



Bibliometric analysis of the determinants of continuous improvement in higher education

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ABSTRACT

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The continuous improvement of education has become a topic of research within the academic world, as it highlights the use and application of teaching, learning, and assessment strategies. For this reason, it was decided to conduct a bibliometric study of the documents published on this topic to understand the evolution of research worldwide. The information was obtained from the Scopus database and covered the period between 2015 and 2025. Among the aspects considered in the analysis were the number of documents per year, the countries with the highest production, the most influential authors, the affiliated institutions, the type of document, and the most frequently used keywords. The data were processed using the Jamovi and VOSviewer programs, which allowed the generation of graphs and co-occurrence maps. The results showed that most of the documents were published in 2024. The United States and China were the leading countries in terms of productivity, while the most prominent authors were from India. Likewise, the United States and India were the countries with the highest institutional representation. The use of keywords focused on the use of technology as a means to strengthen teaching, learning, and assessment, and promote continuous improvement. This field of research is becoming increasingly relevant due to the incorporation of new technologies into educational processes.

Contribution/Originality: This review is of great importance to the scientific community, as it provides a bibliometric analysis of the determinants involved in continuous improvement in higher education. This topic has been little studied from this perspective. Analysis focused on teaching, learning, and knowledge assessment demonstrated its importance for developing continuous improvement at the higher level. The use of educational technology stood out in the study as an element that aids processes at all levels of the educational system.

1. INTRODUCTION

Globally, education is based on three basic elements: learning, teaching, and assessment. When these three elements are properly coordinated, it is possible to achieve truly meaningful learning for each student. Furthermore, they allow individuals to adapt over time and in any scenario that may arise. Specifically in the student population, this promotes the sustainability of formal education (Perisic, Perisic, Lazic, & Perisic, 2023). In formal education,

there is a predominance of the institutional element, which is process-oriented (Elhussein, Leopold, Silva, & Zahidi, 2023). This approach is characterized by imparting instruction aimed at helping students successfully navigate each stage of their lives and professional careers (Maddikunta et al., 2022; Wright, Ritter, & Wisse Gonzales, 2022).

Learning is an essential component of the entire educational process and, as such, must have clear objectives, content, and strategies in line with the area of training, as well as the establishment of activities for students. Authors such as Reeves (2006) add that learning must also include a clear definition of the roles of teachers and students, the use of technology, and the type of assessment (Application strategies). These aspects of learning may vary depending on the geographical, political, social, and cultural characteristics of the educational context. This can lead to a gap between expectations regarding the competencies that students should achieve and the academic reality to which they will be exposed, which translates into the educational proposal to which they are subjected. In view of this apparent gap, the goal of education has been proposed as achieving cross-cutting competencies so that meaningful learning can take place (Sá & Serpa, 2018).

Another element that plays a fundamental role in this process and has been the subject of numerous studies is teaching. In this component, research into the bond established between students and teachers has revealed that this relationship is essential for teaching to be carried out optimally and, at the same time, to reduce stress in both teachers and students due to their pedagogical role (Spilt, Koomen, & Thijs, 2011). Teachers must relate to their students, and this can only be achieved through experience, which guides the emotional responses of their immediate environment (students). Teaching, at the professional level, seeks to provide technical, emotional, and cognitive training for each teacher. This preparation will ensure that the teaching process does not represent a burden for students; on the contrary, it will foster an environment in which learning is motivating and enjoyable (Biedenweg, Monroe, & Oxarart, 2013; McAllister & McKinnon, 2009).

Finally, learning assessment plays a decisive role in the development of each student's knowledge; therefore, it requires a deliberate effort on the part of the teacher (Wolterinck, Poortman, Schildkamp, & Visscher, 2024). In this way, the assessment strategies applied will provide valuable information to generate constant feedback that guides student performance (Quinlan & Pitt, 2025). In this regard, Morris, Perry, and Wardle (2021) argue that both assessment and feedback are crucial for learning. It is important to note that these aspects have captured the interest of the scientific community as they are essential for assessing the level of understanding achieved by students. This is demonstrated by studies that show their effectiveness in educational, social, and psychological settings; they have even been shown to have a positive impact on employability (Gaynor, 2020; Jonsson, 2013; Van Der Schaaf, Baartman, Prins, Oosterbaan, & Schaap, 2013). Both formative assessment and feedback, from a practical perspective, should be present in the curriculum design of courses (Baughan, 2020; Morris et al., 2021; Winstone & Carless, 2019).

