

# The Development of Learning Innovations in Primary Schools Over a Decade: A Bibliometric Analysis

Wildan Nuril Ahmad Fauzi<sup>1</sup>, Iqbal Saffariz Santosa<sup>2</sup>, Yuli Setiawati<sup>3</sup>

<sup>1</sup>Student of Doctoral Program in Basic Education, FIPP, Yogyakarta State University. <sup>2</sup>Student of Doctoral Program in Leadership and Policy Innovation, Gadjah Mada University, <sup>3</sup>State Islamic University Sunan Kalijaga Yogyakarta

## Corresponding author

<sup>1</sup>wildannuril.2023@student.uny.ac.id, <sup>2</sup>iqbalsaffarizsantosa@mail.ugm.ac.id, <sup>3</sup>yulisetiawati819@gmail.com

**Abstract:** This study aims to comprehensively analyze the development of learning innovations in primary schools over the past decade (2014-2024) through a bibliometric approach. Using data retrieved from the Scopus database, this study explores publication patterns by year, country, affiliation, and document type, as well as identifying main topics, co-occurrence of keywords, and collaboration patterns between authors and institutions. The analysis showed that while the number of publications remained relatively stable, the relevance and impact of research in educational innovation remained significant, with high average citations reflecting its academic contribution. The main themes expressed include the dominance of “educational technology,” “teacher training,” and “collaborative learning,” emphasizing the importance of technology integration and improving teacher competencies in the effort to advance the quality of education. While progress has been made, challenges such as disparities in access to technology and variations in teachers' digital competencies remain obstacles to be overcome. The research emphasizes the need to strengthen international collaboration, develop more in-depth studies on the relationship between teacher training and technology adoption, and explore under-researched topics such as “gamification” and “heritage education” to enrich learning approaches. This review provides a comprehensive view of the dynamics of educational innovation and presents strategic recommendations for future educational policy and practice.

**Keywords:** Learning Innovation, Educational Technology, Teacher Training, Bibliometrics, Primary Schools.

## Introduction

The 21st century brings significant changes in various fields, especially the field of education, which is required to adapt quickly to respond to the challenges of globalization and technological advances. The UNESCO report (2020) highlights that the global education system urgently needs to improve access and inclusiveness and ensure education can prepare students with relevant skills to contribute to a digitized and knowledge society. In this context, traditional education systems, which tend to prioritize the passive transmission of knowledge, are increasingly irrelevant in preparing young people who are required to adapt to rapid and unpredictable changes (Mehta & Datnow, 2020). Without a fundamental shift in educational approaches, students will find it difficult to

develop the critical skills required in a complex and dynamic environment.

The importance of educational innovation becomes imperative as the need for renewed learning practices and curriculum development that is more responsive to 21st century skills demands increases. Rogers (2003) defines innovation as an idea, practice or object that is perceived as new and brings significant change to those who adopt it. Innovation in education includes a variety of new approaches, such as the application of digital technologies, the use of interactive pedagogical methods, and curriculum redesigns that focus on mastering critical thinking, collaboration and digital literacy skills (Garay & Quintana, 2019; van Laar et al., 2020). These innovations not only improve the quality of learning outcomes, but also enable students to

engage more actively in the learning process, thus being able to compete in an increasingly complex life.

However, educational innovations do not happen in a vacuum; their success depends on a variety of external factors, including institutional support, technological infrastructure and the capacity of educators. A key challenge in implementing learning innovations is the technology access gap, where variations in educational infrastructure and resources can create disparities in learning quality between regions (Bond et al., 2019; Lavidas et al., 2022). Moreover, teachers' digital competencies add to the complexity, as educators not only need to master the technology itself but also integrate technology effectively in learning practices (Howard et al., 2021; Trust & Whalen, 2021). Therefore, educational innovation requires a holistic approach that focuses not only on technology, but also on changing the educational culture that supports the adoption of new practices.

