

Adaptive Learning Components for Pre-University Students

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Abstract. *The majority of those teaching students in Romanian pre-university education use digital educational resources, educational platforms, and applications that employ artificial intelligence both in the teaching process and in evaluation to support student motivation and improve school results through learning adapted to the needs of the students. During the COVID-19 pandemic restrictions, teachers sought new methods and tools to use in online teaching and assessment. Many of them created digital educational resources that they use both for teaching and for evaluating students.*

In this study, I present the results of research conducted by applying an online questionnaire created with Google Forms to a number of 107 teachers who teach students in Romanian pre-university education. The questionnaire was sent individually through the WhatsApp application to identify the factors that lead to the motivation and improvement of the students' school results. The questionnaire responses were provided during February 20-23, 2024. Digital educational resources, educational platforms, and applications that use artificial intelligence were identified, which are used by teachers to motivate students to learn and to enhance their learning outcomes. The study underscores the significance of tailoring teaching methods to the specific needs of students and highlights the pivotal role of technology in enabling this adaptation process.

Keywords: adaptive learning, improving student performance, online learning, Open Educational Resources, COVID-19.

Introduction

In pre-university education, teachers face a genuine problem due to the fact that students are no longer motivated to learn, and the methods used in classrooms do not yield the expected results for students. According to the study, the use of digital educational resources by 92.52% of teachers follows from the investment during the COVID-19 period, in which teachers learned to use and create digital educational resources. Digital teaching materials have gained ground as an essential pillar in supporting teaching and learning activities, with a significant impact during the restrictions imposed by the COVID-19 pandemic. They represent accessible resources for individual study, most being available online and in the public domain, which facilitates students' instant access. This universal accessibility and the possibility to interact immediately with self-explanatory educational content efficiently improve the learning experience of the student.

In the recent context of the rise of e-learning as a dominant strategy in education, which offers advantages such as flexibility, scalability, and personalization, adaptive learning marks a significant evolution. It involves the intelligent and fluid adjustment of educational content and activities to fit the unique preferences and needs of each student, based on a meticulous analysis of data related to their performance and behavior. Adaptive educational systems use this information to develop personalized learning experiences that improve outcomes and boost student engagement.

Open Educational Resources (OER) are materials designed for learning, teaching, and research, presented in various formats and mediums, which are found in the public domain or are

subject to copyright and have been made available through an open license. This allows for free access, reuse, adaptation, and redistribution by third parties without additional costs. (UNESCO, 2019)

The purpose of this study is to identify the extent to which teachers from the sample researched create and use educational resources adapted to the learning needs of their students, the extent to which they use educational platforms, how much they utilize artificial intelligence in the teaching and assessment stages of their students, and how important all these tools are in motivating students to learn and improving learning outcomes.

The teaching staff who participated in this study, have used various applications to create an open educational resource for teaching and student assessment. The most used applications by the teachers involved in this study were: Wordwall (27%), Kahoot (19%), quizizz (11%), Google Forms (11%), Canva (10%).

Literature review

Digital educational resources are created to support the educational process through digital means, improving access to information and diversifying learning methods. Their purpose can vary depending on the teacher creating them and the target audience. (Vidal, 2022)

The main goal of Open Educational Resources (OER) is to democratize access to education by eliminating financial barriers and promoting equality in education through facilitating universal access to quality educational resources.

Both categories of resources support education through digital means, but OERs offer open and free access, and through Creative Commons licensing, they allow greater flexibility in use, adaptation, and distribution. (Milosevic, 2024)

Educational platforms used by teachers are reusable, adaptable, and redistributable, and they help students develop digital skills, complex logical thinking, and improve their learning outcomes. (Sanabria, 2023)

To improve motivation and learning outcomes, teachers use digital games (DGBL) that engage and train students to work in teams, be attentive, and curious. (Chen, 2023) Students retain concepts presented in games better, achieving better results in summative assessments. (Squire, 2023) Since students easily use mobile technology, digital games can be used in class for teaching and assessment through mobile phones. (Cheng, 2019)