The study of these three elements (learning, teaching, and assessment) has been conducted based on their impact on improving educational quality (Junita, Zaini, Muhith, & Ghani, 2024). However, although real efforts have been made to strengthen the interactions between learning, teaching, and assessment in student training, more consistent work is still needed to achieve continuous improvement in education, especially in the early stages of schooling. For teachers, these components must be accompanied by cognitive and affective processes, which will allow them to interrelate optimally (Eren & Tekinarslan, 2013).

Given the importance of this topic for the educational process, it is necessary to review the available literature in order to understand the evolution of teaching, learning, and assessment as elements directly linked to educational improvement worldwide. The foundation for improving university education lies in teaching and learning. An example of this is the application of active learning, which allows teachers and students to achieve true academic performance (Munna & Kalam, 2021). Similarly, topics related to improving teaching quality and its evaluation (Harrison et al., 2022), innovative techniques for the teaching-learning process in higher education (Challa, Sayed, & Acharya, 2021), continuous educational improvement in developing countries (Fomba, Talla, & Ningaye, 2023),

and strategies for improving educational quality (Pramana, Chamidah, Suyatno, Renadi, & Syaharuddin, 2021) have been the subject of study by the scientific community.

From a bibliometric research perspective, defined as the systematic study of scientific literature to identify patterns, trends, and the impact of publications within a given field (Passas, 2024), few papers have been published in recent years, many on highly specific topics such as improving higher education (Brika, Algamdi, Chergui, Musa, & Zouaghi, 2021), evaluating trends and patterns in open educational resources (Mishra et al., 2022) and applied learning with online resources during the COVID-19 pandemic (Zhang et al., 2022).

Bibliometric analyses in this area have been scarce in recent years and have tended to focus narrowly on patterns of teaching, learning, and educational improvement rather than on broader perspectives. More recent studies, however, have analyzed scientific publications on the use of emerging technologies to improve education, including artificial intelligence (Afzaal, Shanshan, Yan, & Younas, 2024; Lin & Yu, 2024; Liu et al., 2024) virtual reality (Rojas-Sánchez, Palos-Sánchez, & Folgado-Fernández, 2023) data mining (Baek & Doleck, 2022) digital technologies (Wang, Chen, Yu, Liu, & Jing, 2024) deep learning (Bidwe et al., 2022) and machine learning (Abuhassna, Awa, Adnan, Daud, & Almheiri, 2024).

Given that no bibliometric analyses have been found that involve publications on assessment, teaching, and learning as a fundamental triad in continuous educational improvement, which elucidate how this topic has been developed in a broader sense, this study was proposed, to conduct a bibliometric study focused on the most significant aspects of published documents on the determinants of continuous improvement in higher education, to understand global research trends. Co-occurrence and distribution maps of the main bibliometric variables were developed.

2. METHODOLOGY

The study employed scientific literature-mapping techniques. Reviews employing bibliometric methodological practices do not focus on in-depth analysis of substantive study results; rather, their value lies in their ability to document and synthesize general trends that reveal the landscape, composition, and intellectual structure of a knowledge base. Thus, they provide information on knowledge-clustering patterns not typically analyzed in traditional research reviews (Brika et al., 2021; Zupic & Čater, 2015).

To conduct a bibliometric analysis, reliable databases such as Web of Science (developed by Clarivate Analytics) and Scopus (developed by Elsevier) are required. They are the most widely used and provide high-quality data and information on scientific publications (Aria & Cuccurullo, 2017).

For this study, the Scopus database was used to extract scientific papers published between 2015 and 2025 on assessment, teaching, and learning, and their relationship with the continuous improvement of the educational process. Scopus is a multidisciplinary and selective tool launched in 2004 that provides researchers with an accurate, user-friendly, and comprehensive tool to meet research needs across different fields (Caka, 2019; Prancutê, 2021). To retrieve information, the following search equation was applied: TITLE-ABS-KEY (assessment AND teaching AND learning AND continuous AND improvement) AND PUBYEAR > 2015 AND PUBYEAR < 2025.

Applying the equation yielded 427 documents that met the search criteria. For bibliometric data processing, specialized software has evolved to offer different approaches to this type of research (Van Eck & Waltman, 2014). In this study, VOSviewer software was used to create search maps and networks. VOSviewer is a software tool for generating maps based on network data and for visualizing and exploring them (Van Eck & Waltman, 2023). Co-authorship maps by author, organization, and country, as well as keyword co-occurrence maps, were produced and analyzed.

