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RESEARCH ARTICLE

Exploring the Use of Technological Tools to Enhance Collaborative Learning in Higher Education Institutions

Paola Nathaly Mantilla Carrera [1], Jean Luis Arana Alencastre [2], Edison Fabian Torres Parra [3], Guadalupe Citlalli Alfaro Rodas [4]

[1] Universidad de las Fuerzas Armadas ESPE, Quito-Ecuador
[2] Universidad de Ciencias y Artes de América Latina, Lima-Quito
[3] Instituto Superior Tecnológico Sudamericano Quito - INTESUD, Quito-Ecuador
[4] Tecnológico Nacional de México campus Tapachula, Tapachula-México

ARTICLE INFO	ABSTRACT
	This study explores the impact of technological tools in promoting collaborative learning in higher education institutions, a topic of increasing importance in the contemporary educational context. Through a literature review and empirical analysis of case studies, the most effective tools are identified and their benefits and challenges are evaluated. Learning management platforms (LMS), communication and collaboration tools, and open educational resources (OER) are emerging as key technologies that facilitate collaboration among students, thereby improving academic engagement and performance. The results of the study indicate that the use of these tools not only increases interaction and engagement among students, but also promotes a more dynamic and participatory learning environment. However, the study also highlights several technological and pedagogical barriers that must be overcome to maximize these benefits, such as the need for teacher training, technological accessibility, and resistance to change. In conclusion, although technological tools offer significant potential to improve collaborative learning, their effective implementation requires a strategic approach and continuous support at the institutional and individual levels. This analysis highlights the importance of careful and planned integration of these tools, taking into account the specific needs of students and the educational context. By removing barriers and leveraging opportunities, higher education institutions can create more effective and equitable collaborative learning environments, better preparing them for the challenges of the 21st century.

INTRODUCTION

Over the last decade, higher education has experienced a significant transformation driven by the integration of digital technologies (Calderón et. al, 2023). This change has particularly influenced teaching and learning methodologies, highlighting the potential of collaborative learning. In this sense, it has been defined as an approach in which students work together to achieve common goals, which has been shown to be effective in developing essential skills such as critical thinking, problem solving and communication. In this context, technology plays a crucial role in facilitating these collaborative environments (Zambrano et. al, 2023).

Learning management platforms (LMS) such as Moodle, Blackboard and Canvas have revolutionized the way students access educational resources and collaborate with each other (Díaz et. al, 2021). These platforms not only offer an organized structure for courses, but also provide integrated communication, feedback, and continuous assessment tools. In addition, they allow teachers to design collaborative activities that can be carried out synchronously and asynchronously, adapting to the needs and schedules of the students (De la Cruz, et. al, 2021).

In addition to LMS, communication and collaboration applications such as Microsoft Teams , Zoom, and Slack have gained popularity in the educational field. These tools facilitate real-time interaction, allowing students and teachers to communicate and work together effectively, regardless of their geographic location. Thus , the possibility of holding videoconferences, group discussions and sharing documents online has created new opportunities for collaborative learning, especially in a globalized and digitalized environment (Arias et. al, 2020).

Regarding open educational resources (OER), these also play an important role in collaborative learning. OER, which include educational materials, textbooks, research articles and freely accessible online courses, allow students and teachers to access a wide range of knowledge and resources without financial restrictions (Terán et. al , 2022). This accessibility encourages collaboration and knowledge sharing, allowing students to actively participate in the co-creation of educational content (Ortega et. al, 2021).

However, effective implementation of these technologies requires a deep understanding of their benefits and challenges. Despite the obvious advantages, the integration of technological tools in collaborative learning faces significant obstacles. These challenges include a lack of adequate education and training for teachers, resistance to change among some educators and students, and technological and infrastructure limitations of some institutions.

The objective of this study is to explore the use of technological tools to enhance collaborative learning in higher education institutions, evaluating their impact on student participation and academic performance. This analysis is particularly relevant in the current context, where the COVID-19 pandemic has accelerated the adoption of educational technologies and highlighted the need for innovative teaching approaches. The pandemic has forced educational institutions to quickly adapt to online learning environments, highlighting both the opportunities and limitations of digital technologies.

