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Innovations in teaching: analysis of scientific publications in the Scopus database

In the article scientific works related to innovative technologies in education were analyzed. The increase in the number of publications in the Scopus database from 2000 to 2023 confirmed the relevance of the proposed topic. The purpose of the study is to identify the main trends and directions in this field based on a systematic review of 6653 scientific articles identified by the keywords "innovation" and "learning" from the Scopus database. The research methodology includes data collection and analysis using SPSS to determine the growth dynamics of scientific publications, as well as geographic and industry distribution. The theoretical significance lies in expanding knowledge about innovative technologies in education and forming the multidisciplinary nature of this field. The increase in the number of publications identified as a result of the study from 136 works in 2000 to 3255 in 2023 indicates an increased scientific interest in innovative technologies in the field of education in the global space.

Keywords: innovation, teaching, Scopus, educational technologies, systematic review, statistical analysis, SPSS, global education.

Introduction

In the modern academic world, the importance of innovations in the field of teaching is constantly increasing due to the need to adapt educational methods to changing technological and social conditions. Considering the topic through the prism of publications in the Scopus database allows you to objectively assess current trends and developments in this direction, thereby providing scientific confirmation of the effectiveness and prospects of innovative teaching methods. The use of VOSviewer and Bibliometrix tools for bibliometric analysis, as noted by Cruz-Lovera et al. [1], as well as an in-depth search for specific keywords in Scopus, highlighted in the works of Pakkan et al. [2] and Akkaya & Ertekin [3], has become standard practice in scientific research. This not only provides comprehensive coverage of citations and literary excerpts but also expands the profile of journals, improving access to scientific publications and contributing to citation analysis. Analyzing the data obtained from one of the leading scientific databases, it is possible to identify key research areas that attract the attention of scientists around the world and thereby identify the most significant aspects and problems that require further study and development. This will help not only to improve the quality of the educational process but also to promote the integration of new approaches into the practice of higher education.

The relevance of innovation in teaching is highlighted in a number of studies that indicate the need to reconsider traditional approaches, especially in the context of the COVID-19 pandemic. Yu et al. [4] note that teachers are increasingly using online forms of informal learning to stimulate innovative practices during quarantine periods. This reorientation towards innovative teaching is key to inspiring students, developing their creative abilities, and enriching the learning process. At the same time, Xiong et al. [5] indicate that teachers in graduate school usually demonstrate a higher level of innovation than their undergraduate colleagues. An integrated approach to innovative learning includes not only course content but also teaching methods, resources, and assessment [6]. Xu et al. [7] emphasize the importance of innovation in teaching methods for the effective development of innovative talents. The willingness of teachers to innovate in the content of courses also significantly affects their innovative activity [8]. The use of information technology and strategic skills can enhance the effectiveness of teaching and stimulate innovation in learning [9]. Innovative teaching contributes not only to increasing the interest and motivation of students but also to improving educational outcomes [10], while knowledge management, creativity, and organizational behavior play an important role [11]. The creation of a world-class university requires effective management of innovative teaching practices [12], and the development of a system of innovations in physical education is a key aspect for promoting educational innovations [13].

A study of publication activity in the period from 2000 to 2023 using the keywords “innovation” and “teaching” in the Scopus database revealed 6,653 scientific papers, which indicates a high interest in the topic of innovation in education. The United States leads the way in the number of publications, with 5,829 papers, followed by China and Spain with 4,770 and 2,464 publications, respectively. The UK, Australia, and Canada also showed significant activity, publishing 2,058, 1,287, and 861 papers. This highlights the global and multifaceted nature of research in the field of innovative learning. Even countries with fewer publications, such as the Russian Federation (443) and Kazakhstan (70), make a significant contribution to the development of this field, which indicates the widespread interest in innovative methods in education at the international level. This distribution of research activity highlights not only the relevance of innovative teaching issues but also the need for a cross-cultural and multidisciplinary approach to their study.

Our research is aimed at a thorough analysis of scientific papers on the topic “Innovations in teaching” indexed in the Scopus database from 2000 to 2023. The main goal is to study and highlight the key trends, scientific directions, and methodological approaches that determine the development of innovative teaching. The tasks include a quantitative analysis of publication activity over time, a study of the geographical distribution of scientific papers, the identification of leading contributors — scientists and organizations, as well as an analysis of the most significant journals in the field. This will allow us to identify the leading research centers that are most active in the field of innovative teaching methods, identify current knowledge gaps and insufficiently covered topics.

Innovative teaching methods play a key role in modern educational processes, adapting to the latest technological developments and changing pedagogical approaches. According to research by Purba et al. [14] and Almeida et al. [15], educational institutions are increasingly moving from traditional classroom activities to the use of virtual platforms such as Zoom, which facilitates the transition from personal interaction to virtual communication. These changes are extremely important to maintain the pace of development of the educational landscape and meet the diverse learning needs of students. The introduction of innovative and interactive teaching techniques, as shown by studies by Eli [16] and Zhang et al. [17], significantly stimulates the interest and participation of students in the educational process. In addition, modern scientific approaches in education focus on context-oriented pedagogical methods that are aimed at creating an educational environment relevant and attractive to students, linking theoretical concepts with practical applications [18]. Such approaches contribute to improving students' understanding of the material and also emphasize the importance of interdisciplinary training in fields such as artistic design and engineering in order to prepare graduates who are able to meet the demands of a rapidly changing society [19].