In addition, citations by country of origin were collected. The objective was to analyze the importance and visibility of the publications according to their origin, as well as the impact of the research conducted in each country. A frequency graph of the documents by year was also produced using the statistical software Jamovi

(version 2.6.44.0), a free, versatile, and powerful tool for performing basic and complex statistical analyses (Lino-Calle, Carvajal Rivadeneira, Sornoza Parrales, Vergara Ibarra, & Intriago Delgado, 2024).

3. RESULTS

3.1. Distribution of the Documents Reviewed by Year of Publication

Documents belonging to a period of 11 years were retrieved. The most productive years were 2024 with 99 documents (23.2%), 2021 with 48 documents (11.2%), and 2023 with 44 documents (10.3%). This can be seen visually in Figure 1.

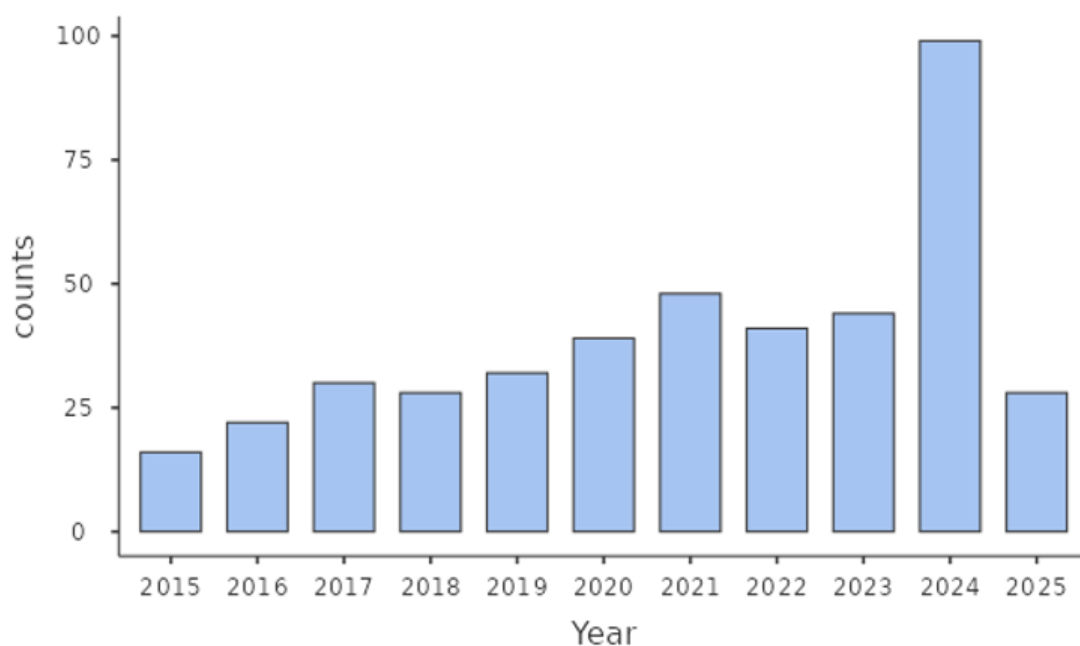


Figure 1. Distribution of documents retrieved per year.

In general, it was observed that most of the documents (260) were published in the last five years, representing 60.9% of the total. This shows that the theme of the triad of assessment, teaching, and learning, with a focus on continuous improvement in education, has been of greater relevance towards the end of the study period, with emphasis from the year 2023 to 2025.

3.2. Analysis of Co-Authorship by Country of Origin

There were 86 countries among which the reviewed documents were distributed. The country with the highest number of documents was the United States, with 91 documents and 650 citations (7.14 citations per document); in second place was China, with 46 documents and 120 citations (2.61 citations per document), and in third place was Spain, with 39 documents and 265 citations (6.79 citations per document).

Other countries that stood out were India, with 32 documents and 55 citations (1.72 citations per document); Saudi Arabia, with 17 documents and 177 citations (10.41 citations per document); United Kingdom, with 17 documents and 139 citations (8.18 citations per document); Australia, with 16 papers and 159 citations (9.94 citations per paper); Malaysia, with 16 papers and 31 citations (1.94 citations per paper); Portugal, with 15 papers and 50 citations (3.33 citations per paper); and Canada, with 13 papers and 103 citations (7.92 citations per paper). Figure 2 shows the map of co-authorships by country.