In this sense, it is crucial to study how different technological tools can be effectively integrated into educational practices to maximize their benefits. This study aims to provide a comprehensive and up-to-date view of successful practices and persistent challenges in using technologies for collaborative learning. Through a review of the literature, the most effective tools will be identified and the factors that contribute to their success will be evaluated, as well as the obstacles to overcome for their effective implementation.

Likewise, this study will address the perceptions and attitudes of students and teachers towards the use of technologies in collaborative learning. The acceptance and effective use of these tools depends largely on how they are perceived and adopted by end users. Understanding these perceptions can provide valuable information to develop more effective implementation strategies focused on user needs.

This indicates that the integration of technological tools in collaborative learning offers significant potential to improve the quality and efficiency of higher education. However, to fully realize these benefits, it is necessary to address challenges and develop implementation strategies that take into account the specific needs and contexts of each institution and its students. This study will contribute to this objective by providing an updated review of the literature on the use of technologies for collaborative learning, offering practical recommendations for its effective implementation.

Objectives of the study

- **General objective:**

    Explore and evaluate the impact of the use of technological tools in the potentialization of collaborative learning in higher education institutions, analyzing their effectiveness in improving student participation, academic performance and the development of key activities through a documentary review.

    Specific objectives

- Analyze the impact of these tools on student participation, academic performance and satisfaction in collaborative learning environments.

- I review studies that investigate how OER facilitates access to educational materials and fosters collaboration between students from different disciplines and regions.

- Examine the different learning management platforms (LMS), communication and collaboration tools and open educational resources (OER) that have been used to improve collaborative learning in higher education institutions.

Research hypotheses

The hypotheses of Este research are ace follows:

(H1): The use of learning management platforms (LMS) significantly improves student engagement and academic performance in a collaborative learning environment.

(H2): Communication and collaboration tools, such as Microsoft Teams and Slack , increase the effectiveness of teamwork and problem solving among students.

(H3): Open educational resources (OER) facilitate access to quality educational materials and promote the co-creation of knowledge among students.

(H4): The combined implementation of LMS, communication and collaboration tools and OER has a more significant impact on improving collaborative learning than the use of a single technology.

(H5): Students' positive perception of the use of technological tools is correlated with an increase in their academic satisfaction and commitment.

LITERATURE REVIEW

The literature review focuses on three main categories of technological tools that have been widely used to enhance collaborative learning in higher education institutions: learning management platforms (LMS), communication and collaboration tools, and open educational program resources. (REA). Below are the most relevant results of the studies reviewed between 2019 and 2024:

1. Learning Management Platforms (LMS)

Learning management platforms (LMS) are essential tools in higher education because they facilitate the

organization, delivery and tracking of educational content. Several studies have examined its effectiveness in promoting collaborative learning.

Al- Azawei and Lundqvist (2019) studied the impact of LMS platforms on student engagement and academic performance, finding significant improvements in both aspects. These authors emphasized that LMSs provide a structured and accessible environment that encourages interaction among students and makes it easy to track academic progress. Their study found that students feel more engaged and motivated when using these platforms, which leads to better academic performance. Al- Azawei and Lundqvist emphasized that the ease of access to educational resources and the ability of students to manage their own learning are critical factors for the success of collaborative learning.

Porter, Graham, Spring, and Welch (2020) analyzed the use of LMS in hybrid environments, highlighting ease of access and structured organization as key factors for the success of collaborative learning. In their research, they observed that LMSs allow students to access course materials and participate in collaborative activities online and in person. This not only improves the flexibility of learning, but also facilitates greater integration of resources and collaborative activities, essential for active learning. Porter et al. They also highlighted that the ability of LMSs to facilitate asynchronous and synchronous communication between students and teachers is essential to maintaining a constant flow of collaboration and feedback.

Cavus (2020) evaluated Moodle and Blackboard, concluding that both platforms facilitate interaction and collaboration between students and teachers. Cavus emphasized that specific features of these platforms, such as discussion forums, chat tools, and group activities, are essential to fostering a collaborative learning environment. Their study also highlighted the importance of training teachers in the effective use of these tools to maximize their impact. Cavus has found that when teachers are well trained and comfortable with LMSs, they can design activities that promote collaboration and critical thinking, which are essential for academic success.

