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INTEGRATION OF TECHNOLOGY IN COLLABORATIVE LEARNING Strategies and impacts on modern education

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SUMMARY

The study in question explored the application of Collaborative Learning integrated with digital technologies in the contemporary educational context. The main objective was to analyze how this combination improves the learning process by developing essential skills for the 21st century in students. The methodology adopted consisted of a literature review on Collaborative Learning and the use of educational technologies. The database consulted was Scielo Brasil. Theoretical models and case studies that illustrate the practical implementation of this approach in educational settings were examined. The results indicated that Collaborative Learning, supported by technological resources, not only facilitates interaction and cooperation between students, but also enhances the acquisition of knowledge and skills. This is due to the fact that digital technologies provide diverse platforms for communication, exchange of ideas, and access to a wide range of educational resources. It is extremely important to incorporate technology into the educational process, highlighting that this integration is fundamental to preparing students for the challenges of the future, promoting a more dynamic, interactive education that is aligned with the demands of the contemporary world.

Key words: Collaborative Learning. Educational Technologies. Active Methodologies. Technological Resources. Educational Skills.

ABSTRACT

The study in question explored the application of Collaborative Learning integrated with digital technologies in the contemporary educational context. The main objective was to analyze how this combination enhances the learning process by developing essential skills for the 21st century in students. The methodology adopted consisted of a literature review on Collaborative Learning and the use of educational technologies. The database consulted was Scielo Brasil. Theoretical models and case studies illustrating the practical implementation of this approach in educational settings were examined. The results indicated that Collaborative Learning, supported by technological resources, not only facilitates interaction and cooperation among students, but also enhances the acquisition of knowledge and skills. This is due to the fact that digital technologies provide diverse platforms for communication, exchange of ideas, and access to a vast array of educational resources. It is of paramount importance to incorporate technology into the educational process, emphasizing that this integration is essential to prepare students for the challenges of the future, promoting a more dynamic, interactive education aligned with the demands of the contemporary world.
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1. INTRODUCTION

The technologies that emerge from digital culture give new meaning to our relationships in the most varied ways and impose on us a clear need to reflect on the changes perpetrated

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> the use of technologies in today's society. In this sense, it is extremely important to discuss pedagogical practices that use technologies in the teaching-learning process, inside or outside the school space, aiming to develop in the student skills and abilities that make them protagonists of their learning (Vidal; Miguel, 2020*apud*Teases; Bernardo; in Oliveira, 2022).

In the contemporary scenario, the field of education is faced with the imperative need to adapt to a world in constant evolution, marked by accelerated technological and social transformations. In this context, the present study aims to explore the effectiveness of Collaborative Learning, an active teaching methodology, which is distinguished by its ability to engage students in an effective and meaningful way.

The main objective of this study is to investigate how Collaborative Learning, when integrated with digital technologies, can enrich the educational process and contribute to the development of essential skills in the 21st century. To achieve this objective, the methodology adopted consists of an analysis of specialized literature and case studies in the educational context. The studies for this study were collected through a consultation in the Scielo Brasil database.

This review focuses on identifying and synthesizing the main educational theories that underlie Collaborative Learning and examining how the integration of technological tools has been used to enhance this pedagogical approach. Furthermore, the study explores the challenges and strategies for the effective implementation of technology-mediated Collaborative Learning in different educational contexts.

Anchored in Vygotsky's social learning theories and supported by contemporary research, Collaborative Learning is highlighted as an educational practice that promotes active and collaborative learning. In an increasingly interconnected world, technology plays a fundamental role in education, offering new opportunities for interaction and knowledge sharing. The integration of digital tools, such as online discussion forums and collaborative platforms, not only facilitates the logistics of cooperation between students, but also expands the scope and depth of learning.

This study also explores the need for a significant change in the pedagogical approach of educators, who must assume the role of facilitators in the learning process, encouraging interaction and teamwork among students. Furthermore, the importance of overcoming practical challenges is discussed, such as the need for adequate training in the use of technological tools and ensuring equitable access to these technologies for all students.

According to Arrelias, Bernardo and de Oliveira, (2022), collaborative learning, which places the student as the protagonist and co-author of their own training, is a concept that has been explored since the 18th century. This learning model emphasizes collaboration between students and teachers in the construction of individual and collective knowledge.