Bibliometric studies have become an important tool for understanding the dynamics and development of research in the field of educational innovation, particularly in identifying trends, collaboration patterns and the impact of research that has developed over the past decade. Using bibliometric analysis, researchers can identify shifts in research focus, evaluate the contributions of various scholarly actors, and map international and interdisciplinary collaborations that contribute to the field (Scott, 2008; Van de Ven & Hargrave, 2004). This approach enables the identification of under-explored areas and provides deep insights into the evolution of the concept of educational innovation in a broader context.

The implementation of learning innovations is crucial in basic education to form the foundation of students' learning skills and attitudes. According to the Merdeka Curriculum implemented in Indonesia, innovations focusing on 21st century skills, such as critical thinking, collaboration, and mastery of digital technology, should be integrated into early learning to ensure students' readiness to face an uncertain future (Lubis et al., 2023; Sufyadi et al., 2021). Technology can play an important role in enriching learning experiences, increasing

motivation, and facilitating access to a wider range of information and learning resources (Al Haddar et al., 2023; Dweikat, 2016). However, technology integration must also be accompanied by efforts to improve teacher competencies and provide adequate infrastructure, so as not to increase the education gap.

This study aims to analyze the development of learning innovations in primary schools during the period 2014-2024 with a bibliometric approach, to:

1. Map the distribution of publications by year, country, affiliation and document type, to understand global trends in learning innovation.
2. Identify dominant research topics, co-occurrence of key terms, and patterns of collaboration between authors and institutions, to illustrate the dynamics of research in this field.
3. Uncover gaps in the existing literature and formulate research areas that require further attention, particularly those relevant to improving the quality and effectiveness of learning in basic education.

The research objectives were mapped in order to answer the following research questions:

1. How have patterns of publication and collaboration in learning innovation in primary schools evolved over the past decade?
2. What topics and issues have been the main focus of research into educational innovations, and how have they contributed to improving the quality of learning?
3. To what extent has the adoption of new learning technologies and methods been systematically applied and evaluated in the context of primary education?

This research is expected to comprehensively reveal the dynamics of learning innovation research, offer relevant recommendations for education policy, and provide practical guidance for the implementation of innovative strategies that can be adapted to educational needs in various countries, including their potential application in the Indonesian educational context.

## Materials and Methods

This study uses bibliometric analysis, a quantitative methodology widely recognized among researchers for its ability to handle large amounts of literature data and produce significant research effects (Aria & Cuccurullo, 2017; Roemer & Borchardt, 2015). This method aims to classify published material on a research topic by using certain criteria to examine and classify articles, as well as identify publication patterns, research trends, and author contributions (Durán Sánchez et al., 2015; Martínez-López et al., 2018).

### Literature Source And Data Colection

The bibliographic data for this study is taken from the Scopus database, which is one of the largest and most comprehensive peer-reviewed literature databases (Niknejad et al., 2021). The document search string consists of a combination of compound keywords combined with the AND operator. The search field contains the keywords “Educational Innovation” OR “Teaching Innovation” AND “Primary Education”. The initial query without filtering produced 117 document results. The search and retrieval of data was conducted on October 9, 2024. These results were then filtered to eliminate some irrelevant items based on the inclusion and exclusion criteria. The data was then analyzed using bibliometric software based on the R package, which allows dynamic visualization and detailed evaluation of the research subject (Aria & Cuccurullo, 2017). This technique is used to map relationships between study topics, assess the influence of research activities, and illustrate the literature's thematic structure and growth trends (Blanco-Mesa et al., 2017; Ye et al., 2020). As the database used was limited to Scopus, the authors do not claim that an exhaustive list of data has been obtained. The possibility of missing data from other databases, such as Web of Science, PubMed, ERIC, and so on, can be minimized if there is a compatible formatting standard that allows merging data generated from independent databases. Unfortunately, the bibliometric R package software used in this study does not currently support such ambitions.

### Data Extraction, Loading, and Conversion

In total, 31 data were collected after being screened based on inclusion and exclusion criteria for subsequent export and analysis (Table 1). The Scopus platform was chosen because it allows the export of up to 2000 data simultaneously, unlike Web of Science (WoS), where a maximum of 500 data can be exported per time. In addition, Scopus also allows researchers to export data to different file formats such as BibTeX, CSV, Plain Text, RIS format, etc. In this study, the data was exported in CSV format, which allows it to be imported into biblioshiny for bibliometric tools (Aria & Cuccurullo, 2017).