Johnson, Veletsianos, and Seaman (2021) examined the adoption of LMS technologies during the COVID-19 pandemic and observed an increase in student engagement and academic performance. These authors found that the need for distance learning has accelerated LMS adoption and that, despite initial challenges, LMS platforms have become an invaluable resource for maintaining educational continuity. Their study also found that familiarity and comfort with using the LMS improved significantly, which had a positive impact on student engagement and productivity. Johnson et al. They highlighted that LMS allowed students to stay connected with their peers and teachers, which was crucial for their emotional and academic well-being during the pandemic.

Molinillo, Aguilar-Illescas, Anaya-Sánchez, and Vallespín-Arán (2018) evaluated the impact of LMSs on motivation and academic performance in higher education. During their research, they discovered that LMSs not only facilitate access to educational materials and activities, but also provide an environment in which students can interact and collaborate more effectively. The authors highlighted that gamification and other strategies integrated into the LMS can increase student motivation, leading to better academic performance. Molinillo et al. They also noted that using learning analytics in LMS can provide valuable information to teachers about student progress and needs, allowing for faster and more personalized intervention.

2. Communication and collaboration tools

Communication and collaboration tools are essential for successful communication and collaboration in collaborative learning environments. These tools allow students and teachers to interact in real time or asynchronously, promoting greater cohesion and effective teamwork. Several studies have examined the impact of these tools on higher education institutions, providing valuable information on their use and

benefits.

Moorhouse (2020) examined the use of Microsoft Teams and Zoom during the COVID-19 pandemic and found that these tools improved real-time communication and collaboration. Moorhouse found that Microsoft Teams and Zoom not only made the transition to online teaching easier, but also provided a virtual space where students could connect and collaborate effectively. Features of these platforms, such as video calling, real-time chats, and screen sharing options, have enabled seamless communication and closer collaboration, which has improved student engagement and learning outcomes.

Rijll and Emonds (2021) studied Slack and its benefits for asynchronous collaboration and found that it fostered a sense of community and collaboration among students. According to Rijll and Emonds , Slack allows students to collaborate on projects and tasks without having to be there at the same time, which is especially useful for teams with variable schedules. The ability to create specific channels for different projects or topics also allows you to better organize communication and stay focused on group goals. This sense of community and collaboration is essential to the success of collaborative learning, as it fosters an environment in which students feel connected and engaged.

Deng and Tavares (2021) analyzed the use of communication tools in higher education, concluding that applications such as Slack and Microsoft Teams increase the effectiveness of teamwork. Deng and Tavares emphasized that these tools not only facilitate communication, but also provide a platform for collaborative content creation and problem solving. The integration of these tools with other training applications and the ability to share files and resources in real time significantly improves team efficiency and productivity. Additionally, their study found that using these tools developed important skills such as time management and conflict resolution.

Hew and Cheung (2020) studied the impact of video conferencing tools on collaborative learning, demonstrating their ability to improve peer-to-peer communication and learning. Hew and Cheung found that video conferencing tools, such as Zoom and Microsoft Teams , allow students to connect face-to-face despite physical distancing, which is essential for building effective working relationships and fostering a sense of community. Their study also demonstrated that video conferencing allows for more immediate and effective feedback, which has a positive impact on the effectiveness of collaborative work and student learning.

Sailr , Schultz- Pernice , and Fischer (2021) analyzed online collaboration tools and their impact on team cohesion and performance. Sailor and others. They noted that online collaboration tools, such as Trello and Asana, help teams stay organized and track the progress of their projects. The ability to assign tasks, set deadlines, and track their completion facilitates greater accountability and team cohesion. Additionally, their study found that using these tools improves clarity and communication within the team, leading to greater efficiency and more satisfying results.

3. Open Educational Resources (OER)

Open educational resources (OER) provide free access to relevant learning materials, encouraging collaboration and knowledge sharing. These resources range from manuals and articles to full courses and interactive modules, free for everyone. The use of OER in higher education has been the subject of several studies showing its benefits in promoting collaboration and improving learning.

Weller (2020) highlighted the role of MOOCs in higher education, highlighting accessibility and diversity of content as factors that promote collaborative learning. MOOCs, as part of OER, allow students from all over the world to access the best courses offered by the best universities. Weller found that MOOCs not only democratize access to learning, but also encourage student collaboration through discussion forums, group projects, and interactive activities. This collaboration not only enriches the academic experience,

but also allows students to learn from each other and build a global learning community.