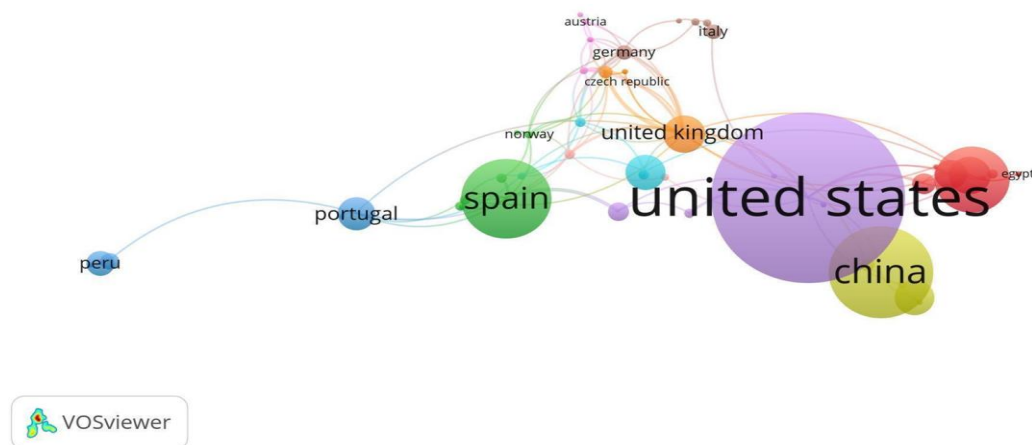


Figure 2. Map of co-authorships by country.

According to the map shown in Figure 2, the co-authorship network is distributed among 18 countries, including the United States, China, India, the United Kingdom, Uganda, Chile, Saudi Arabia, Italy, France, and Egypt. Another network consisted of the United Kingdom, Saudi Arabia, Australia, Portugal, Russia, Germany, Austria, Switzerland, Greece, the Netherlands, Norway, and Sweden. Spain formed a network with Portugal, the United Kingdom, the Netherlands, Colombia, Peru, Greece, Norway, and Chile.

The countries with the most extensive co-authorship networks were the United States, China, India, and Spain, from which networks were formed with other countries with lower document production. The triad of evaluation, teaching, and learning to improve education has been most studied in these countries, and they are related to other countries with lower production, which indicates important international collaboration.

3.3. Analysis of Co-Authorships by Author

A total of 1,493 authors were counted, of whom 40 published at least two papers. The authors with the highest number of publications were D. Anitha (India), C. Jeyamala (India), Wajid Hussain (United States), and Mohamed Ismail (Canada). Figure 3 shows the co-authorship map.

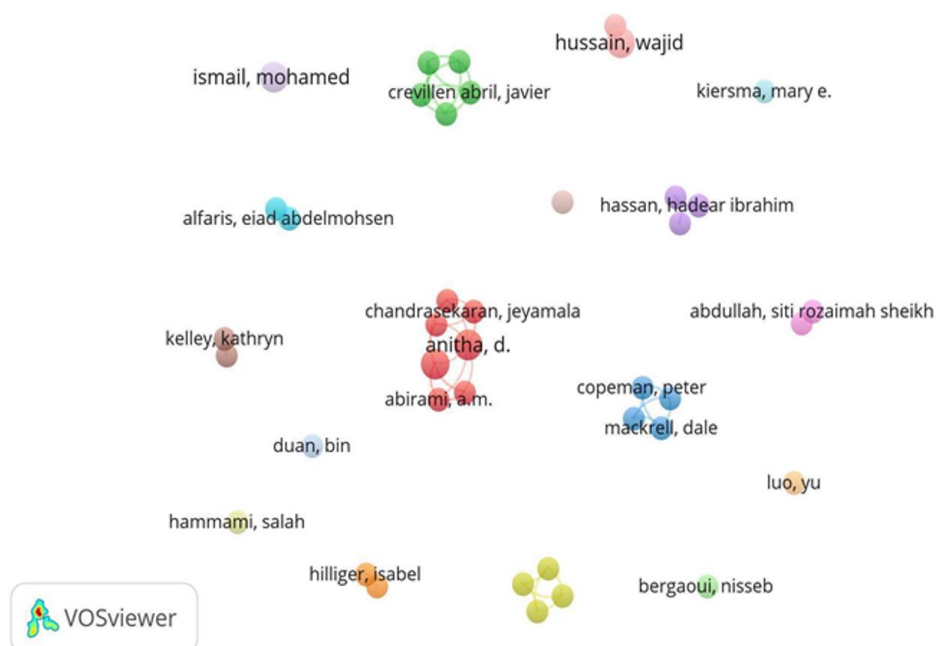


Figure 3. Map of co-authorships by author.

