

DIGITAL TUTORS USING ARTIFICIAL INTELLIGENCE AND EDUCATION IN THE 21ST CENTURY

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ABSTRACT: The book chapter demonstrates that technology has been transforming education through digital tutors, software based on Artificial Intelligence that offers personalized educational support to students and even teachers. These tutors, applicable from basic to higher education, are designed to help in different areas of knowledge. They offer instant feedback and

adjust the level of complexity of the study, provide extra features like interactive exercises and videos. However, there are countless challenges to be faced so that this technology obtains a prominent position within the educational process. This article aims to identify the main challenges that must be faced to allow greater use of this technology in academia. The methodology used was bibliographical research with a qualitative approach. The result of the research points to a growing use of digital tutors, despite criticisms of their use as a substitute for teachers in digital media. In contrast, more recent articles defend its gradual integration into teaching. It is concluded through the research that the potential of digital tutors to improve academic performance and personalize education is great, however it is essential to analyze and face the real challenges in order to allow a broader application of this technology.

KEYWORDS: Digital Tutor. Artificial intelligence. Education.

INTRODUCTION

Technology has over the last decades increasing many changes in the area of education, among them the use of digital tutors has been gaining more space every day in education, they are made possible by a variety of technologies and infrastructures that work together to provide a personalized learning experience to its users. Algumas dessas tecnologias incluem: Artificial Intelligence (AI) that is at the heart of digital tutors, and allows personalization and adaptation to the individual needs of students through advanced algorithms.

It also includes other technologies, such as Machine Learning that allows tutors to adapt and learn from student performance, offering more targeted support, Data Analytics which are the collections and analysis of data on student performance, these allow continuous adjustment in teaching, identifying areas of need and success.

Learning Management Platforms (LMS) are the systems that provide the necessary infrastructure to integrate digital tutors into existing curricula, allowing easy access and monitoring by educators. Integrated or not the platforms, there are cloud technologies or cloud computing that facilitates access to digital tutors from anywhere, making learning more flexible and accessible.

There are mobile devices and tablets. These enable mobility and need to be compatible with different systems, allowing students to access digital tutors in various contexts, whether in the classroom or at home. They need cybersecurity to ensure data security, which is critical in online education, and cybersecurity technologies ensure that student information is kept safe and private.

Finally, we have High-Speed Networks, with the function of enabling the connectivity essential for continuous access to digital tutors, and High-Speed Networks facilitate a seamless learning experience, as well as allowing collaboration and communication through chat and video conferencing tools. These technologies, working together, form the foundation that enables digital tutors to transform education, making it more accessible, personalized and effective.

Thus, the successful integration of these technologies requires careful planning and observation of the specific needs and challenges of education in different contexts. According to Souza (2014, p. 10) “there are countless possibilities that until recently were unthinkable, which makes the challenge of enabling technology as an essential tool in the teaching-learning process a difficult task.”

In addition, digital tutors are educational software designed to help students in their learning process by providing personalized support and immediate feedback. They are different from traditional teachers in that they use artificial intelligence technology to personalize each student’s learning experience. According to education experts Molly Zielezinski; Linda Darling-Hammond and Shelley Goldman,

Technology and learning contexts interact with the characteristics of the student. Together, they shape the student experience and outcomes associated with the use of digital, this ecosystem is far more complex than the binary conceptions of technology use that were common in the late twentieth century. (ZIELEZINSKI; DARLING-HAMMOND; GOLDMAN, 2014, p. 5).

According to Costa (2018), there is a consensus in academia among educators and researchers, maintaining that education in the 21st century will undergo a total transformation, teaching and learning methods will be reformulated. Instruction will become more personalized, and emerging communication technologies, including digital tutors, will have a marked presence. That is, there will be a significant increase in the use of digital tutors in this and the next decade. This work sought in the available bibliography to identify the main difficulties for its use in the school environment and that, according to Rocha and Barreto (2018), “one of the greatest difficulties encountered in the course of implementing a new technology comes mainly from the resistance of teachers and even managers who discovered themselves too late for the technologies started in the twentieth century”.

This scientific article brings a spectrum of light, demonstrating the relevance of digital technologies in the scenario of contemporary education, especially in the training of educators, considering that technical knowledge required by the labor market and social interaction require students of the twenty-first century a training based on the promotion of learning mediated by digital Technologies. It is, therefore, about optimizing the efficiency of the teaching and learning process through solutions such as digital tutors.