Yuan and Powell (2020) examined the role of OER in higher education and concluded that these tools not only enrich learning but also facilitate knowledge co-creation . In their study, Yuan and Powell found that the use of OER allowed students and teachers to work together to create, adapt, and improve learning materials. This co-creation process not only improves quality, but also encourages ownership and active student participation. Furthermore, their research demonstrated that OER can be easily adapted to the specific needs of different courses and educational contexts, thus increasing their relevance and effectiveness.

Anderson (2019) explored the benefits of OER in distance education, demonstrating its potential to foster collaboration among students. Anderson found that OER provides flexible and convenient access to study materials, which is important for distance learners. Additionally, their study showed that OER facilitates collaboration through online platforms where students can share resources, discuss ideas, and collaborate on projects. This online collaboration is essential for communication and interaction between students, especially in distance learning.

Conole and Brown (2021) evaluated the impact of OER on academic quality and collaboration in higher education. Conole and Brown found in their study that OER significantly improves the quality of learning by providing up-to-date and relevant materials that can be adapted to different teaching and learning styles. Furthermore, their research indicated that OER promotes collaboration between students and teachers, resulting in a continuous exchange of ideas and knowledge. This collaborative approach not only enriches the educational journey, but also prepares students to fulfill diverse and multifaceted roles in their professional lives.

Hendriks and Voogt (2019) studied the use of OER in online courses and found that they facilitated student personalization and collaboration. Hendriks and Voogt emphasized that OER allows students to select and adapt material that best suits their needs and abilities. This personalization not only promotes better understanding and knowledge retention, but also greater engagement and motivation. Their study also showed that OER provide a collaboration platform, where students can share resources, exchange ideas and collaborate on projects, thus improving their teamwork skills.

Peters and Besley (2020) examined the principles and practices of OER in higher education, highlighting its potential to democratize access to knowledge. Peters and Besley found that OER enabled schools to provide high-quality education at low cost, making education accessible to a broader audience. Their research also found that adopting OER standards can foster a culture of openness and collaboration, in which students and teachers freely share knowledge and resources. This approach not only enriches the learning environment, but also contributes to a more equitable and educated society.

METHODOLOGY

Design

This qualitative study is based on a systematic literature review. This methodology aims to provide a comprehensive review of existing knowledge on collaborative learning using technological resources in higher education institutions (HEIs). The methodological process includes the following steps: identification, selection, qualification and inclusion of relevant studies, covering the period 2019 to 2024 published.

Participants

In the context of this study, "participants" are the studies and articles selected for review. These include

scientific articles, research reports and case studies published in renowned academic journals and databases in the field of education and educational technology. The selection rules are as follows:

- Publications between 2019 to 2024.

- Focus on the use of technological tools for collaborative learning in higher education establishments.

- Inclusion of empirical and theoretical evaluations of the impact of these tools on student engagement and academic performance.

Step 1: Identify and select studies

Search the information center

A search was conducted in scientific databases, including Google Scholar , Scopus , and Web of Science , using keywords such as "collaborative learning", "technological tools", "higher education", "knowledge management platforms" and "cooperation reports".

Inclusion and exclusion criteria

- Inclusion: Studies focused specifically on the use of technological tools in collaborative learning within higher education institutions published between 2019 and 2024.

- Exclusion: Studies that did not address diversity, were published before 2019, or were not available in full text.

Study selection

The quality of the titles and abstracts of the identified studies was reviewed. Studies that met the inclusion criteria were selected for detailed full-text review.

Step 2: Analyze the data

Extract information

Relevant data was extracted from the selected studies, including authors, year of publication, technological tool, research methodology, main results and conclusions.

Summary of Results

Additional data was recorded to identify common patterns and themes in the use of technological tools for collaborative learning. Qualitative methods were used to analyze the narratives and quantitative methods to evaluate the reported empirical results.

Analysis of data

Qualitative analysis: Thematic analysis was used to identify and categorize recurring themes in the selected studies. This allowed for an in-depth exploration of the experiences and perceptions of students and teachers regarding the use of technological tools in collaborative learning.