Figure 3 shows that, of the main authors mentioned in the previous paragraph, Mohamed Ismail has no co-authorship networks, i.e., he appears as the sole author in all three publications. The author with the largest co-authorship network was D. Anitha, who has published papers in collaboration with Thiruchadai, Jeyamala, Pudumalar, Uma, and Deisy (2022). Wajid Hussain has published papers with Hussain, Fong, and Spady (2024). Another outstanding co-authorship network is that formed by Spaniards (Álvarez-Montero, Martínez, Hípola, Abril, & Vázquez, 2024).

From Australia, authors Peter Copeman, Blooma John, Dale Mackrell, and Rosetta Romano formed these networks, while in Mexico, Silvia Lizett Olivares, Mildred Vanessa López Cabrera, Jorge Eugenio Valdez García, and Martha Ruth Loyola Segura did so. No international collaborative co-authorship networks were observed; rather, all networks were between co-authors from the same country, which indicates that studies on the interrelationship between evaluation, teaching, and learning as essential elements in continuous educational improvement have been carried out in isolation, so that only papers with authors from the same country have been published.

3.4. Analysis of Documents by Type

Table 1 shows the breakdown of the distribution of the documents retrieved by type. As can be seen, most of the research corresponds to articles, followed by documents published in the form of conference papers and book chapters. These three types accumulated 95.5% of the published documents, leaving other types of scientific documents, such as books, conference reviews, editorials, scientific notes, and reviews, with a very low participation.

Table 1. Distribution of retrieved documents by type.

Type of document	Frequencies	Percentage of total
Article	252	59.0
Book	4	0.9
Book chapter	24	5.6
Paper	132	30.9
Conference summary	2	0.5
Editorial	1	0.2
Note	3	0.7
Reviews	9	2.1

It is clear that, when dealing with the study of the triad evaluation, teaching, and learning as a driver of continuous improvement in education, researchers have focused mainly on scientific journals as a means of disseminating their findings, most of which have been the product of original research. The importance of scientific events, such as congresses, cannot be denied as a means of disseminating knowledge on the subject matter in question, a fact that can be affirmed with emphasis on what was obtained in the present research.

3.5. Analysis of Documents by Institution of Affiliation

A total of 923 institutions to which the retrieved documents were affiliated were counted. Among them, nine presented two or more affiliated documents and were therefore taken as the main ones. The institution with the highest number of affiliations was the Department of Information Technology of the Thiagarajar College of Engineering in India, with three in total. Eight other institutions had two affiliations: the University of Canberra (Australia), Wake Forest University (United States), Accreditation Council for Pharmacy Education (United States), Rose-Hulman Institute of Technology (United States), and the Department of Family and Community Medicine (Saudi Arabia).

According to the country of origin of the institution, the United States was the main producer of documents, with three institutions accounting for a total of six documents. India was the second country in this category, with

The highest concentration of documents on the investigated topic was from 2021 onward (Figure 1), i.e., in the final five years of the study period, with a peak in 2024. This is consistent with what was stated in the previous paragraph, since educational research is focusing mainly on the effect of digital tools on the processes inherent to the educational task, such as the triad of assessment, teaching, and learning, and on how technology applied to these processes and their interrelation influences the improvement of education. In this regard, Haleem, Javaid, Qadri, and Suman (2022) indicate that technology applied to education has facilitated student learning by increasing their interest in studying and researching. Isak, Babak, and Hren (2023) also argue that the use of digital tools is relevant to the teaching and learning process of students in technical careers and that they substantially improve education, as well as student performance. Another work consistent with what was observed was that of Sharma and Singh (2024), who mention that, in recent years, the advance of technology has been beneficial, with a positive impact on education, which has caused a profound influence on the teaching-learning processes, on the evaluation of content, and, therefore, on the improvement of educational systems.