Research in the field of innovation in education pays considerable attention to understanding the geographical distribution of innovation activities. According to Zhou & Zhu [20], the application of spatial distribution methods to analyze the characteristics and factors affecting innovative enterprises in Zhejiang Province allows for a deeper study of regional characteristics. Similarly, a study in Germany by Fritsch & Wyrwich [21] highlights how the country's federal tradition shapes the distribution of universities and research institutions, which has a significant impact on innovation patterns. An important aspect is also the impact of localized innovations on the profitability of shares of travel companies, as shown by the Napierała & Szutowski study [22], which emphasizes the need to analyze the spatial distribution in innovation networks. In Shanghai, the study of the structure and mechanisms of proximity of formal innovation networks by Cao et al. [23] demonstrates the concentration of innovative partners in the city and neighboring areas. Comparative analysis between Europe and the USA by Crescenzi et al. [24] emphasizes the role of institutional processes in shaping the dynamics of innovation and their geographical distribution. Also, studies by Zhao et al. [25] and Dongyun & Xu [26] discuss the impact of cognitive, social, and geographical proximity on innovation cooperation, highlighting the importance of non-geographic proximity in knowledge exchange and interaction, which contributes to a deeper understanding of both regional and international aspects of innovation activity.

The impact of technology on innovative processes in education is noticeably enhanced by the integration of modern tools such as virtual reality (VR), robotics, big data, artificial intelligence, and digital tools. For example, the use of VR in education and training in construction engineering, as shown by research by Wang et al. [27], demonstrates significant potential for improving learning outcomes. Robotics is also recognized as a significant factor in the transformation of the educational system [28]. The COVID-19 pandemic intensified the transition to online education, which stimulated the development and

implementation of new methods and technologies aimed at improving the educational process and student engagement [29, 30]. In addition, the importance of innovative approaches of teachers and the need for their continuous professional development to promote innovative practices were emphasized [31]. Research in the field of industrial design confirms the importance of innovations in educational methods to overcome challenges and improve learning efficiency [32]. Thus, the integration of technology into education is seen as a means of providing innovative learning, increasing student engagement and satisfaction, and improving overall learning outcomes.

Concluding the literature review, it can be argued that the active introduction of innovative technologies and techniques into the educational process plays a crucial role in the formation of an effective learning environment capable of meeting the needs of students in the 21st century. Attention to the dynamics of innovation in different regions and the impact of technology on teaching practices allows not only for the improvement of the quality of education but also provides a basis for developing strategies that will facilitate the integration of innovations into the educational process at the global level. These findings highlight the importance of continuous research and analysis of innovative approaches in education as a critical element for the training of qualified professionals who are able to function effectively in a rapidly changing world.

Methods and materials

This study is based on the analysis of a wide range of publications indexed in Scopus from 2000 to 2023 on the topic of innovation in teaching, including the keywords “innovation” and “teaching”. The total number of documents selected for analysis has reached 6653, which provides a large-scale and multi-faceted basis for the study. This dataset includes 2,725 articles, which are the main source of scientific literature, 3,384 conference reports reflecting advanced research ideas and discussions, 255 review articles providing a broad context and critical analysis of existing research, as well as 90 book chapters expanding the perspectives of research analysis.

A variety of document types, including editorials, notes, and short reviews, add depth to the analysis and enrich the study with a variety of points of view. The importance of this approach lies in the opportunity to highlight not only the quantitative aspects of research activity but also the qualitative content of the scientific dialogue in the field of innovation in education. The collection of materials from various journals, including “Proceedings Frontiers in Education Conference Fie” and “ACM international Conference Proceeding Series”, reflects the relevance of the topic of innovation in teaching on various academic exchange platforms and demonstrates the multidisciplinary nature of research. Special emphasis in the research materials is placed on publications with a high degree of involvement in innovative educational processes, such as the Journal of Physics Conference Series, Lecture Notes in Computer Science (including the Lecture Notes in Artificial intelligence and Lecture Notes in Bioinformatics), and Communications in Computer and information Science. This choice of sources makes it possible to include the latest achievements in the field of educational technologies and teaching methods in the analysis, providing a comprehensive look at modern scientific research and practical developments.

The number and variety of publications in the field of innovation in teaching, selected from the Scopus database, provide extensive material for analysis. Such an extensive amount of data makes it possible not only to identify general trends and directions in the field of innovation in education but also to trace the dynamics and evolution of ideas over time. In addition, the inclusion of articles and reports from various cultural and geographical contexts contributes to a deep understanding of how innovations in education are adapted and applied in different settings, reflecting both unique national approaches and global educational trends.

For a detailed analysis of the collected materials, a whole arsenal of tools was used, the central place among which is occupied by the statistical package SPSS. The choice of SPSS is due to its versatility: the software product not only provides reliable primary data processing but also offers a wide range of options for complex statistical analyses such as multivariate, correlation, and regression. This makes it an indispensable tool for research that requires processing large amounts of data and obtaining accurate statistical results. SPSS provides researchers with the ability to perform calculations of averages, medians, standard deviations, and other basic statistical parameters and supports more advanced statistical procedures, including cluster analysis, factor analysis, and multidimensional scaling, which allows you to identify hidden relationships and patterns in the data.

Analytical data processing began with the accurate and systematic collection of information from the Scopus database for the period from 2000 to 2023. The search was carried out using the keywords

"innovation" and "teaching", which allowed us to collect all relevant works corresponding to the specified parameters. Each publication went through an initial evaluation process to confirm its compliance with research objectives. The collected information was entered into a database indicating the type of document, authorship, year of publication, and number of citations. This ensured the formation of a detailed descriptive profile of the studied material and formed the basis for further analysis.