For these authors, historical examples of the application of collaborative learning include the work of Professor George Jardine at the University of Glasgow between 1774 and 1826 and the group learning activities implemented by Colonel Francis Parker in public schools in the United States at the end of the 19th century. For Arrelias, Bernardo and de Oliveira, (2022), these practices have been applied over the years, demonstrating the relevance and effectiveness of collaborative learning.

In this way, technology-mediated Collaborative Learning is presented in this study as an adaptive and innovative response to the demands of contemporary education, with the potential to reshape the educational landscape and prepare students for the challenges of the future. The successful implementation of this approach, however, depends on the ability of educational institutions to adapt and cultivate a culture that values both collaboration and technological integration in the learning process.

2. DEEP THEORETICAL AND PRACTICAL DEVELOPMENT OF TECHNOLOGY-MEDIATED COLLABORATIVE LEARNING

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The concept of Collaborative Learning, based on Vygotsky's theories (1978), highlights the importance of social interactions in cognitive development. According to Vygotsky, learning occurs more effectively in a social context, where students can build knowledge collectively. This perspective is corroborated by Johnson and Johnson (1999), who argue that collaboration between peers promotes deeper engagement with content and facilitates understanding and retention of information.

Collaborative Learning, as described by Arrelias, Bernardo and de Oliveira (2022) and Barbosa et al. (2022), is a student-centered educational model, based on the theories of Piaget, Vygotsky, Paulo Freire and Pierre Lévy. In this model, students are co-authors of their training, actively participating in the teaching and learning process. They work as a team, collaborating with peers and teachers to build individual and collective knowledge. This process is enriched by joint problem solving, project creation and sharing of knowledge and experiences. According to Vieira (2019), online collaborative learning is seen as an opportunity to experience interaction with other participants, share knowledge, experiences and learning, and thus enrich the teaching and learning process.

For Carneiro, Garcia and Barbosa (2019), from the perspective of a liberating education, emphasizes what...

> Paulo Freire (1975, p. 33) taught us that "The role of the educator is not to "fill" the student with "knowledge", whether technical or not, but to provide, through the dialogical relationship educated/educated, educating -educator, the organization of correct thinking in both. What Paulo Freire called a dialogical relationship presupposes that the training process must invest both in cognition, affectivity and values that pass between the actors in the learning process (Carneiro; Garcia; Barbosa, 2019).

In this sense, Carneiro, Garcia and Barbosa (2020) define collaborative learning as processes of social interaction in which students actively work together with shared learning objectives and participate in a teaching-learning process. From this perspective, knowledge is considered social and built from collaborative efforts to learn, understand and solve problems. For Vieira (2019), in this pedagogical proposal, students are seen as active explorers in their knowledge acquisition process, participatory, self-managed and prone to sharing information with their peers within a collaborative learning environment.

Ferreira (2021), Arrelias, Bernardo and de Oliveira (2022) and Vieira (2019), highlight the significant role of Information and Communication Technologies (ICT) in collaborative learning. ICT facilitates communication and collaboration between students and teachers, regardless of their physical location, and offers access to a variety of educational resources, allowing students to build knowledge together. Furthermore, according to Carneiro et al. (2020), ICT encourages students' active participation in the learning process, allowing them to share ideas, work on projects and receive feedback in real time.

For Vieira (2019) and Ferreira (2021), ICT tools also offer flexibility and personalization, allowing students to advance at their own pace, explore content according to their interests and learning styles, and collaborate with colleagues who have skills complementary. These characteristics are fundamental for the professional development of teachers, as they allow the exchange of experiences, joint reflection and access to new methodologies, promoting the construction of professional networks and stimulating innovation.

In this context, as stated by Vieira (2019), ICT, combined with collaborative learning, expand learning possibilities, covering different styles and favoring the construction of knowledge. They function as a supporting technological resource that allows interaction and perception of the world, contributing to the inclusion of students with learning difficulties and specific educational needs. For Carneiro et al. (2020), ICT creates an environment conducive to collaboration, exchanges, mutual support and reliability between students and teachers, favoring the inclusion of all students. On the other hand, Carneiro, Garcia and Barbosa (2020) highlight the significant impact of digital technologies on the transmission of knowledge and education.