Therefore, there are numerous challenges to be faced within a process of implementation of a new technology in education, either by lack of infrastructure, or by the difficulties inherent to the educational system itself adopted. We will address in the topic discussion, in greater depth these issues that are configured in difficulties to be faced in the process of insertion of digital tutors in the educational environment.

METHODOLOGY

In this work, the research made use of the qualitative approach, descriptive in relation to the objectives and, from the perspective of the design, it is a bibliographical research. Data collection was performed in the Web of Science database, where 670 indexed articles were initially found, using the following keywords: Digital tutor. Teaching. Apprenticeship. Education. Secondly, filters were applied to keep only the articles of enriched cited references, open access and review articles, which resulted in a reduction of 107 articles.

A new filter was implemented in the research where only the Areas of study were kept: Education and Educational Research, Research and Remote Education, Human-Computer Interaction, Computer Vision and Graphics, Distributed and Real-Time Computing, Artificial Intelligence and Machine Learning.

Then only the articles in English, Spanish and Portuguese were selected, reducing the number of articles found to 230, of which the 50 articles with the highest number of citations for reading the abstract were selected, after this stage it was observed the need for complementarity of the content, because only 5 of them dealt with the proposed theme. They are cited in the body of the text.

To strengthen the analysis in the research, focusing on the bibliographic framework necessary to achieve the objective of the proposed work, new research was carried out on websites and in the physical collection of the library of the Federal University of Rondônia. The findings are also cited. Figure 01 shows the search result in the WS database.

The screenshot displays the Web of Science search interface. At the top, the Clarivate logo and navigation options are visible. The search query is entered in the search bar, and the results are filtered to 230 items. The top result is highlighted, showing the title, authors, journal, and citation count.

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230 resultados de Coleção principal da Web of Science para:

Q Digital Tutor* (Todos os campos) and Teaching (Todos os campos) and Learning (Todos os campos) and Education (Todos os campos) [Analisar resultados] [Relatório de citações] [Criar alerta]

Filtrado por: NOT Anos da publicação: 2009 or 2008 or 2007 or 2006 or 2005 or 2004 or 2003 or 2002 or 1999 or 1998 or 1997 or 1996 or 1992 X

NOT Tipos de documento: Artigo de conferência or Acesso antecipado or Material editorial or Meeting X NOT Idiomas: Russian or Chinese or German or Ukrainian X [Limpar todos]

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1 [Digital University Teaching and Learning in Management-The Gini from the COVID-19 Bottle and Its Empirical Representations in Germany]

Witt, J.; Klump, M. and Beyer, B.

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Figure 01 – search result in the Web of Science database.

Source: authors, 2023.

In the analysis of the data collected in the publications, there was a scarcity of studies directly related to the objective of the study. Much research is done on emerging technologies in education, but with regard to the difficulties to implement them there is still a lack of studies.

DISCUSSION

In the context of contemporary education, the importance of the constructivist approach is highlighted, which emphasizes the active construction of knowledge by the student, as opposed to the behaviorist view of learning as a response to external stimuli. This view is supported by (MAYER, 1995) who recognizes the influence of online learning technologies on the conception of learning. The author explains that through the use of different technologies, such as computers and interactive media, the educational potential is expanded, allowing the delivery of content rich in graphics, interactivity and geographical location.

However, the author points out that the use of technology itself does not guarantee learning and highlights the importance of student-centered approaches and the construction of knowledge, which is possible through the use of digital tutors. Advances in research on how people learn, and how technology can support learning, are discussed based on studies on schema building, cognitive development, and theories of learning.

As for the preparation and professional development of teachers, according to (HANUSHEK; RIVKIN, 2012) in his article “The Distribution of Teacher Quality and Implications for Policy” the author notes that although the quality of teachers is often considered a crucial determinant for student learning, research shows that observable characteristics, such as education and experience, have little impact on the variation of test scores applied to students.

On the one hand, this fact raises questions about the effectiveness of these characteristics as measures of teacher quality. On the other hand, educational policies have increasingly focused on student outcomes, leading to approaches such as value-added analysis, which focuses on the direct relationship between teachers and student outcomes. However, this approach has limitations in defining an effective teacher and does not consider specific characteristics of teachers.