SPSS was used to evaluate and interpret the qualitative and quantitative aspects of the collected material. Descriptive and inferential statistical analyses were performed during the use of the program. Calculations of the central trend and the measure of the spread were carried out, as well as analyses of dependencies and relationships between various variables. An important part of the process was the formation of hypotheses and the verification of their statistical significance. The content analysis of publications was carried out in order to identify the most significant topics and trends in the subject area, which made it possible to highlight the most important aspects of innovations in education and their application in teaching.

The next stage included data visualization, which was performed using SPSS and additional software to create charts, tables, and graphs that facilitate the perception of the analysis results. The interpretation of the data was carried out on the basis of the obtained visual materials, which contributed to a deeper understanding and synthesis of the main conclusions of the study. As a result, a final report was compiled synthesizing all the collected and analyzed data, which served as the basis for further writing the article. In conclusion, it can be emphasized that the methodology of data processing and analysis applied has provided a comprehensive and in-depth understanding of the topic of innovation in teaching. The selection of relevant data, their careful analysis using proven tools, and a consistent analysis procedure allowed us to ensure the reliability and validity of the research results. The findings contribute to the expansion of academic knowledge in the field of innovative education and can serve as a starting point for further research in this direction.

Results and Discussion

The multidimensional analysis allowed us to identify key trends and directions in the research of the emotional aspects of language. The temporal analysis showed a steady increase in the number of publications over the years, which indicates an increase in interest in this topic in the scientific community. The geographical analysis confirmed the broad international nature of the research, with active contributions from scientists from various countries and cultures. The research covers many branches of knowledge, which emphasizes their multidisciplinary nature. The analysis of the journals revealed the leading publishing platforms that serve as centers for the dissemination of knowledge about emotions in language. The analysis of keywords in the titles of works indicates the main research topics in this field, and the evaluation of the number of citations highlighted the most influential works that determine the direction of scientific debate. These results reflect the current state and dynamics of research on the emotional aspects of language, emphasizing their importance for understanding human communication and interpersonal interactions.

The study of the number of publications by year related to the emotional aspects of language demonstrates an important trend of increasing academic interest in this topic. Between 2000 and 2023, there has been a steady increase in publication activity, starting with 136 papers in 2000 and ending with 3,255 publications in 2023. This increase reflects the expanding role of emotions in linguistic research and the growing recognition of the importance of emotional factors in language learning and communication (Fig. 1).

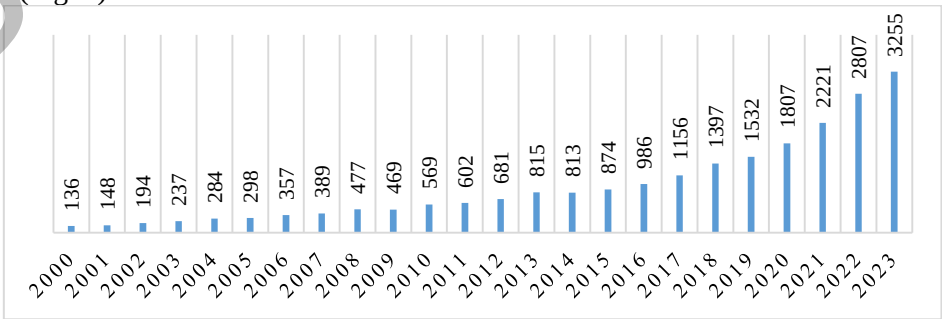

Figure 1. Dynamics of publication activity for scientific publications on innovations in teaching: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from publications indexed by Scopus)

Since 2010, there has been a particularly noticeable rise in interest in this topic, which may be due not only to the expansion of methodological approaches in linguistics and psychology, but also to an increase in the number of international research collaborations and projects. The peak values in 2021 (2,221 publications) and 2022 (2,807 publications) emphasize the intensification of research in the analysis of the relationship between language and emotions, as well as pay attention to the development of new theoretical approaches and applied research in this area.

An analysis of the number of publications by country reveals the geographical distribution of academic activity in the field of innovation in teaching, as shown by data from Scopus. China (1,632 publications) and the United States (1,381) demonstrate the highest levels of research interest and productivity, which may reflect the broad infrastructure and funding of research in these countries. Spain (835) and the United Kingdom (360) are next in terms of activity, which highlights their contribution to the development of pedagogical innovations and scientific cooperation in the European region (Fig. 2).

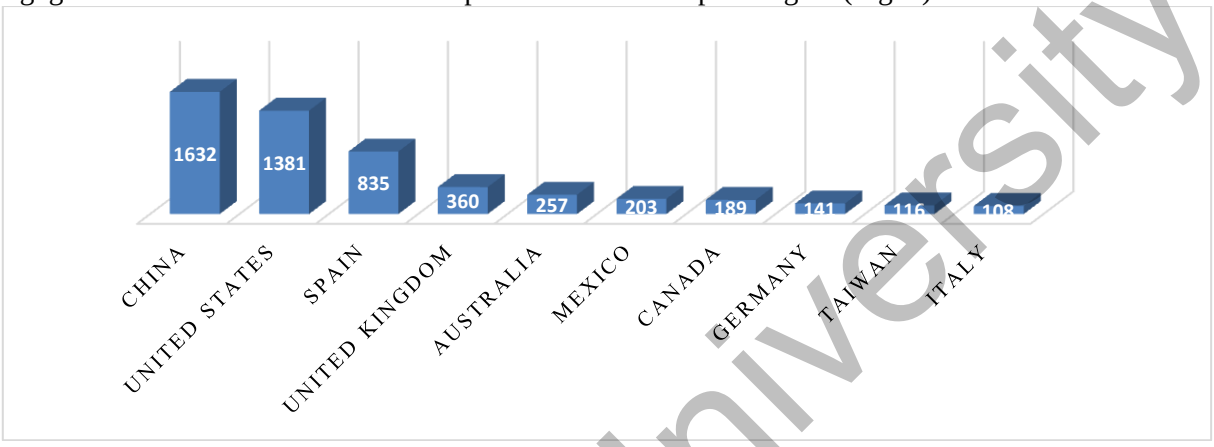

Figure 2. Top 10 countries by the number of publications on pedagogical innovations: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from publications indexed by Scopus)