These technologies increase accessibility to information, allow personalization of learning and facilitate student integration. Furthermore, they promote collaborative and interactive learning and provide mobility and ubiquity in the learning process. For Carneiro et al. (2020)...

> The development of collaborative digital tools resulted in the implementation and dissemination of knowledge, which facilitated the sharing of learning. Collaborative digital tools can allow users to work together by sharing knowledge, as it involves ideas, skills and self-confidence. The evolution of technologies and the dissemination of knowledge is becoming increasingly incisive in the way users share information. Therefore, people connected to the web can

> access millions of information just by clicking a button. Digital technologies and the Internet have innovated the way of transmitting and collecting new knowledge (Carneiro et al., 2020).

Vieira (2019) and Carneiro et al. (2020), together with the role of virtual learning communities and educational social networks in transforming education, highlight the positive influence of digital technologies in education. They promote a more collaborative, interactive approach focused on sharing knowledge and experiences among participants, enabling the diversification of pedagogical strategies and meeting the individual needs of students.

Barbosa et al. (2022) emphasizes the importance of online collaborative activities for teachers' professional development. These activities, which include the exchange of experiences, joint reflection and access to new methodologies, promote the construction of professional networks and stimulate innovation, becoming a valuable tool for constant updating and improvement of educational practice.

On the other hand, Carneiro, Garcia and Barbosa (2020), in agreement with Barbosa et al. (2022), highlight the transformative role of virtual learning communities and educational social networks in education. These platforms, by promoting interaction and collaboration, contribute to the development of collective knowledge and improvement of educational practices. Furthermore, they provide access to new pedagogical models and expand the reach of shared knowledge, highlighting the significant role of these platforms in promoting a more collaborative and interactive educational approach.

On the other hand, in the study by Neto, Fernandes and Amiel (2020), collaborative learning is presented as an essential concept for improving online teaching and learning, as emphasized by Barbosa et al. (2022) and Carneiro, Garcia and Barbosa (2020). For these authors, the intersection between collaborative learning and Artificial Intelligence (AI) lies in the ability of AI to promote and facilitate collaboration between students in Virtual Learning Environments (VLEs). Collaborative learning is explored as a pedagogical approach that emphasizes interaction between students, mutual cooperation and the collective construction of knowledge. In this context, AI, including conversational agents and chatbots, are used to support and enhance collaborative learning.

According to Neto, Fernandes and Amiel (2020), AI has the ability to identify collaboration patterns, analyze the quality of interactions, suggest collaborative activities and promote active student participation. This contributes to creating more effective and engaging collaborative learning environments. Therefore, AI plays a crucial role in promoting collaborative learning, facilitating interaction between students, stimulating collaboration and contributing to the development of shared knowledge in online educational contexts.

França, Dias and Borges (2020) address collaborative learning as an essential element for building collective knowledge and strengthening the educational process. Furthermore, França, Dias and Borges (2020) highlight the evolution of the link between education and technology, expanding the possibilities of collaborative educational environments, such as virtual learning communities and educational social networks. For França, Dias and Borges (2020), these technological platforms offer resources that facilitate learning in heterogeneous and geographically dispersed contexts. The author also discusses the challenges and opportunities of Computer-Mediated Collaborative Learning (CSCL), including the collaborative assessment of students using computational platforms in the Education 4 era, highlighting the importance of considering aspects such as students' personal characteristics and level of absorption. of content to promote effective collaboration.

> Education in the digital age is marked by changes in the behavior of individuals and their interactions in daily life. The need to deal with complex problems has led to the emergence of new practical skills, knowledge, attitudes and behavioral change. These changes are responses to the introduction of new technologies and paradigms in education, so that individuals are better prepared to deal with the demands of modern society (França; Dias; Borges, 2020).

According to Barbosa and de Souza Pio (2020), collaborative learning through mobile games can have a significant positive impact on science teaching. Mobile games in collaborative approaches streamline classes, making them more interactive and engaging, and encourage student participation. The introduction of collaborative activities with the application of mobile games can improve students' knowledge acquisition, providing more meaningful and effective learning. Furthermore, learning

Collaborative zation through mobile games can foster the development of diverse skills in students, such as learning self-direction, problem-solving skills, peer assessment, and socialization.