The use of adaptive learning through artificial intelligence (AI) or machine learning (ML) in e-learning creates considerable potential to transform the educational domain. It personalizes the learning process for each student. By analyzing the individual characteristics of students in detail, these technologies can adjust the content, pace, and teaching methods to improve educational outcomes. This customization enhances student engagement and motivation, contributing to better information retention and improved academic performance. (Gligorea, 2023)

E-learning has introduced challenges, such as the reduction of personal interaction between teachers and students, which has highlighted the need to develop more personalized approaches to meet the diverse requirements of students. Thus, online education has not only transformed the teaching paradigm but also emphasized the importance of continuously adapting to the changing needs of students. (Essa, 2023)

Digital educational resources and Open Educational Resources (OER) play a crucial role in democratizing access to education, enhancing methodological diversity and access to quality information, eliminating financial barriers, and promoting equality. Educational platforms provide reusable, adaptable resources and facilitate the development of students' digital skills, improving

their outcomes through digital games and adaptive learning via artificial intelligence, which personalizes the educational process. However, e-learning introduces challenges, including the reduction of personal interaction, necessitating continuous adaptations to meet the diverse needs of students, emphasizing the importance of adapting digital pedagogy to the evolving educational landscape.

Methodology

Empirical studies have shown that the use of digital educational resources, OERs, educational platforms, and digital educational games makes pre-university students more attentive, motivated, and eager to win by answering tests correctly, leading to better learning outcomes.

In Romania, for middle school students aged 10 to 14, digital textbooks have been available since 2010, coinciding with efforts to modernize and digitize the educational process. These textbooks have been gradually integrated into schools, and in recent years, they have become increasingly prevalent, aiming to facilitate access to information and adapt to modern technologies in education. The textbooks contain videos, images, and interactive tests. Digital textbooks for the Computer Science and ICT subject have been available since 2017.

Due to the Covid-19 pandemic restrictions, teachers made efforts to identify the most suitable methods to motivate students to pay attention to online lessons and to improve learning outcomes. Consequently, they created and used digital educational resources, 92.52% of the 107 teachers who were the subject of the study. These new teaching-learning methods based on technology and their adaptation to the current societal context are known today as Education 4.0. (Ramírez-Montoya, 2022). The Education 4.0 concept is used to develop and implement innovative methods in the field of education, relying on the use of technology as the main tool for achievement. Education 4.0 encourages (1) a shift from a teacher-centered teaching style to a student-centered one, and from a passive learning mode to an active one, (Tang, 2020) (2) explores real-life scenarios and challenging situations that allow students to improve their professional skills by applying the knowledge acquired, and (3) cultivates research skills and complex reasoning, facilitating the formulation of solutions to contemporary societal problems and challenges.

Adaptive learning represents an advanced educational strategy that uses technology to personalize the learning process, adapting it to the individual characteristics of each student, such as their needs, preferences, and their own learning pace. This approach uses algorithms and artificial intelligence to adjust the educational content and teaching methods based on the performance and engagement level of the learners. Through this personalization, adaptive learning aims to increase the efficiency of the educational process, maximize student participation, and improve learning outcomes. In the context of e-learning, it offers remarkable flexibility, allowing for the continuous adaptation of teaching materials and learning activities to the profile of each student, based on data analysis about them, to optimize the educational experience and intensify student engagement in the learning process. (Gligorea, 2023)

Results and discussions

The result of the study conducted on a sample of 107 teachers from pre-university education in Dâmbovița County, Romania, leads us to the conclusion that a significant percentage (92.52%) of the surveyed teachers have created or used digital educational resources and 89.71% believe that digital educational resources support the improvement of learning. Regarding the use of platforms

that contain applications utilizing artificial intelligence, 87.85% of the surveyed teachers use such platforms in class for teaching and assessment.