In the country-of-origin analysis, the United States emerged as the leading contributor, producing the highest percentage of documents, as shown in Figure 2. The study of the educational triad in the United States has increased in recent years, especially after the COVID-19 pandemic, when certain details that negatively influenced the performance of teaching-learning processes in the era of digital education became evident, for example, fundamental contextual conditions such as teacher preparation, access to and autonomy of technology, understanding of students' learning abilities and needs, and their self-regulated learning skills (Johnson, Walton, Strickler, & Elliott, 2023). Another reason why the United States stood out as the country with the highest production in this thematic is the boom in the use of emerging digital technologies in the educational field in the country, including technologies such as big data (Bosman, Oladepo, & Ngambeki, 2024) augmented reality (Giancaspro, Arboleda, Chin, Yang, & Secada, 2024) robotic platforms (Lyman & Wilcox, 2023) digital learning management systems (Potts, Jin, & Rabie, 2023) among others. They demonstrate that the reviewed topic is being approached through digitalization in the United States, which aligns with the number of papers published.

China and Spain also contributed a significant number of documents on the reviewed topic. In China, assessment from a teaching perspective has been studied, revealing a focus on more contemporary methods while moving away from traditional ones (Coombs, Rickey, DeLuca, & Liu, 2022). This may influence the generation of scientific papers related to assessment as a basic component in the measurement of teaching and learning improvement. In the same context, it has been mentioned that in China, learning assessment is based on public examinations, which seems not to be giving the expected results, since important issues such as cultural and social aspects are not taken into account (Yan & Brown, 2021). For this reason, research to improve this situation has increased in the last five years.

In Spain, attention has also been devoted to studying the triad of assessment, teaching, and learning in the continuous improvement of education. Teaching practice has been the subject of study in this country, especially in the evaluative aspect, and contextual, human, and curricular factors have been identified that should be taken into account to improve teaching practice and student performance (Fernández-García, Inda-Caro, & Viñuela-Hernández, 2023). This provides an incentive for further research in this area, which explains why Spain ranks third in the number of published documents. As in other countries, Spain also saw a boom in the publication of research based on the use of technology to improve the teaching-learning process and the evaluation of knowledge, including those dedicated to the digital competencies of teachers (García-Vandewalle, García-Carmona, Trujillo Torres, & Moya Fernández, 2023) and the use of digital technologies during and after the COVID-19 pandemic (Pozo, Pérez Echeverría, Cabellos, & Sánchez, 2021). These studies confirm the results obtained and place Spain as one of the leading countries in terms of research on the continuous improvement of education based on the optimization of the assessment, teaching, and learning triad.

The importance of published papers, measured by the number of citations per paper, was highest for Saudi Arabia, with a high number of citations coming from other countries, such as Australia, the United Kingdom, and

Canada. The United States, the top document producer, ranked fifth in terms of importance. The above shows that the quantity of papers is not related to their quality or to the importance researchers give them for citation. Mischo, Schlembach, and Cabada (2024) conducted a study in which they analyzed the relationship between the impact-factor indexes and the number of articles published in a university in the United States, and found that there is no significant relationship between the two or with citations, which coincides with what was observed in this study. In this same context, it has been indicated that the citations made to scientific papers depend on various factors that directly influence their importance, among them indexing, the location of the journal in quartiles, the accessibility of the paper, the reputation of the author, and the keywords used (Soheili, Khasseh, Mokhtari, & Sadeghi, 2022). In the particular case, it can be inferred that accessibility, author information, regional importance, and keywords are the factors that determined what was observed, since all the documents come from the same database.

The three countries with the highest number of papers were also the main countries in terms of the formation of co-authorship networks in research on the topic addressed in this study, with India joining as another important country. In the last five years, India has shown a special interest in the quality of education, especially at the university level, with a trend towards continuous improvement of processes to achieve better placement in rankings and to achieve accreditation of institutions (Fernandes & Singh, 2022). In the same context, emphasis has been placed on the study of quality and continuous improvement in education for accreditation purposes, comparing different institutions and the accreditation standards applicable to each (Reddy, Sharma, & Gupta, 2024). The above shows that research is being generated in India to improve the quality of education and its institutions, which has resulted in the publication of scientific papers that place the country among the first in this subject and also as an important player in terms of co-authorship networks.

The co-authorship networks by author also ratified the importance of India as a leading producer of research on the assessment, teaching, and learning triad for the continuous improvement of education, with two authors among those with the highest participation (Figure 3). The most important author was D. Anitha, who, in line with the trend of research being developed in that country, presented work related to improving the quality of learning outcomes based on effective instructional design (Chandrasekaran, Anitha, & Uma, 2023) improvement by creating teaching dynamics (Anitha, Jeyamala, Abirami, & Thiruvengadam, 2024) educational experiences during the COVID-19 pandemic and its influence on educational quality (Ayyappan, Noushad, & Varghese, 2024) improvement of computer science student learning and the influence of student engagement (Chandrasekaran, Anitha, & Thiruchadai Pandeewari, 2021).

