need, we now need to adjust our expectations: not only did the preschool go online, but so did a slew of other activities. Children who are at home require meaningful screen time. Thus, online or hybrid learning may provide children with the autonomy and responsibility, a feeling of teamwork and trust, and resilience that they require for their future.

Transitioning from a traditional to an online preschool, as well as organizational issues, limits, and a lack of resources, has resulted in a lot of exhaustion, as well as a drop in performance among children who feel more alienated and powerless. Furthermore, traditional preschooling does not compare to online learning, with data indicating that digital education produces worse results. It is critical that they are encouraged and praised, even for minor efforts, on a daily basis.

The focus of this theoretical approach was the technology acceptance model of teachers, but it could provide us a more deepen understanding of the online education in ECEC if further research would focus on technology acceptance model in parents of toddlers.

References:

1. Balog, A (2008). Approaches on the Quality Evaluation of the On-line Public Services (eServEval). *Revista Română de Interacțiune Om Calculator*, 1 (număr special RoCHI 2008), 125-128
2. Balog, A. (2006). Masurarea calitatii sistemelor de comert electronic. *Proc. RoCHI 2006, MatrixRom*, 35-40.
3. Balog, A., Cristescu, I. (2009). Teorii și modele ale acceptării noilor tehnologii, *Revista Română de Interacțiune Om-Calculator* 2(2), 147-160.
4. Balog, A., Pribeanu, C. (2010). The Role of Perceived Enjoyment in the Students' Acceptance of an Augmented Reality Teaching Platform: a Structural Equation Modelling Approach. *Studies in Informatics and Control*, 19 (3), 319-330.
5. Bandura, A. (1986). *Social Foundations of Thought and Action: A Social Cognitive Theory*. Englewood Cliffs, NJ: Prentice-Hall.
6. Bocoș, M., Jucan, D. (2007). Teoria și metodologia instruirii, Teoria și metodologia evaluării. *Paralela 45*. Pitești.
7. Bong, W.K., Bergland, A., & Chen, W. (2019). Technology Acceptance and Quality of Life among Older People Using a TUI Application. *Int. J. Environ. Res. Public Health*, 16, 4706. <https://doi.org/10.3390/ijerph16234706>.
8. Chiu, C.-J., Hu, Y.-H., Lin, D.-C., Chang, F.-Y., Chang, C.-S., & Lai, C.-F. (2016). The attitudes, impact, and learning needs of older adults using apps on touchscreen mobile devices: Results from a pilot study. *Comput. Hum. Behav.* 63, 189–197.
9. Davis, F.D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results. Doctoral dissertation Massachusetts Institute of Technology (1986) Retrieved from <https://dspace.mit.edu/handle/1721.1/15192>.

10. Dogruel, L., Joeckel, S., & Bowman, N.D. (2015). The use and acceptance of new media entertainment technology by elderly users: Development of an expanded technology acceptance model. *Behav. Inf. Technol.* 34, 1052–1063.
11. Fauville, G., Luo, M., Queiroz, A.C.M., Bailenson, J.N., & Hancock, J. (2021). Zoom Exhaustion & Fatigue Scale, *Computers in Human Behavior Reports*, Volume 4, 100119, <https://doi.org/10.1016/j.chbr.2021.100119>
12. Hong, X., Zhang, M., & Liu, Q. (2021). Preschool Teachers' Technology Acceptance During the COVID-19: An Adapted Technology Acceptance Model. *Frontiers in Psychology*, 12.
13. Hsiao, C.-H., Tang, K.-Y. (2015). Examining a model of mobile healthcare technology acceptance by the elderly in Taiwan. *J. Glob. Inf. Technol. Manag.* 18, 292–311.
14. Ionescu, M. (2011). *Instrucție și educație*, Editura Eikon, Cluj-Napoca.
15. Ionescu, M. (2011). *Instrucție și educație. Paradigme educaționale moderne*. Cluj-Napoca: Eikon, 46, 20.
16. Legris, P., Ingham, J., & Colletette, P. (2003). Why do people use information technology? a critical review of the technology acceptance model. *Inf. Manage.* 40, 191–204. doi: 10.1016/S0378-7206(01)00143-4.
17. Lekjaroen, K., Pongantayotin, R., Charoenrat, A., Funilkul, S., Supasitthimethee, U., & Triyason, T. (2016). IoT Planting: Watering system using mobile application for the elderly. In *Proceedings of the 2016 International Computer Science and Engineering Conference (ICSEC)*, Chiangmai, Thailand, pp. 1–6.
18. Li, Y. H., & Huang, J. W. (2009). Applying theory of perceived risk and technology acceptance model in the online shopping channel. *World Academy of Science, Engineering and Technology*, 53(1), 919-925.
19. Liu, H., Wang, L., & Koehler, M. J. (2019). Exploring the intention-behavior gap in the technology acceptance model: a mixed-methods study in the context of foreign-language teaching in China. *Br. J. Educ. Technol.* 50, 2437–2556. doi: 10.1111/bjct.12824.
20. Onaca, D., Muresan, A., Pitariu, H. (2008). Hedonic and pragmatic attributes in determining the mobile phone user experience. *Revista Română de Interacțiune Om Calculator*, 1 (număr special RoCHI 2008), 129-132.
21. Park, Y., Son, H., & Kim, C. (2012). Investigating the determinants of construction professionals' acceptance of web-based training: an extension of the technology acceptance model. *Autom. Constr.* 22, 377–386. doi: 10.1016/j.autcon.2011.09.016.
22. Rogers, E. M. (1995). *The Diffusion of Innovation* (4 ed.). New York: The Free Press.
23. Succi, C, & Cantoni, L. (2006). Looking for a comprehensive eLearning acceptance framework. A literature review and a tentative map. *Proc. ED-Media 2006*, 912-919.
24. Teo, T. (2008). Pre-service teachers' attitudes towards computer use: A Singapore survey *Australasian Journal of Educational Technology*, 24(4), 413-424.
25. Teo, T. (2009). Modelling technology acceptance in education: A study of pre-service teachers. *Computers & Education*, 52(2), 302-312. <https://doi.org/10.1016/j.compedu.2008.08.006>
26. Teo, T. (2009). The impact of subjective norm and facilitating conditions on pre-service teachers' attitude toward computer use: A structural equation modeling of an extended technology acceptance model. *Journal of Educational Computing Research*, 40(1), 89-109. <https://doi.org/10.2190/EC.40.1.d>