To identify new ways to motivate students to actively participate in classes and achieve better learning outcomes, 107 teachers from pre-university education in Dâmbovița County, Romania were asked for their opinion on how the use of digital educational resources in the teaching phase leads to learning improvement and 89.71% (Figure 1) responded with a lot and very much. Reformulating the question, teachers believe that in the student assessment phase, the use of digital educational resources leads to learning improvement for 85.04%.

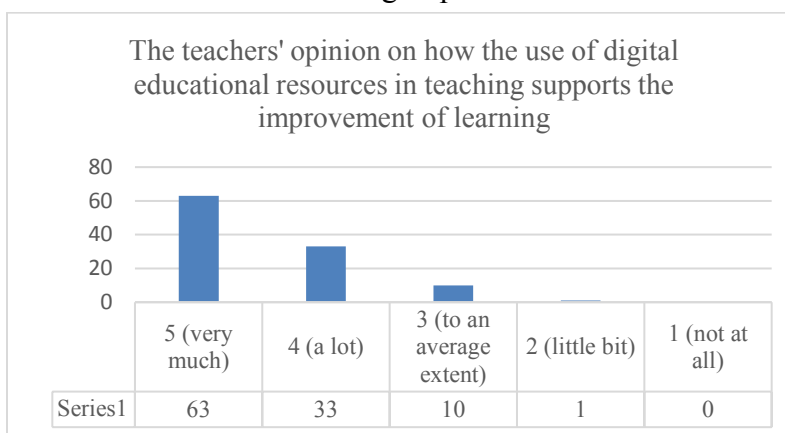


Figure 1. The resulting diagram after processing the data collected from teachers about the teachers' opinion on how the use of digital educational resources in teaching supports the improvement of learning

Source: Source: Author' own research results, <https://forms.gle/UsPBN1RafUBZfp4E6>.

It has become essential for teachers to use educational platforms for managing student classes in terms of recording absences and the results of student assessments. Additionally, teachers utilize educational platforms that offer applications developed with artificial intelligence both in the teaching phase and for student assessment. According to the responses obtained from a survey applied to 107 teachers, 87.85% have used educational platforms or applications that employ artificial intelligence. When asked, "Do you think that using platforms or applications that utilize artificial intelligence in class with students helps improve learning?" the responses were 62% a lot and very much, while 27% were average (Figure 2).

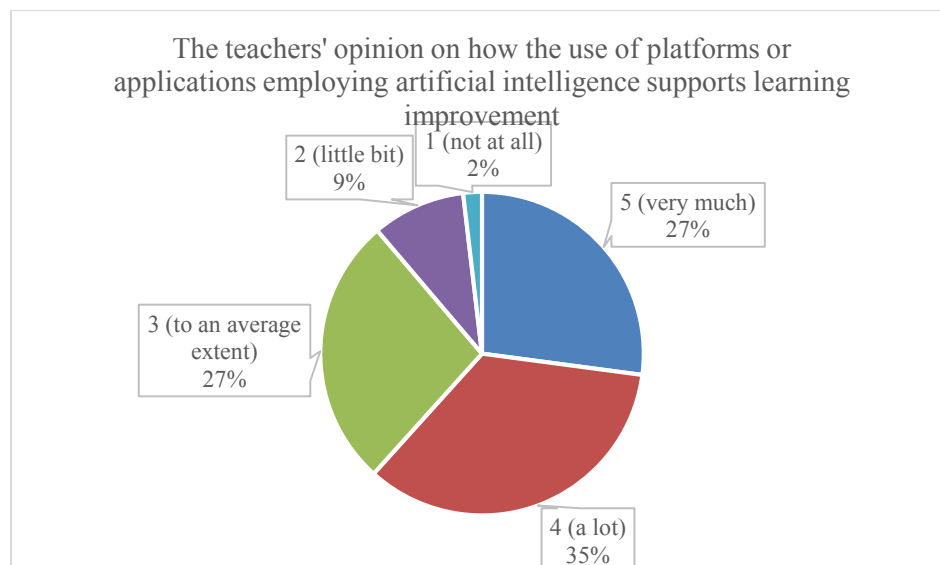


Figure 2. The resulting diagram after processing the data collected from teachers about the teachers' opinion on how the use of platforms or applications employing artificial intelligence supports learning improvement

Source: Source: Author' own research results, <https://forms.gle/UsPBN1RafUBZfp4E6>.