The rest of the top 10 countries continue to show significant interest in innovation in education, which confirms the global orientation of research in this area. Australia, Mexico, and Canada, together with other countries, contribute to the development and dissemination of innovative approaches to teaching, reflecting the diversity of educational practices and strategies in various cultural and political contexts. These data indicate the wide scale of research efforts and multicultural interactions in modern pedagogy.

A study of scientific activity by branches of knowledge revealed the dominant influence of the social sciences, which occupy a leading position with 3,040 publications. Such activity reflects multidisciplinary interaction and a wide range of topics addressed by social researchers in the context of innovations in teaching, emphasizing the importance of educational methods in social processes and practices. Computer science, with 2,590 publications, also stands out prominently, demonstrating the integration of information technology and computer learning into the educational sphere, which is a sign of the increasing role of digitalization in teaching (Fig. 3).

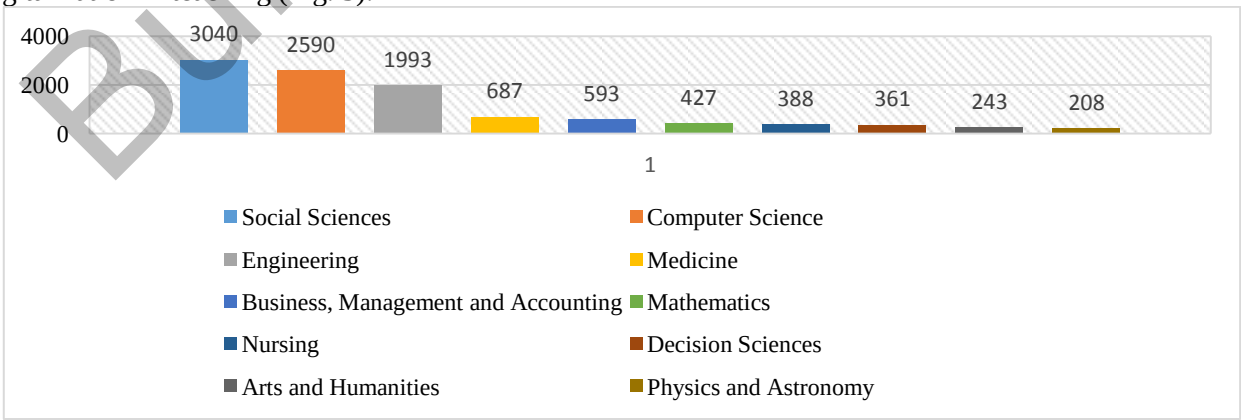

Figure 3. Top 10 industries by the number of scientific publications on pedagogical innovations: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from publications indexed by Scopus)

Engineering sciences have been continuing the series of works since 1993, testifying to the importance of technical innovations in educational methods. Medicine and the healthcare sector also make a significant contribution (687 publications), which may be associated with the development of medical education and improving the quality of training of specialists in this field. These results highlight the wide variety of disciplines involved in the research and implementation of innovative approaches to education and point to the multidimensional development of educational technologies and teaching methods.

An analysis of the number of publications carried out by organizations reveals significant academic activity in the field of innovation in teaching. in particular, Tecnológico de Monterrey stands out with 177 publications, which indicates its leading role in scientific research and the development of new educational methods. Spanish universities are also showing marked activity, with Universidad de Sevilla and Universidad de Granada publishing 65 and 62 papers respectively, reflecting the importance of research work in these educational centers (Fig. 4).

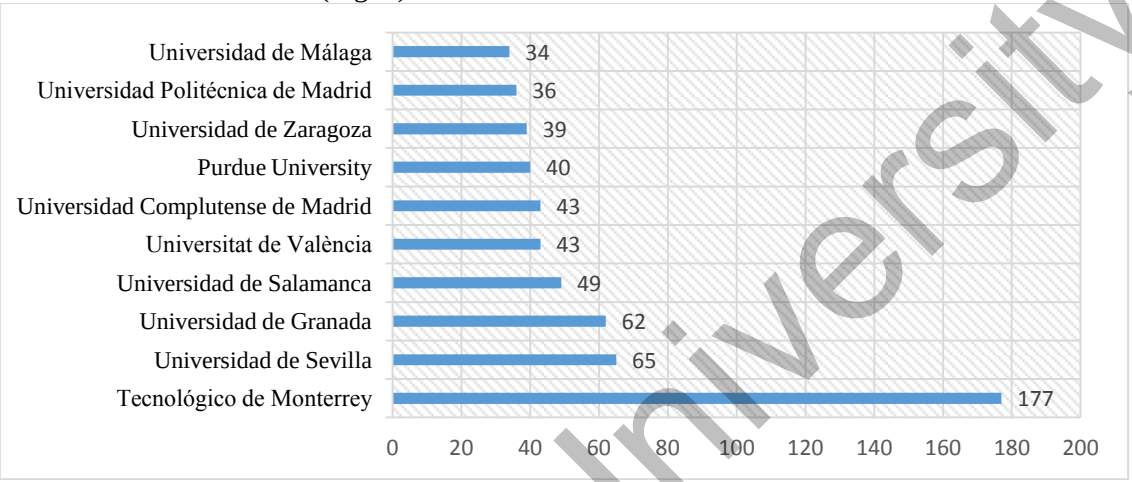

Figure 4. Top 10 organizations by the number of scientific publications on innovations in teaching: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from publications indexed by Scopus)

The analysis also highlights the significant contributions of institutions such as Purdue University and Universidad Complutense de Madrid, with 40 and 43 publications respectively, highlighting their importance in advancing pedagogical research. The data confirm that universities and research institutes are key players in spreading knowledge about innovative teaching methods and their impact on the development of modern education.