Another prominent author was Wajid Hussain from the United States, who published several articles related to the topic under study, particularly on learning assessment. His work includes studies on the assessment of engineering students using digital evolutionary counseling systems (Hussain et al., 2024), the study of performance indicators in learning measurement instruments (Hussain & Spady, 2017), and competency-based learning assessment (Mohiudddin, Rasool, Mohd, & Mohammad, 2019).

The significant contribution of Canadian author Mohamed Ismail was also highlighted, even though Canada is not among the countries with the highest output. He is a researcher known for his studies focused on learning assessment and knowledge accreditation. He has published articles on learning assessment from an integrated, outcomes-based framework (Ismail, 2017) and the use of Excel for accreditation and the collection of self-assessment data (Ismail, 2018). The work presented by this researcher shows that, although Canada is not among the countries with the highest participation in the collected documents, there is a trend towards research in knowledge assessment, especially after the COVID-19 pandemic, which has also influenced the assessment of curricular content (Aurini & Davies, 2021; DeCoito & Estaiteyeh, 2022; Whitley, Beauchamp, & Brown, 2021).

According to the analysis by type of document (Table 1), journal articles and conference papers were the most relevant. This shows that scientific journals are the most important dissemination medium for researchers who publish papers related to the educational triad formed by assessment, teaching, and learning, as well as their

influence on the continuous improvement of educational quality. It should be noted that scientific conferences are also a means used by researchers to disseminate the results of their research. In this sense, scientific journals are considered the media for the dissemination of science (Tenopir et al., 2016) due to their quality, visibility, and reputation, which is consistent with the results obtained.

Scientific conferences have also been considered important for science dissemination, as some authors consider them as important spaces for presenting new research, receiving feedback, and establishing contact with other researchers with the same interests, which is the most important aspect (Klemeš, 2016). This mode of dissemination is highly relevant in basic science and engineering disciplines, where most important results are published (Kochetkov, Birukou, & Ermolayeva, 2022). However, as observed in this research, they are also gaining importance in education as a means of knowledge dissemination.

When analyzing the institutions of affiliation of the retrieved documents, the United States and India again stand out. In the case of China, although it is the second-largest producer of documents, none of its institutions had more than one affiliated document, so it was excluded from the analysis of the most productive institutions. The other countries with affiliations considered in this analysis were Australia and Saudi Arabia. From the United States, three institutions collectively published six papers: Wake Forest University, with research on knowledge assessment (Castaneda et al., 2024; Luthy, Koehler, & Crowe, 2024); Accreditation Council for Pharmacy Education, with research on teaching accreditation (Murry et al., 2024; O'Sullivan et al., 2024); and Rose-Hulman Institute of Technology, affiliated with issues related to higher education quality and curriculum (Fridley, Bielefeldt, Sutterer, Williamson, & Back, 2019; Mueller & Walsh, 2024). In the case of India, a single institution appeared as an affiliation in three papers on improving educational quality and supporting a course-based evaluative approach, as well as enhancing student learning and engagement (Chandrasekaran et al., 2021; Thiruchadai et al., 2022; Thiruvengadam, Baskar, Jeyamala, & Abirami, 2022).

The University of Canberra (Australia) presented research on curriculum quality assessment, specifically on its indigenization (Romano et al., 2023; Romano et al., 2021). For its part, Saudi Arabia was represented by the Department of Family and Community Medicine, where research was conducted on teaching and assessment techniques applicable to foster and enhance student professionalism (Alqahtani et al., 2023) and on educational innovations applicable to teaching work for continuous improvement of the triad of assessment, teaching, and learning (Alqahtani, Alfari, & Naeem, 2023).

In addition to the keywords used in the search criteria, others were visualized that guide the research trends in this topic on the triad of assessment, teaching and learning in the continuous improvement of education, among which higher education stands out, indicating a significant amount of research whose object of study has been university students and higher education institutions (Alonzo, 2025; Faccin & de Andrade, 2025; Herrera, Mejías, & Cid, 2024; Mueller & Walsh, 2024). This topic has represented an important part of research on the improvement of educational quality in higher education institutions, especially to understand how knowledge is evaluated by students, as well as the evaluation of teachers themselves, as a fundamental contribution to the continuous improvement of student performance and of the courses taught (Carlucci, Renna, Izzo, & Schiuma, 2019). On the other hand, with the rise of technology and virtual education, the study of teaching-learning processes and the evaluation of knowledge has been key to understanding the evolution of higher education, due to the need to establish procedures that ensure quality in the different phases of the life cycle of the courses taught, regardless of the modality (Santally, Rajabalee, Sungkur, Maudarbocus, & Greller, 2020). This explains why there are so many documents that rely on higher education for research.