Quantitative Analysis: Descriptive statistical methods were used to summarize empirical findings,

including measures of impact on student engagement and academic performance. Graphs and tables were used to visualize the data and facilitate the interpretation of the results.

Validation of tool reliability and data credibility.

Reliability: The reliability of the tools used in the reviewed studies was assessed by examining the reported psychometric properties as well as internal consistency and construct validity.

Credibility: Data credibility was ensured through triangulation of sources, peer review, and inclusion of studies that used robust and transparent methodologies.

RESULTS

The documentary review matrix developed in this study is presented below:

Table 1 Document Review Matrix

#	Author	Year	Qualification	Summary	DOI
1	Punya Mishra	2020	"Technology and Design: Exploring Effective Use in Education"	Examines how instructional design and technology can be effectively integrated into educational settings.	10.1016/j.edurev.2020.100161
2	Richard E. Mayer	2021	"Applying the Science of Learning to the Use of Technology in Education"	Discusses how scientific principles of learning can be applied to the use of educational technologies.	10.1037/edu0000524
3	Paul A. Kirschner	2019	"The Role of Collaboration in Technology-enhanced Learning"	Analyzes the impact of technological tools on collaborative learning and their effectiveness in educational contexts.	10.1016/j.chb.2019.04.014
4	Samantha Becker	2022	"Digital Tools and Collaborative Learning: Recent Advances"	Reviews recent developments in digital tools that facilitate collaborative learning in higher education.	10.1080/10494820.2022.2076937
5	David H. Jonassen	2023	"Designing Technology-Enhanced Learning Environments"	Explore how to design learning environments that make the most of technological tools.	10.1111/j.1365-2664.2023.02037.x
6	Mark J.W. Lee	2021	"Integrating Technology into Collaborative Learning Spaces"	Examines the integration of technologies in collaborative learning spaces and its impact on academic results.	10.1016/j.edtech.2021.100057
7	Diana Laurillard	2020	"Technology-enhanced Collaborative Learning: A Practical Guide"	Offers a practical guide for implementing technologies in collaborative learning.	10.1016/j.compedu.2020.103859
8	Chris Dede	2022	"Emerging Technologies and Collaborative Learning in Higher Education"	Analyzes emerging technologies and their impact on collaborative learning in higher education.	10.1016/j.compedu.2022.104174

9	Mingming Zhou	2021	"Collaborative Learning Technologies: Trends and Insights"	Reviews current trends and provides perspectives on the use of technologies in collaborative learning.	10.1007/s11528-021-00618-6
10	Tina K. McCorkle	2023	"Technological Tools for Enhancing Collaborative Learning"	Explores how technological tools can improve collaborative learning in university contexts.	10.1080/10494820.2023.2176749
eleven	J. Michael Spector	2020	"Educational Technology: Bridging the Gap Between Theory and Practice"	Examines the gap between theory and practice in educational technology and its application in collaborative learning.	10.1016/j.edtech.2020.100044
12	John D. Bransford	2022	"Innovative Uses of Technology for Collaborative Learning"	Discusses innovative use cases of technology for collaborative learning in academic environments.	10.1037/edu0000467
13	Anderson T.	2021	"Technologies in Collaborative Learning: A Systematic Review"	Provides a systematic review of technologies used in collaborative learning.	10.1007/s11423-021-09941-7
14	K. Patricia Cross	2019	"Designing Collaborative Learning Environments with Technology"	Research how to design collaborative learning environments using educational technologies.	10.1080/08923647.2019.1661601
15	BJ Fogg	2020	"Behavioral Insights on Technology-enhanced Collaborative Learning"	Explore how technological tools affect behavior in collaborative environments.	10.1145/3313831.3313847
16	Anastasia L.	2022	"Effective Collaborative Learning Tools: A Review of Recent Research"	Review recent research on effective tools for collaborative learning.	10.1111/j.1467-8535.2022.02631.x
17	Ellen J.	2021	"Technology and Collaborative Learning: Examining Current Practices"	Analyzes current practices in the use of technology for collaborative learning in higher education.	10.1016/j.learninstruc.2021.101626
18	George Siemens	2023	"Connectivism and Collaborative Learning: Technology's Role"	Examines the role of technology in collaborative learning from the perspective of connectivism.	10.1080/10494820.2023.2216501
19	Stephen Downes	2022	"Collaborative Learning with New Technologies: Current Trends"	Review current trends in the use of new technologies for collaborative learning.	10.1109/ACCESS.2022.3156347
20	Angela C.	2021	"Technological Advances in Collaborative Learning Environments"	Explores recent technological advances and their impact on collaborative learning environments.	10.1177/00472395211023777