An analysis of scientific publications by the number of publications in the field of innovation in teaching highlights the importance of certain series and conferences for the dissemination of research results. The series “Proceedings Frontiers in Education Conference Fie” with 190 publications and the “ACM international Conference Proceeding Series” with 180 papers stand out as the most important platforms for the exchange of knowledge and best practices in education, which confirms the value of conferences as meeting places for scientists and educators to discuss the latest achievements in the field (Fig. 5).

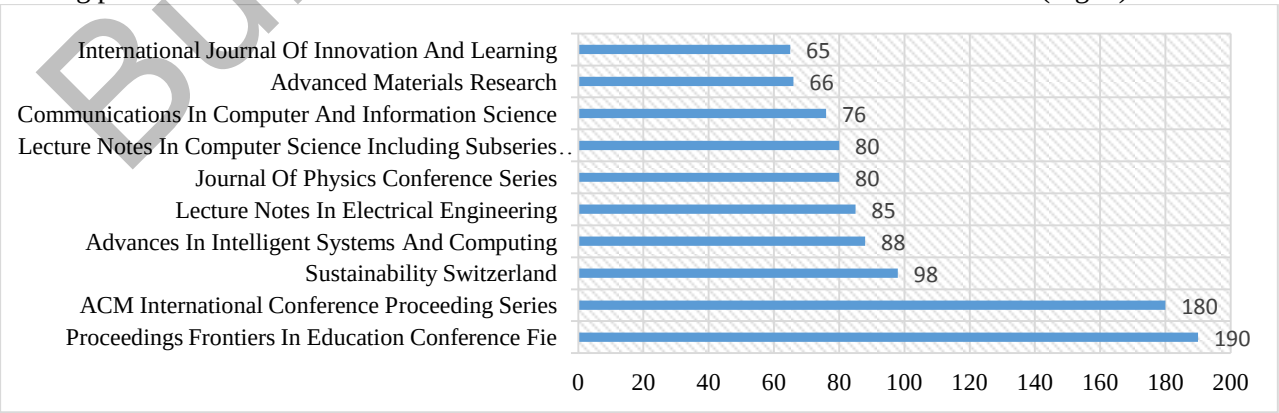

Figure 5. Top 10 scientific publications by the number of publications on pedagogical innovations: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from publications indexed by Scopus)

Publications such as Sustainability Switzerland and Advances in intelligent Systems And Computing are also significant in the context of innovative research in education, with 98 and 88 publications respectively, demonstrating a growing interest in sustainable development and intelligent systems in the educational process. The presence of specialized journals on this list, such as Medical Teacher and Nurse Educator, with 30 publications each, underscores the importance of targeted education and the development of professional skills in the field of healthcare. These scientific publications are key tools for the dissemination of innovative ideas and research in various fields of pedagogical science.

The analysis of keywords in the titles of publications on innovations in teaching revealed the importance of thematic areas in current research trends. The word “teaching” prevails with 2,131 mentions, which emphasizes the main focus of scientists on pedagogical methods and approaches. “Education” and “innovation” with 1,417 and 1,383 mentions, respectively, reflect an emphasis on educational practices and the introduction of innovative ideas (Table 1).

Table 1

Top 20 keywords found in the titles of scientific publications on innovations in teaching: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from the database of articles indexed by Scopus)

Keywords	*Number Of Keywords*	*Keywords*	*Number Of Keywords*
teaching	2131	innovative	458
education	1417	university	440
innovation	1383	course	431
learning	1140	study	404
engineering	768	development	353
students	596	training	351
design	575	model	329
based, research	572	higher	315
technology	502	using	294
practice	462	educational	286

The concepts of “learning”, “engineering”, and “technology” mentioned 1,140, 768, and 502 times, respectively, show the importance of technological innovations and engineering solutions in the educational process. A certain interest of researchers in “students”, “design”, and “based research”, with the number of mentions being 596, 575, and 572, indicates the centrality of student experience and research practices in educational innovations. Thus, keyword analysis provides an understanding of research guidelines and reveals the main topics that shape scientific discourse in the field of teaching and learning. Figure 6 shows a visual representation of the keywords found in the titles of articles on innovative pedagogical research.

Figure 6. Keywords and thematic areas of publications on innovations in teaching identified in the titles of scientific publications based on the analysis of publications in Scopus

The analysis of article citation trends reveals significant interest in topics related to the use of digital technologies in the medical and educational fields. The article "Use of electronic health records in U.S. Hospitals" by Jha, A.K., Desroches, C.M., et al., published in 2009, leads with 1,111 citations, reflecting the importance of integrating information systems into medical institutions [33].

The work "Competence-based postgraduate training: Can we bridge the gap between theory and clinical practice?" by Ten Cate, O. et al., published in 2007, also enjoys considerable interest with 770 citations, emphasizing the relevance of discussing the competence-based approach in postgraduate medical education (Table 2) [34].