27. Teo, T. (2011). Factors influencing teachers' intention to use technology: Model development and test. *Computers & Education*, 57(4), 2432-2440. <https://doi.org/10.1016/j.compedu.2011.06.008>
28. Teo, T. (2013). Influences of contextual variables on the intention to use technology in education: A latent variable modeling approach. *Campus-Wide Information Systems*, 30(2), 95-105. <https://doi.org/10.1108/10650741311306282>
29. Teo, T. (2015). Comparing pre-service and in-service teachers' acceptance of technology: Assessment of measurement invariance and latent mean differences. *Computers & Education*, 83 22-31. <https://doi.org/10.1016/j.compedu.2014.11.015>
30. Teo, T., & Noyes, J. (2011). An assessment of the influence of perceived enjoyment and attitude on the intention to use technology among pre-service teachers: A structural equation modeling approach. *Computers & Education*, 57(2), 1645-1653. <https://doi.org/10.1016/j.compedu.2011.03.002>
31. Teo, T., & Noyes, J. (2014). Explaining the intention to use technology among pre-service teachers: A multi-group analysis of the unified theory of acceptance and use of technology. *Interactive Learning Environments*, 22(1), 51-66. <https://doi.org/10.1080/10494820.2011.641674>
32. Teo, T., & Schaik, P. van (2012). Understanding the intention to use technology by preservice teachers: An empirical test of competing theoretical models. *International Journal of Human-Computer Interaction*, 28(3) 178-188. <https://doi.org/10.1080/10447318.2011.581892>
33. Teo, T., Fan, X., & Du, J. (2015). Technology acceptance among pre-service teachers: Does gender matter? *Australasian Journal of Educational Technology*, 31(3), 235-251. <https://doi.org/10.14742/ajet.1672>
34. Teo, T., Zhou, M., & Noyes, J. (2016). Teachers and technology: Development of an extended theory of planned behavior. *Educational Technology Research & Development*, 64(6) 1033-1052. <https://doi.org/10.1007/s11423-016-9446-5>.
35. Teo, T. (2012). Examining the intention to use technology among pre-service teachers: An integration of the technology acceptance model and theory of planned behavior. *Interactive Learning Environments*, 20(1), 3-18, 10.1080/10494821003714632.
36. Towell G., & Shavlik J. W. (1992). Interpretation of artificial neural networks: mapping knowledge-based neural networks into rules, in *Advances in Neural Information Processing Systems* (San Mateo, CA), 977-984.
37. Venkatesh, V. (2000). Determinants of perceived ease of use: Integrating control, intrinsic motivation, and emotion into the technology acceptance model. *Information Systems Research*, 11, 342-365.
38. Venkatesh, V., & Bala, H. (2008). Technology acceptance model 3 and a research agenda on interventions. *Decision Sciences*, 39(2)m, 273-312. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
39. Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, 39(2), 273-315. doi:10.1111/j.1540-5915.2008.00192.x
40. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Management Science*, 46(2), 186-204, doi:10.1287/mnsc.46.2.186.11926.

41. Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425–478, doi:10.2307/30036540, JSTOR 30036540.
42. Yang, H. D., & Yoo, Y. (2004). It's all about attitude: revisiting the technology acceptance model. *Decision support systems*, 38(1), 19-31.
43. Yang, Y., & Wang, X. (2019). Modeling the intention to use machine translation for student translators: an extension of technology acceptance model. *Comput. Educ.* 133, 116–126. doi: 10.1016/j.compedu.2019.01.015.
44. Zhang, L., Zhu, J., & Liu, Q. (2012). A meta-analysis of mobile commerce adoption and the moderating effect of culture. *Computers in Human Behavior*, 28, 1902-1911. <https://doi.org/10.1016/j.chb.2012.05.008>