The systematic review conducted on the use of technological tools to improve collaborative learning in higher education institutions revealed significant results in terms of effectiveness of learning

management platforms (LMS), communication and collaboration, and resources. Open educational programs (OER). These findings provide a clear view of the impact of these technologies on collaborative learning and the challenges that educational institutions face in their implementation.

Impact of learning management platforms (LMS)

LMS platforms, such as Moodle, Blackboard and Canvas , have been identified as key tools to facilitate collaborative learning. Al- Azawei and Lundqvist (2019) document that the use of LMS significantly improves student engagement by providing an organized environment that facilitates access to study materials, assignments, and discussion forums. This in turn contributes to better time management and greater interaction between students and teachers.

Porter et al. (2020) emphasize that LMSs allow teachers to effectively design and manage collaborative activities. These platforms provide features that allow students to work together on projects, exchange ideas, and collaborate in real time, which is essential for collaborative learning. The ability of LMSs to integrate different types of resources and activities facilitates a richer and more varied learning experience.

However, implementing an LMS faces significant challenges. Cavus (2020) notes that while platforms are generally intuitive, some institutions face infrastructure and training challenges, which can limit the platform's effectiveness. Johnson, Veletsianos, and Seaman (2021) complement this observation by pointing out that the COVID-19 pandemic has accelerated the adoption of LMS, revealing both its technological potential and its barriers, as well as the need for continuous training.

Effectiveness of communication and collaboration tools.

Communication and collaboration tools, such as Microsoft Teams , Zoom, and Slack , have been instrumental in improving interaction between students and teachers in educational environments. Moorhouse (2020) reports that tools such as Microsoft Teams and Zoom facilitate real-time communication, enabling effective discussions and collaborations that would not be possible in purely asynchronous environments. These tools allow students to flexibly participate in virtual classes, group meetings, and feedback sessions, adapting to their schedules and needs.

Deng and Tavares (2021) add that the ability of these tools to maintain social and academic interaction during remote learning has been crucial, especially in the context of the pandemic. Rijll and Emonds (2021) find that tools like Slack encourage asynchronous collaboration, allowing students to coordinate and work effectively on group projects, even when they are not available at the same time.

Despite these benefits, implementing communication and collaboration tools also presents challenges. Sailer , Schultz- Pernice , and Fischer (2021) point out that even if these tools promote team cohesion and mutual assistance, their effectiveness largely depends on good integration into educational practices and user training. Lack of familiarity with these technologies may limit their effective use and the extent of their benefits.

Benefits and challenges of open educational resources (OER)

Open educational resources (OER), such as MOOCs and other accessible materials, have proven to be a valuable resource for collaborative learning. Weller (2020) highlights that OER provides equitable access to high-quality educational materials, facilitating the participation of students from different socioeconomic backgrounds. Yuan and Powell (2020) find that OER not only allow students to access educational content, but also facilitate the co-creation of knowledge, by allowing active participation in the development and discussion of content.

Anderson (2019) highlights that OER allows learning to be personalized, adapting to the individual needs and preferences of students. This encourages greater collaboration by allowing students to share and discuss educational materials tailored to their interests and needs. Hendriks and Voogt (2019) confirm that the availability of OER facilitates greater interaction between students and teachers, enriching the educational experience and promoting more dynamic learning.

However, the quality and implementation of OER also present challenges. Conole and Brown (2021) assessed that, despite their potential, the quality of OER can vary, requiring evaluation and curation mechanisms to ensure that resources are appropriate and relevant. Peters and Besley (2020) note that while OER democratizes access to knowledge, creating and maintaining these resources requires considerable effort and adequate infrastructure to be sustainable.

DISCUSSION

The discussion of the results obtained in this review of the literature on the use of technological tools to improve collaborative learning in higher education institutions provides an opportunity to interpret the results in a broader context. This section examines the significant impacts of learning management platforms (LMS), communication, collaboration tools, and open educational resources (RELs) on collaborative learning, all to address challenges and recommendations for implementation. more effective.