Table 2

Top 5 most cited works in the field of pedagogical innovations: analysis of Scopus data for 2000–2023 (Source: own calculations based on data from the database of articles indexed by Scopus; Export Date: April 14, 2024)

Authors	*Title of the Work*	*Classification*	*Year*	*Citations*
Jha, A.K., Desroches, C.M., Campbell, E.G.,... Rosenbaum, S., Blumenthal, D.	Use of electronic health records in U.S. Hospitals	Health informatics	2009	1111
Ten Cate, O., Scheele, F., Ten Cate, Th.J.	Competency-based postgraduate training: Can we bridge the gap between theory and clinical practice?	Medical Education	2007	770
Boulos, M.N.K., Wheeler, S.	The emerging Web 2.0 social software: An enabling suite of sociable technologies in health and health care education	Health Education Technology	2007	705
Huang, H. -M., Rauch, U., Liaw, S. -S.	Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach	Educational Technology	2010	534
López-Pérez, M.V., Pérez-López, M.C., Rodríguez-Ariza, L.	Blended learning in higher education: Students' perceptions and their relation to outcomes	Education Science	2011	503

In the field of educational technologies, the article "The emerging Web 2.0 social software: An enabling suite of sociable technologies in health and health care education" by Boulos, M.N.K., Wheeler, S. collected 705 citations, which indicates a growing interest in social technologies in education [35]. The topic of virtual reality in education also attracts attention: a study by Huang, H. -M. et al. "Investigating learners' attitudes towards virtual reality learning environments" has 534 citations [36].

The relationship between theory and practice in education is particularly important, as can be seen from the number of citations of articles on blended learning and challenges in medical education. These data confirm the significant contribution of these works to the development of methodological approaches and strategies in the field of pedagogy and medicine, opening up new prospects for educational practice and research.

In the course of our study "Innovations in teaching: a study of publications in the Scopus database", an analysis of the top 5 articles showed various aspects of innovation in education (Table 3). The work of Jha et al. "Use of electronic health records in U.S. Hospitals" demonstrates the importance of digitalization of medical records and its impact on the quality and accessibility of healthcare, which is important for the development of educational programs in medical schools. The article has gained more than 1,000 citations, which highlights its impact on the academic community [33]. A study by Ten Cate et al. "Competence-based postgraduate training" with more than 700 citations focuses on the need to compare theoretical knowledge and practical skills in medical education, which is key for training specialists [34].

Table 3

Top 5 comparative analysis of research on innovations in teaching: methods, results and conclusions (Source: own calculations based on data from the database of articles indexed by Scopus)

Authors	*The title of the work*	*Methods Used*	*Results*	*Conclusions*
1	2	3	4	5
Jha, A.K., Desroches, C.M., Campbell, E.G.,... Rosenbaum, S., Blumenthal, D.	Use of electronic health records in U.S. Hospitals	The study involved the development of a survey instrument by synthesizing prior hospital-based surveys of electronic records systems. Feedback was obtained from experts in health information technology, survey research, and health policy. The survey sample included acute care general medical and surgical member hospitals, and data collection was conducted in collaboration with the American Hospital Association.	The survey assessed the presence of 32 clinical functionalities of an electronic records system in hospitals. Findings indicated variations in the implementation of these functionalities across different units within hospitals. The study also identified barriers to adoption and potential mechanisms for facilitating the adoption of electronic health records.	The study highlighted the challenges and opportunities associated with the adoption of electronic health records in U.S. hospitals. While some hospitals had successfully implemented certain functionalities, there were uncertainties about the ease of implementing these systems across all units. The findings underscored the need for targeted strategies to overcome barriers and promote the widespread adoption of electronic health records for improved healthcare delivery.
Ten Cate, O., Scheele, F., Ten Cate, Th.J.	Competency-based postgraduate training: Can we bridge the gap between theory and clinical practice?	The authors observed confusion around the term competency in postgraduate medical training. They proposed analyzing critical activities of professional practice and relating them to predetermined competencies. The use of entrustable professional activities (EPAs) and statements of awarded responsibility (STARs) was suggested to bridge the gap between competency frameworks and clinical practice.	The introduction of competency-based postgraduate medical training has raised critical issues of curricular implementation. There is a need to clarify competency terminology to design effective teaching and assessment programs. EPAs and STARs were identified as potential tools to connect competency-based education with clinical practice.	Competency-based curricula should focus on EPAs as central elements without disregarding general competencies. Work-based assessment should address both EPAs and general competencies. A practical EPA-based approach to assessment can balance educational theory and clinical teaching practice.
Boulos, M.N.K., Wheeler, S.	The emerging Web 2.0 social software: An enabling suite of sociable technologies in health and health care education	The document discusses the utilization of Web 2.0 technologies in health and health care education. It explores various tools such as social bookmarking, wikis, blogs, and podcasts in the context of sharing information, collaborating, and educating within the healthcare sector.	The use of Web 2.0 technologies has shown promise in enhancing communication, knowledge sharing, and collaboration among healthcare professionals, patients, and educators. Examples include the creation of public wikis for tracking information, the development of educational podcasts, and the establishment of online communities for sharing resources.	The authors suggest that the integration of Web 2.0 tools in health and health care education can lead to improved information dissemination, increased collaboration, and enhanced learning experiences. By leveraging these sociable technologies, healthcare stakeholders can engage in more interactive and dynamic ways of sharing knowledge and resources within the field.