On the other hand, for Barbosa and de Souza Pio (2020), the use of mobile games for collaborative learning presents significant benefits, such as promoting problem solving, favoring communication, accessibility and interaction, and stimulating activity and participation of students. students. However, there are also challenges, such as limited application in specific disciplines, technological limitations, and the need for game development and testing specific to science disciplines. Therefore, these benefits and challenges highlight the importance of exploring the potential of mobile games in collaborative learning and indicate opportunities for research and development in this promising area.

> Digital games have characteristics that arouse curiosity and encourage the player to face challenges, since when they are educational they encourage learning. In this context, games for mobile devices have been gaining ground due to their practicality and attractive playful characteristics, however, schools in general are still adapting to new information technologies and that is why it can be said that little is heard about mobile games in the Brazilian educational system (Barbosa; de Souza Pio, 2020).

That said, Carneiro, Garcia and Barbosa (2020) contrast traditional teaching and collaborative learning, pointing out the fundamental differences between the two. According to them, while the traditional model is often teacher-centered and unidirectional transmission of knowledge, collaborative learning emphasizes the active participation of group members, interdisciplinarity, interaction and the collective construction of knowledge. Collaborative learning recognizes that knowledge is social and is built from collaborative efforts to learn, understand and solve problems. In contrast to the passive role of students in the traditional teaching model, in a collaborative learning environment, students are seen as active explorers in their knowledge acquisition process. These differences highlight the paradigm shift from traditional education to more collaborative and interactive approaches, driven by the evolution of technologies and the need to promote more meaningful and engaging learning.

The study by Santanna, de Almeida and Jatobá (2020) emphasizes collaborative learning as a crucial element for the continued training of teachers. According to them, it is characterized as a process of building knowledge through social interactions, valuing group work and the exchange of experiences. Collaborative training is seen as a powerful source for the development of interpsychological processes, valuing the different phases of teachers' professional development and the importance of everyday experiences in transforming educational practices.

For Santanna, de Almeida and Jatobá (2020), the structuring of the collaborative training proposal aims to enable co-authorship and co-construction of the knowledge produced in the investigation, considering the expertise and needs of the participating teachers. Through collaboration, teachers are encouraged to critically reflect on their practice, share a common language, build and reconstruct knowledge about teaching, promoting self-regulation of learning and pedagogical practices. These aspects highlight the importance of collaborative learning as an effective approach for the continuing education of teachers, promoting the exchange of experiences, the collective construction of knowledge and professional teacher development. In this sense, it is worth highlighting what these authors say about the continuing education of teachers...

> Continuing teacher training aims to improve academics and seek to improve professional quality. With these trainings, teachers make up for part of this lack by renewing their pedagogical practices, restructuring and deepening the knowledge acquired in initial training (Santanna, de Almeida and Jatobá, 2020).

The relationship between education and technology is significantly explored in the context of teacher training, specifically through the use of collaborative digital technologies. These technologies, such as Google Classroom® and WhatsApp®, are used to promote interaction between teachers, allowing the sharing of materials, the discussion of pedagogical issues and the exchange of experiences, contributing to the improvement of teaching practice (Santanna ; de Almeida; Jatobá, 2020).

These tools encourage collaborative learning by promoting a collaborative approach

in continuing education, where educators can learn from each other and support each other. The use of digital technologies also expands access to information and educational materials, facilitating teachers' practice and enriching the learning process. This exploration of the relationship between education and technology, through collaborative digital technologies, aims not only to improve the quality of teacher training, but also to promote a culture of collaborative and innovative learning in the educational environment (Santanna; de Almeida; Jatobá, 2020) .

However, the effective application of Collaborative Learning in the educational environment requires an understanding of the elements that compose it. Slavin (1995) identifies that the formation of heterogeneous groups and the promotion of positive interdependence are crucial to the success of this methodology. These groups should be structured so that members depend on each other to achieve learning objectives, thus encouraging mutual accountability.

The integration of technology in Collaborative Learning significantly expands its possibilities. Bates (2015) suggests that digital technologies, such as online learning platforms and communication tools, offer new ways of interacting and collaborating that transcend physical barriers. These technologies allow the creation of collaborative virtual environments where students can share resources, discuss ideas and work on common projects, regardless of geographic location.