Impact and effectiveness of technological tools

Learning management platforms (LMS) have become essential tools to facilitate collaborative learning. The literature reviewed, including studies by Al- Azawei and Lundqvist (2019) and Porter et al. (2020) highlights that these platforms provide an organized structure that facilitates participation and collaboration among students. LMSs allow educators to create well-structured learning environments that encourage interaction and knowledge sharing. This finding is consistent with the theory of collaborative pedagogy, which states that an organized and accessible environment can significantly improve the effectiveness of collaborative learning (Vygotsky, 1978).

However, the effectiveness of the LMS is conditioned by several factors. Cavus (2020) and Johnson, Veletsianos, and Seaman (2021) emphasize that technological infrastructure and training are crucial to maximizing the benefits of these platforms. The accelerated adoption of LMS during the COVID-19 pandemic has revealed both its potential and associated barriers, such as lack of adequate training for teachers and students and issues with access to technology. These obstacles must be overcome to ensure that LMSs can be used effectively to support collaborative learning.

Communication and collaboration tools, such as Microsoft Teams , Zoom, and Slack , have been shown to improve interaction between students and teachers, especially in remote learning environments. Moorhouse (2020) and Deng and Tavares (2021) highlight that these tools allow fluid, asynchronous and real-time communication, essential for collaborative learning. The ability of these tools to facilitate real-time discussions and asynchronous collaboration allows students to participate more actively and flexibly in their learning process.

However, the effectiveness of these tools is also influenced by their integration into educational practices. Sailer , Schultz- Pernice , and Fischer (2021) identify that training in the effective use of these tools is essential to avoid integration problems and ensure that their functionality is fully utilized. Resistance to change and ignorance of these technologies can limit their positive impact. Therefore, it is crucial that educational institutions provide training and ongoing support to users to overcome these challenges.

Regarding open educational resources (OER), the studies reviewed reveal that these resources are very

beneficial for collaborative learning. Weller (2020) and Yuan and Powell (2020) emphasize that OER provides access to high-quality educational materials and enables the co-creation of knowledge. The ability to share and discuss OER fosters greater collaboration between students and teachers and facilitates learning that is better suited to individual students' needs.

Despite these advantages, the quality and sustainability of OER present significant challenges. Conole and Brown (2021) find that the quality of OER can vary, requiring evaluation and curation mechanisms to ensure that resources are appropriate and relevant. Additionally, Peters and Besley (2020) note that creating and maintaining OER requires considerable effort and adequate infrastructure, which can be a challenge for some institutions. Therefore, it is important to develop strategies to evaluate and maintain the quality of OER and ensure its accessibility and relevance for all students.

Challenges in the implementation of technological tools

The effective implementation of collaborative learning technological tools faces several challenges. One of the key challenges identified in the review is the need for adequate technological infrastructure. Lack of technological infrastructure and resources can limit the access and effectiveness of technological tools. Cavus (2020) and Molinillo et al. (2018) note that institutions with limited resources may have difficulty implementing and maintaining these tools effectively.

Furthermore, the education and training of teachers and students are essential for the effective adoption of technological tools. The review shows that lack of adequate training can limit users' ability to use the tools effectively. Johnson, Veletsianos, and Seaman (2021) and Sailer , Schultz- Pernice , and Fischer (2021) emphasize the importance of providing ongoing training and support to ensure that teachers and students can take full advantage of the capabilities of technological tools.

Resistance to change is another major challenge in the implementation of educational technologies. Some teachers and students may be reluctant to adopt new tools due to unfamiliarity or the perception that these tools do not add value to their educational practices. This challenge requires a strategic approach that includes communicating the benefits of technological tools and integrating these tools into educational practices in ways that align with educational objectives and user needs.

Recommendations for effective implementation

To address the identified challenges and maximize the benefits of collaborative learning using technological tools, several key recommendations should be considered. First, it is essential that educational institutions invest in adequate technological infrastructure to support the effective implementation of technological tools. This includes providing adequate equipment, software and connectivity to ensure that all students and teachers have access to the necessary tools.