Continuation of Table 3

1	2	3	4	5
Huang, H. -M., Rauch, U., Liaw, S. -S.	Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach	The study employed a questionnaire with 16 questions rated on a 7-point Likert scale to evaluate learners' attitudes towards VRLEs. To ensure content validity, a content validity study was conducted involving experts in the field. Three experts reviewed the questionnaire based on relevance, appropriateness of wording, and clarity of questions. A pre-test with 30 learners was conducted to refine the questionnaire, resulting in a final set of 25 items. The dimensions of measurements included interaction, immersion, imagination, motivation, problem-solving capability, collaborative learning, and intention to use VR.	The internal consistency reliability of the questionnaire was high (Cronbach's alpha = 0.92), indicating the reliability of the instrument. Multiple regression analysis revealed that interaction, immersion, and imagination were significant predictors of collaborative learning. The study found that imagination had the highest contribution (37 %) to collaborative learning. Additionally, collaborative learning was a strong predictor of learners' intention to use VRLEs.	The study concluded that interaction, immersion, and imagination play crucial roles in enhancing collaborative learning in VRLEs. The findings suggest that incorporating elements of imagination in VR experiences can significantly impact learners' engagement and learning outcomes. Furthermore, the study highlights the importance of collaborative learning in influencing learners' intention to use VR technology for educational purposes. These insights can guide educators in designing effective VR learning experiences to promote active engagement and knowledge acquisition among learners.
López-Pérez, M.V., Pérez-López, M.C., Rodríguez-Ariza, L.	Blended learning in higher education: Students' perceptions and their relation to outcomes	The study conducted by López-Pérez et al. at the University of Granada utilized a blended learning approach to enhance the teaching and learning process. A total of 17 groups with 1431 students registered for the 2009-2010 academic year participated in the study. The researchers focused on measuring the impact of blended learning on student outcomes and perceptions. Data was collected through a questionnaire addressing students' gender, class attendance levels, and perceptions of the blended learning experience.	The study found that blended learning had a positive effect on reducing dropout rates and improving exam marks among first-year undergraduate students in business studies courses. The analysis of students' perceptions revealed that the majority of participants perceived blended learning as beneficial for understanding course content, increasing motivation, and enhancing satisfaction with the learning experience. Objective measures, such as final exam marks, were positively correlated with students' subjective perceptions of utility, motivation, and satisfaction related to blended learning activities.	In conclusion, the research conducted by López-Pérez et al. demonstrated the effectiveness of blended learning in higher education settings. The findings indicated that a well-designed blended learning approach can lead to improved student outcomes, including reduced dropout rates and enhanced exam performance. Students' positive perceptions of blended learning activities were associated with better academic results, emphasizing the importance of considering both objective and subjective measures in evaluating the impact of educational interventions. The study contributes valuable insights into the benefits of blended learning and underscores the need for further research to explore its potential in enhancing teaching and learning practices.

An article by Boulos and Wheeler on the impact of Web 2.0 social technologies on the educational process in the healthcare sector, with more than 700 citations, shows how technologies can facilitate access to knowledge and improve collaboration between specialists [35]. Research by Huang et al., "Investigating learners' attitudes towards virtual reality learning environments" [36], as well as López-Pérez et al., "Blended learning in higher education" [37], with more than 500 citations each, opens up new perspectives on the use of virtual reality and blended learning to increase motivation and effectiveness of the educational process. These works together emphasize the importance of integrating innovative approaches into the educational environment. They show how new technologies can improve the quality of education and make it more

accessible and effective for students and teachers. Such research contributes to the development of educational programs focused on practical relevance and compliance with modern health and engineering requirements. The conclusions from these articles are important for the further development of educational strategies and teaching methodologies, including the integration of digital tools and innovative educational practices.

During the analysis of publications on the topic of innovations in teaching indexed in the Scopus database for the period from 2000 to 2023, key trends and significant areas were identified. Research has shown the active introduction of digital technologies into the educational process, which contributes to improving interaction between students and teachers and improving the quality of education. The use of electronic health records, the integration of social technologies and virtual reality into curricula, as well as blended learning, acts as powerful tools to achieve higher adaptability and student engagement. All this reflects a wide range of opportunities for updating and improving educational methods, confirming the need to continue studying and introducing innovative approaches into the educational process.

The results confirmed the importance of educational innovations in adapting curricula to modern technological and social changes, which is emphasized in the works of researchers such as Nabi et al. [38]. They found that entrepreneurship education has a significant impact on the development of skills, the creation of startups, and long-term positive changes in individuals and business structures. Such conclusions correlate with our observations on how innovations in educational methods contribute to improving the quality of vocational training. In addition, the research of Mikheeva and Pankova [39] demonstrates the importance of integrating technical and technological solutions into vocational education, which is also reflected in our analysis of the use of information technology to improve the educational process.The multifaceted nature of innovation in education is confirmed by the work of Ciascai et al. [40], who consider innovations through the prism of psychopedagogical, scientific, methodological, and infrastructural changes. These aspects have a significant impact on educational practice and provide opportunities for systemic reforms. Special attention is paid to the role of educational institutions in promoting innovation, which is confirmed in the research of Kuchynska et al. [41], pointing to the key role of universities and colleges in the processes of updating educational systems. Also, Kuratko [42] notes a significant interest in the development of entrepreneurial skills, emphasizing the current trend in education aimed at preparing students for more active and practical application of knowledge in the real economic environment.