Artificial intelligence helps teachers create customized lesson sequences tailored to the learning needs of students, motivating them to learn. Artificial intelligence significantly supports learning through developed applications and by assessing the concepts learned. Traditional learning standardizes the learning stages for all students, whereas modern applications use technology to develop personalized learning trajectories, considering both the aspect and techniques of motivating students as well as the adapted progression of content. (Tapalova, 2022). In the conducted research, teachers have different opinions on how applications that use artificial intelligence motivate students to learn (Figure 3), indicating that students' use of applications without guidance from a teacher does not lead to better outcomes, with the teacher still playing a particularly important role both in motivating students and in achieving better learning results.

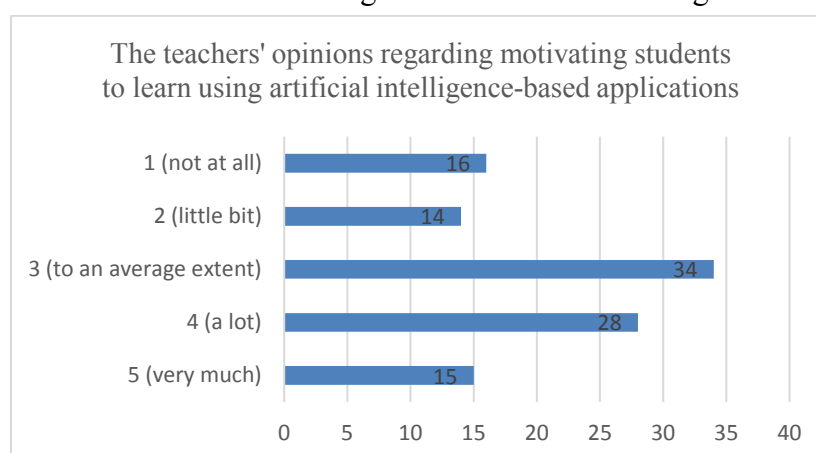


Figure 3. The resulting diagram after processing the data collected from teachers about the teachers' opinions regarding motivating students to learn using artificial intelligence-based applications

Source: Source: Author' own research results, <https://forms.gle/UsPBN1RafUBZfp4E6>.

Conclusion

The study presented was conducted on a sample of 107 teachers from the Romanian pre-university education system and shows that the majority of teachers use digital educational resources, platforms, and applications with artificial intelligence in the teaching and assessment process. Of these, a significant percentage (92.52%) use educational resources in class with their students, and some of them create educational resources for students. Teachers create educational resources to better match their students' learning styles to motivate them to pay attention, learn, and achieve better academic results. By providing tools tailored to the students' needs at the most appropriate moments of the lesson, the learning outcomes are improved. Most of the teachers participating in this study use the applications Wordwall (27%), Kahoot (19%) for knowledge recapitulation, ongoing assessment, and summative evaluation. These tools are suitable for motivating students and improving academic results by offering adapted learning. The Covid-19 pandemic has accelerated the adoption of new methods and digital educational tools, with teachers creating their resources to support online teaching and assessment. Research conducted on a sample of 107 teachers has identified their preferences in using technology to improve student motivation and performance. The results indicate significant use (92.52%) of digital resources, highlighting the positive impact of technology in education. Applications such as Wordwall, Kahoot, quizizz, and Google Forms are frequently used by teachers. The study underscores the importance of tailoring teaching methods to the needs of students and the crucial role of technology in facilitating this process.

The teachers who are part of this sample are educators who desire better learning outcomes for their students. To achieve these outcomes, the teachers create and use educational resources adapted to the educational needs of the students, utilize educational platforms to provide them with unlimited access to resources and employ artificial intelligence to motivate students to learn. An analysis of each subject taught in pre-university education could be conducted to create learning platforms tailored to the specific learning needs of students.

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