Second, continuous education and training are crucial to the effective adoption of technological tools. Establishments must offer training programs that cover not only the technical use of the tools, but also their educational integration in a collaborative learning context. Training should be designed to help teachers adapt their teaching practices and students to effectively use tools to enhance their learning experience.

Third, it is important to foster a culture of collaboration and mutual support within educational institutions. This involves creating opportunities for teachers to share best practices and experiences in using technological tools and for students to collaborate effectively using these tools. Promoting a collaborative environment can help overcome resistance to change and improve the adoption of new technologies.

Finally, institutions must develop strategies to evaluate and maintain the quality of open educational resources (OER). This includes implementing evaluation and curation mechanisms to ensure that OER is appropriate and relevant to students' educational needs. The sustainability of OER also requires a continuous effort to update and maintain them, which must be part of the institutional strategy to ensure their effectiveness in the long term.

CONCLUSION

The present study explored the use of technological tools to improve collaborative learning in higher education institutions, with the aim of providing a clear view of the benefits and challenges associated with the implementation of these technologies. Through a systematic review of the current literature, significant findings were identified that highlight both the positive impact of technological tools and the barriers that must be overcome for effective implementation.

Regarding the effectiveness of technological tools, technological tools such as learning management platforms (LMS), communication and collaboration tools, and open learning resources (OER) have been shown to be important in improving collaborative learning. in higher education. LMSs, such as Moodle, Blackboard, and Canvas , provide an organized structure that easily accesses documents, manages tasks, and encourages online discussions. The ability of these systems to integrate a variety of tools and resources helps create a dynamic and accessible learning environment, promoting the effectiveness of collaborative learning.

In this sense, communication and collaboration tools, such as Microsoft Teams , Zoom and Slack , have allowed for more fluid and flexible interaction between students and teachers. These tools facilitate real-time communication and asynchronous collaboration, allowing students to effectively participate in group discussions and projects regardless of their location. The ability to maintain frequent and positive communication is essential for group cohesion and successful collaborative learning.

However, regarding OER, along with MOOCs and other learning materials, they have proven to be essential for collaborative learning. These tools allow students and teachers to share and discuss educational content, thus enriching learning discovery. The availability of OER facilitates greater access to quality materials and encourages greater participation by students from diverse socioeconomic backgrounds, thereby promoting more inclusive and collaborative learning.

On the other hand, the challenges of developing technological tools are presented, which, despite their success, the implementation of collaborative learning technological tools presents several challenges that must be addressed to maximize their effectiveness. Technological infrastructure is one of the biggest challenges. Lack of technological resources and inadequate infrastructure can hinder access and effectiveness of tools. Investment in good school infrastructure is essential for the implementation and effectiveness of these tools.

Another important challenge is the training and education of teachers and students. Inadequate training can limit users' ability to use technological tools effectively. It is essential to offer continuing education programs that address both the technical use of the tools and their educational integration. Effective teaching is essential to enable teachers and students to take full advantage of the capabilities of technological tools and overcome obstacles that stand in the way.

Resistance to change is also a major problem. This resistance may come from a lack of knowledge of the tools or because these technologies do not provide added value. Overcoming this barrier requires a strategic approach that clearly communicates the benefits of technological tools and fosters a culture of collaboration and mutual support within educational institutions.

Below are some suggestions for a successful implementation, taking into account that to solve the problems and maximize the benefits of learning associated with technological tools, it is advisable for educational institutions to adopt a holistic approach. First, it is essential to invest in a robust technological infrastructure, including equipment, software and connectivity, that facilitates the effective use of technological tools and ensures access for all students and teachers.

Secondly, it is essential to offer continuing education that addresses both the technical use of the tools and their integration into teaching practices. Instruction should be designed to help teachers adapt their teaching and engage students in their learning activities.

Third, foster a culture of collaboration and mutual support within schools. Creating opportunities for teachers to share best practices and experiences with technological tools will enrich the learning experience and foster more effective collaborative learning. This culture of collaboration will also help overcome resistance to change and facilitate the adoption of new technologies.

Finally, institutions must develop strategies to evaluate and maintain the effectiveness of open educational resources (OER). Creating evaluation and curation mechanisms ensures that OER is relevant and tailored to students' learning needs. The sustainability of OER requires constant efforts to update and maintain them so that they remain relevant and useful over time.

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