The implications of our research are significant for the entire educational field, highlighting the critical importance of innovation in learning to adapt to a rapidly changing world. The analysis of trends and innovations in educational practice has shown that the use of new technologies and techniques not only improves the quality of education but also makes the learning process more flexible and accessible. As a result, educational institutions that actively integrate innovative approaches demonstrate the best results in student engagement and academic success. These results confirm the need to continue research in this area and serve as the basis for the development of policies and strategies at the level of educational institutions and state educational authorities.

Based on the data obtained, we recommend that researchers and teaching teams focus on developing and testing new educational tools and programs that could contribute to improving education and training. It is also important to increase interaction between educational institutions and the business sector to ensure the relevance of training courses and programs. The development of international cooperation and knowledge exchange between countries will help spread best practices and innovative approaches in education. For further study, we suggest considering the following research questions:

1) Which specific technological innovations are most effective in the educational process?

2) How do changes in educational methods affect the career success of graduates?

3) What factors contribute to the successful implementation of innovations in various cultural and economic contexts?

4) How to ensure sustainable financing of innovative educational projects?

5) What strategies can help to increase student motivation and engagement through innovative technologies?

6) Which approaches are most effective for teaching in a multicultural environment?

7) How to evaluate the effectiveness of innovative educational programs?

8) What are the risks associated with the introduction of innovations in the educational process?

9) How to maintain a constant updating of educational content in educational institutions?

10) What measures can help teachers better adapt to new technologies?

11) What legal and ethical aspects should be taken into account when integrating innovations into education?

12) Which international partnerships are most effective for promoting innovation in education?

In conclusion, it can be noted that the introduction of innovations in the educational process remains a key factor in adapting educational systems to modern challenges. The results of the study confirm that progressive educational practices and technologies contribute not only to improving the quality of education, but also ensure a deeper integration of academic and professional communities into the processes of continuing education and vocational training. The effectiveness and relevance of such approaches as interdisciplinary interaction, the use of new information technologies, and individual approach strategies in education, identified during the analysis, emphasize the need for further research of these aspects to enhance the contribution of education to the social and economic development of society.

Conclusions

Concluding our research, it is worth emphasizing that the analysis of publications in the Scopus database has revealed significant trends in teaching innovation. We have found that the active introduction of new technologies and methodological approaches contributes to improving the quality of education and makes the learning process more adaptive and responsive to modern challenges. The attention to the diversity of didactic models and the integration of digital technologies reflects the growing need to train students who are able to function effectively in a dynamically changing world.

The great interest in interdisciplinary research underlines the importance of synergy of various scientific fields for the development of comprehensive educational solutions. This also indicates the need to support such projects at the level of educational institutions and public policy. The integration of practical and theoretical knowledge aimed at the development of key competencies seems to be the main direction for achieving higher educational standards and training qualified specialists.

Based on the results of our research, it can be argued that the further development of educational innovations will contribute not only to improving the quality of education, but also to ensuring deeper integration of graduates into professional fields, which in turn contributes to social and economic progress. In conclusion, our analysis of publications confirms the importance of innovations in the field of education as the most important factor in the training of a new generation of specialists capable of effectively solving the future challenges of the global community.

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С.Ж. Жанжигитов

Оқытудағы инновациялар: Scopus дерекқорындағы ғылыми жарияланымдарды талдау

Мақалада білім берудегі инновациялық технологиялармен байланысты ғылыми жұмыстар талданады. 2000 жылдан 2023 жылға дейін Scopus дерекқорындағы жарияланымдар санының артуы ұсынылған тақырыптың өзектілігін растайды. Зерттеудің мақсаты — Scopus дерекқорынан «инновация» және «оқыту» кілт сөздері бойынша анықталған 6653 ғылыми мақаланы жүйелі шолу негізінде осы саладағы негізгі тенденциялар мен бағыттарды анықтау. Зерттеу әдістемесі ғылыми жарияланымдардың өсу динамикасын, сондай-ақ географиялық және салалық үлестіруді көрсету үшін SPSS көмегімен деректерді жинау мен талдауды қамтиды. Теориялық маңыздылығы оқытудағы инновациялық технологиялар туралы білімді кеңейту және осы саланың көпсалалы сипатын қалыптастыру. Зерттеу нәтижесінде анықталған жарияланымдар санының 2000 жылғы 136 жұмыстан 2023 жылы 3255-ке дейін өсуі әлемдік кеңістіктегі білім беру саласындағы инновациялық технологияларға ғылыми қызығушылықтың артқанын көрсетеді.

Кілт сөздер: инновация, оқыту, Scopus, білім беру технологиялары, жүйелі шолу, статистикалық талдау, SPSS, жаһандық білім.

С.Ж. Жанжигитов

Инновации в преподавании: анализ научных публикаций в базе данных Scopus

В статье проанализированы научные работы, связанные с инновационными технологиями в образовании. Увеличение количества публикаций в базе данных Scopus с 2000 по 2023 годы подтвердило актуальность предложенной темы. Цель исследования — определить основные тенденции и направления в этой области на основе систематического обзора 6653 научных статей, установленных по ключевым словам «инновация» и «обучение» из базы данных Scopus. Методика исследования включает сбор и анализ данных с помощью SPSS для показа динамики роста научных публикаций, а также географического и отраслевого распределения. Теоретическая значимость заключается в расширении знаний об инновационных технологиях в образовании и формировании мультидисциплинарного характера этой области. Рост количества выявленных в результате исследования публикаций со 136 работ в 2000 г. до 3255 в 2023 г. свидетельствует о возросшем научном интересе к инновационным технологиям в сфере образования в мировом пространстве.

Ключевые слова: инновация, преподавание, Scopus, образовательные технологии, систематический обзор, статистический анализ, SPSS, глобальное образование.

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