Additionally, technology makes it easier to personalize learning and track student progress. According to Siemens (2004), the analysis of data generated on online learning platforms can offer valuable insights into the individual and group learning process, allowing for a more effective adaptation of pedagogical strategies. This personalization is critical to meeting each student's learning needs and promoting a more inclusive and effective educational experience.

Technology-mediated Collaborative Learning prepares students for the challenges of the modern world, developing essential skills for the 21st century. Valente (2021), emphasizes the importance of developing skills such as communication, collaboration, critical thinking and creativity. Technology-supported Collaborative Learning aligns perfectly with these goals, offering an environment where these skills can be practiced and improved.

It is important to recognize the challenges associated with implementing this methodology. The lack of adequate training for teachers in the use of technological tools and the limitations of students' access to technology are obstacles that must be addressed. Furthermore, the need for curricular restructuring to effectively integrate technology-mediated Collaborative Learning into the educational process is a significant challenge that educational institutions face (Garrison & Kanuka, 2004).

In this way, technology-mediated Collaborative Learning represents a promising pedagogical approach that combines the benefits of social interaction with the advantages of digital technologies. This approach not only improves the quality of education, but also prepares students for the demands and challenges of the contemporary world.

3. METHODOLOGICAL COURSE

This study, of a theoretical nature, consists of a bibliographical review on the topic “Collaborative Learning Mediated by Technology”. Following the definition of Gil (2002; 2019), bibliographic research is a type of research that is developed based on already prepared material, consisting mainly of books and scientific articles. Bibliographic research can be independent work or constitute the initial step of another research, since all scientific work presupposes preliminary bibliographic research.

The database consulted for this study was Scielo Brasil. The parameters used to select articles included the relevance of the article to the proposed topic, the quality of the research carried out, the date of publication (with preference for more recent works) and the credibility of the authors and the journal where they were published. the article was published. Bibliographical research, as described by Severino (2013, p. 103), is based in existing records, resulting from previous studies, found in printed documents, such as books, articles, theses and others.

The researcher develops his work based on the contributions of the authors of the analytical studies present in the texts. Bibliographic research enables a wide range of information, in addition to allowing the use of data scattered across numerous publications, also helping to construct, or better define, the conceptual framework that involves the proposed object of study (Gil, 2002; 2019). In this way, the bibliographic review presents itself as an essential tool for understanding and deepening the topic “Collaborative Learning Mediated by Technology”.

4. FINAL CONSIDERATIONS

Technology-mediated Collaborative Learning, including the use of mobile games and Artificial Intelligence (AI), is an effective approach to continuing teacher training and teaching and learning. This methodology, based on theories of social learning and constructivism, provides an environment where students can develop crucial skills such as critical thinking, problem solving, effective communication and teamwork. Furthermore, it leverages the advantages of technology to overcome geographic and temporal barriers, allowing continuous interaction between students and the carrying out of collaborative activities in a broader and more diverse context.

Educators play a vital role in this process, not only as facilitators of knowledge, but also as mediators in the use of technology for educational purposes. Continuing teacher training is essential to ensure that they are able to effectively integrate digital tools into their pedagogical practices.

Educational institutions must be prepared to face challenges associated with technological infrastructure and professional training. It is important to consider students' personal characteristics and content absorption level to promote effective collaboration.

Education must be seen as a dynamic and adaptable process, which responds to constant changes in the technological landscape and the emerging needs of society. Thus, the incorporation of this pedagogical approach can be seen not only as an improvement in the quality of education, but also as an essential preparation of students for the challenges and opportunities of the future.

Finally, technology-mediated Collaborative Learning represents a significant advance in education. It offers a more inclusive, interactive and effective approach to teaching and learning, aligned with the demands of the modern world. Although it presents challenges, its potential to improve the quality of education and prepare students for a dynamic future is undeniable. Therefore, investing in this approach is not just a pedagogical choice, but an imperative for an education that seeks to be relevant, effective and transformative in the 21st century. Continuing to explore the potential of digital technologies in collaborative learning is fundamental to the evolution of education in the digital age.

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