The authors (LOREMAN; FORLIN and SHARMA, 2014), discuss the importance of measuring the effectiveness of teaching through voluntary approaches and highlight the analysis of added value in the teaching process as a promising strategy to evaluate the contribution of teachers in the performance of students at all levels of education.

Chetty, Friedman, and Rockoff (2012) their paper “The Long-Term Impacts of Teachers: Teacher Value-Added and Student Outcomes in Adulthood,” demonstrated that teachers have substantial economic value and that impacts on test scores are useful for

identifying high-quality teachers. These findings are important for the development of educational policies that seek to improve the quality of teaching and reduce disparities in access to effective teachers.

Thus, policies and teacher training come against educational equity that refers to the idea of providing all students with equal opportunities and access to a quality education, regardless of their socioeconomic origin, ethnicity, gender or other personal characteristics. The goal of educational equity is to ensure that all students have the same chances of academic success and personal development, regardless of their individual circumstances.

Therefore, educational equity is an old and still current theme, according to Dewey in his book “Democracy and Education”, published in 1916. The author lays the foundations for the discussion of the theme, even though the book is not focused specifically on the theme the argues is that education should be seen as a democratic process and that all human beings have the right to a quality education that meets their individual needs. He emphasizes the importance of an inclusive education, which promotes the active participation of students and prepares them to become fully involved in society (DEWEY, 1916).

In this way, the evaluation can take into account several indicators, such as students’ academic outcomes, completion rates, equity in access to education, quality of teachers, available educational resources, among others, according to the Organization for Economic Cooperation and Development (OECD), which annually conducts the PISA “Program for International Student Assessment” that seeks to measure the performance of students in essential skills, such as reading, math and science. In addition to evaluating students, the PISA report also analyzes the performance of school systems in different countries, allowing comparisons and analyses of educational policies.

In 2015, based on PISA, the OECD releases a series of reports where it recognizes the importance of information and communication technologies (ICT) very much in the face of the limitations of access to these technologies still presents itself as one of the biggest constraints, the report highlights several other challenges to leverage technology in education. The impact analyzed at the time was limited due to factors such as overestimation of digital skills, unsatisfactory policies, lack of pedagogical understanding and low-quality educational software.

Currently, it is observed that the complex relationship between students, computers and learning requires more exploration. However, the results should not discourage us. Technology can expand access to knowledge, provide up-to-date materials, enable collaboration, support new pedagogies, and enhance experiential learning (OECD, 2015).

Diverse scientific research on the acquisition of knowledge covers several areas, technological advances provide new perspectives, allowing a re-evaluation of long-standing issues related to learning. In addition, new questions and approaches to the study of this process arise. In this context, the technology of digital tutors emerges as a tool of great potential (KUHL; LIM; GUERRIERO and VAN DAMME, 2019).

However, the obstacles that are presented before the implementation of digital tutors on a large scale, are numerous in addition to those already mentioned, we have: (a) Access to Technology and Infrastructure: In many regions, especially in rural or economically disadvantaged areas, access to high-speed Internet in most cases is limited; (b) Costs: The implementation of digital tutors requires investment in software, hardware and training, which can be prohibitive for some institutions; (c) Teacher Training and Acceptance: Teachers and educators may need extensive training to effectively utilize these tools, and some may resist the adoption of this technology in the classroom; (d) Data privacy and security: The protection of student data is a significant concern, requiring robust security measures and compliance with regulations; (f) Quality and effectiveness: Ensuring that digital tutors are of high quality and effective in enhancing learning is a challenge, requiring continuous research and development; (g) Interoperability with existing systems: Integrating digital tutors with current education systems can be technically complex and requires careful planning and (h) Social and pedagogical concerns: Some critics argue that technology can diminish human interaction, which is vital for learning.

On the political spectrum, difficulties can be complex and multifaceted, requiring a coordinated and collaborative approach among policymakers, educators, administrators, and other stakeholders to overcome them. Political leadership and commitment to innovation and equity in education will be key to addressing these challenges and harnessing the potential of digital tutors. These are points of observation that have relevance in the political context: (a) Lack of funding: Restrictive budget policies may limit the funds available to invest in educational technology, including digital tutors; (b) Inequality in the distribution of resources: Policies that do not adequately address the equitable distribution of technological resources can create disparities in access between different regions and socioeconomic groups; (c) Regulation and compliance: Lack of clear regulation or overly restrictive regulations can create obstacles to the effective implementation and use of digital guardians; (d) Political resistance: Opposition from political groups or teachers' unions that see technology as a threat to established jobs or educational traditions can hinder the adoption of digital tutors; (e) Competitive policy priorities: Education can compete with other areas, such as health and infrastructure, for political attention and resources, limiting the ability to focus on educational innovation; (f) Privacy and security issues: The need to protect students' privacy may lead to political restrictions that hinder the effective implementation of AI-based solutions and data analytics; (g) Licensing and intellectual property policies: Issues related to software licensing and intellectual property may create legal and policy barriers to the adoption of digital guardians; and (h) Global and international policies: In a global context, differences in educational and technological policies between countries may make it difficult to implement uniform solutions in different jurisdictions.