The word "curriculum" also suggests an approach based on the analysis of the implementation of the educational triad studied in institutions (Al-Aubaidy, 2024; Jaleel, Iqbal, Cheema, Iftikhar, & Bashir, 2024; Luo & Li, 2024; Stolwijk, van Bergen, Jetten, & Maas, 2025). It is known that curriculum analytics is a fundamental part of learning analysis and, from it, important decisions are made to improve the teaching-learning process, as well as

educational programs, including assessment methodologies (Hilliger, Aguirre, Miranda, Celis, & Pérez-Sanagustín, 2020), which justifies the number of scientific papers that have had curriculum improvement as a central theme. In this sense, it has also been pointed out that the pressure of national and international accreditations has led to policies of continuous improvement of the curriculum, although these have not been entirely effective because their impact on student performance has been neglected (Hilliger, Celis, & Pérez-Sanagustín, 2022), which has influenced the study of this subject.

On the other hand, the emergence of active learning suggests a tendency to apply this strategy to improve the efficiency of the educational triad (Binder et al., 2021; Calderón, Serrano, Serrano, & Blanco, 2021; Hoak & Richards, 2020; Romero-Untiveros, Lara-Herrera, & Ullón-Ramírez, 2024). Educational transformation has reached all levels with the incursion of technology into educational systems, which influences the educational triad and is changing the perspective on the future of curriculum designs and the teaching-learning process itself (Huggett, Smith, Hsieh, & Ownby, 2025). This means that models such as active learning have been the subject of research for their influence on improving the quality of education. The use of methodologies such as technology-mediated active learning improves the quality of learning when using different active techniques that prepare students to improve their performance and, therefore, the educational triad (Sukkar et al., 2024).

Self-assessment is related to research conducted in the context of technology-mediated education and complemented by other key phrases, such as "collaborative learning" or "technological education" (Binder et al., 2021; Chugh, Ram Mohan Rao, Karthik, & Prabhu Kishore, 2017; Luetsch & Burrows, 2016; Pantoja & Raymundo, 2017). In this context, the importance of self-assessment has been highlighted in previous studies, which have concluded that it should be applied on an ongoing basis to ensure continuous improvement and adaptability of students and teachers (Fernández, 2019; Masuwai, Zulkifli, & Hamzah, 2024; Wang & Ge, 2021).

5. CONCLUSION

Throughout the study period, scientific production on teaching and learning, as well as on knowledge evaluation as a means of promoting the continuous improvement of education worldwide, has played a relevant role, with a significant number of scientific papers published in the Scopus database. This relevance became more evident towards the end of the period, particularly in the most recent year (2024). According to the reviewed authors, this is mainly due to the use of educational technology, which has contributed significantly to improving the quality of education and the teaching-learning and evaluation processes at all levels of the educational system.

The countries with the highest overall scientific production were also those that contributed most to the study of the educational triad and its role in the continuous improvement of educational quality (the United States and China). However, other countries, such as India and Spain, also stood out for their research output in this area. This is evidence that the continuous improvement of educational quality is a broad field of research in which research has been conducted in various parts of the world, and which encompasses the leading countries in research and scientific dissemination worldwide. Likewise, the most productive authors in the subject studied were from two of the countries with the highest scientific production (the United States and India), while China showed a greater dispersion of authors, which prevented its researchers from forming part of the co-authorship networks identified.

The main institutions of affiliation of the published papers were also from the United States and India, which corroborates the importance of continuous educational improvement as a research topic in these two countries. All the institutions were of a higher level and from various academic fields, such as universities and technological institutes, which showed a more evident tendency to study technology as a mediator in educational quality and in the efficiency of the triad assessment, teaching, and learning as a basis for continuous improvement.

The tendency to examine technology as a mediator of educational processes and their continuous improvement was reflected in the keyword co-occurrence analysis. Keywords such as active learning, collaborative learning, and technological education, which appeared in networks related to higher education and curriculum, were evidenced.

This suggests that studies on continuous improvement in education have increasingly focused on higher education and on the curriculum as a key element of educational quality, which, in turn, is linked to the improvement of teaching–learning and knowledge assessment strategies.

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