From the point of view of pedagogy, the difficulties can be equally complex and multifaceted, requiring in addition to the aforementioned topics an approach that seeks

to solve the following problems: (a) Adaptation to Individual Needs: Create digital tutors that can adapt to the individual learning needs and different learning styles of students; (b) Integration with the Existing Curriculum: Finding ways to integrate digital tutors into the existing curriculum so that they complement, rather than replace, traditional teaching methods can be challenging; (c) Educator Empowerment: Teachers need to be trained not only to use technology, but also to integrate it effectively into their pedagogical practices. Endurance and a lack of necessary skills can be a barrier; (d) Quality Assessment: Determining how to assess the quality and effectiveness of digital tutors in promoting real learning requires a deep understanding of pedagogy; (e) Student-Teacher Relationship: Maintaining the vital student-teacher relationship in an environment where digital tutors play an important role may require a careful pedagogical approach; (f) Focus on Social and Emotional Skills: Teaching social and emotional skills through digital tutors can be more challenging than teaching academic content, requiring new pedagogical approaches; (g) Accessibility and Inclusion: Ensuring that digital tutors are accessible to all students, including those with special needs, requires careful consideration and inclusive design; (h) Technology Dependence: Finding the right balance between technology and traditional teaching methods to avoid over-reliance on digital tutors is a pedagogical concern; (i) Ethics and Values: The implementation of digital tutors should be aligned with the ethical and moral values of the educational community, ensuring that technology is used responsibly and fairly; and (j) Assessment and Feedback: Effectively assessing student progress and providing meaningful feedback in an environment with digital tutors can be complex.

Consequently, overcoming the difficulties associated with the implementation of digital tutors in teaching is not an easy task, considering the volume and complexity of these difficulties encountered.

CONCLUSION

From the research we can observe that the complexities inherent to the educational process is configured as an obstacle in the implementation of digital tutors in teaching. In general, in studies on the learning process and the use of digital tutors, it was possible to observe important insights with an interdisciplinary perspective in a broad spectrum.

The analysis of the results highlights the importance of technological advancement and the need for new research on learning aided by digital tutors, offering new approaches and possibilities of understanding this complex phenomenon. It is evident that the interaction between teacher and student has undergone numerous changes in recent decades with the advent of communication technologies, however the work activity of the teacher is far from being replaced by artificial intelligence.

Therefore, digital tutors face numerous barriers to their implementation in an appropriate way to teaching, among the main ones mentioned, it is possible to observe that

infrastructure, access to the internet, public policies aimed at increasing new technologies to the educational process, are configured as the most prominent difficulties being the biggest obstacles to be overcome in a process of implementation of digital tutors.

Thus, educational practices and educational policies, as well as the qualification of the entire educational technical staff with emphasis on teachers / facilitators still need greater engagement, other factors such as the lack of specific IT knowledge, in addition to socioeconomic factors, become obstacles to an effective application of digital tutors.

In addition, the need for effective communication, collaboration and knowledge exchange among researchers, educators and policymakers is crucial for the continuous improvement of education and can contribute to the development of normative instruments that meet social anxieties.

From the cognitive point of view, new knowledge only acquires its value when it is disseminated within the scientific community and transposed to society. This is because the production of knowledge is a social process, and it is only through the interaction between academia and society that new ideas and discoveries can be evaluated, tested and integrated into existing knowledge (POLANYI, 2000).

Therefore, in this context, from the objective of identifying the main difficulties for the implementation of digital tutors in teaching, this work sought to contribute to the practice and expansion of knowledge related to the use of digital tutors in education, which emerges with the use of disruptive technology. The research theme seems to be inexhaustible, that is, future research around specific studies in the area of higher education and qualification of teachers through the application of digital tutors, should continue.

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