## Results and Discussion

This section presents the main findings from the analysis of scientific publications in the field of learning innovation for the period 2014 to 2024. Each result is further discussed to assess its contribution to the development of the field and its implications for future learning innovations.

### Results

#### Main information

Table 1. Main information

Description	Results
<b>MAIN INFORMATION ABOUT DATA</b>	
Timespan	2014:2024
Sources (Journals, Books, etc)	25
Documents	31
Annual Growth Rate %	0
Document Average Age	4,32
Average citations per doc	29,74
References	1393
<b>DOCUMENT CONTENTS</b>	
Keywords Plus (ID)	96
Author's Keywords (DE)	117
<b>AUTHORS</b>	

Authors	85
Authors of single-authored docs	4
<b>AUTHORS COLLABORATION</b>	
Single-authored docs	4
Co-Authors per Doc	2,81
International co-authorships %	0
<b>DOCUMENT TYPES</b>	
article	27
conference paper	4

The data presented provides a comprehensive overview of scientific production in the field of learning innovation over the period 2014 to 2024. During this time, 31 documents were published in 25 different sources, reflecting the diversity of research activities. An annual growth rate of 0% indicates stability in the number of publications, while the average document age of 4.32 years suggests that most publications result from recent research. With an average citation per document of 29.74, it can be inferred that these documents significantly impact the academic community, with many researchers referring to them. There were a total of 1393 references used in these publications, as well as 96 Plus keywords and 117 author keywords, demonstrating the depth and variety of the research focus. Collaboration among 85 authors, with an average of 2.81 co-authors per document, reflects the importance of cooperation in producing high-quality research. Most documents were published in article format, with 27 articles and 4 conference papers, which provides high visibility and supports a more comprehensive knowledge exchange among researchers. Overall, this information illustrates the dynamism and significant contributions within the field of educational innovation, signaling that this research is constantly evolving to meet changing educational needs.

### Most Global Cited Documents

Table 2. Most Global Cited Documents

Paper	DOI	Total Citations	TC per Year	Normalized TC
Román-González et al., 2017, Computers in Human Behavior	10.1016/j.chb.2016.08.047	508	63,50	2,85
Cózar-Gutiérrez & Sáez-López, 2016 International Journal of Educational Technology in Higer Education	10.1186/s41239-016-0003-4	130	14,44	1,36
Quinn & Owen, 2016, Australian Journal of Education	10.1177/0004944115626402	61	6,78	0,64
Fernández-Batanero et al., 2019, British Journal of Educational Technology	10.1111/bjet.12675	43	7,17	3,19
Pinto-Llorente et al., 2018, Quality & Quality	10.1007/s11135-017-0509-4	34	4,86	1,00
Triviño-Cabrera et al., 2021, Sustainability	10.3390/su13031128	23	5,75	1,77
Bel-Martínez, 2017, Revista de Education	10.4438/1988-592X-RE-2017-377-354	18	2,25	0,10
Ruys et al., 2014, Teacher and Teaching	10.1080/13540602.2014.885705	16	1,45	1,88
Molina-Torres & Ortiz-Urbano, 2020) Sustainability	10.3390/su12219043	12	2,40	1,29
Martínez-Pérez et al., 2022, Frontiers in Education	10.3389/feduc.2022.846998	11	3,67	2,50

The table showing the most cited documents in the field of educational innovation reveals the significant contribution of various studies in this domain. The article written by Román-González et al., (2017) in Computers in Human Behavior leads with a total of 508 citations and an average of 63.50 citations per year, signifying the great influence of this research in the context of technological applications in education. This work was followed by Cózar-Gutiérrez & Sáez-López (2016), who focused on innovation in higher education in their publication in the International Journal of

Educational Technology in Higher Education, which recorded 130 citations and 14.44 citations per year, indicating that discussions regarding innovation at different levels of education remain relevant. In addition, articles written by Quinn & Owen (2016) and Fernández-Batanero et al., (2019) demonstrate the importance of local context in educational innovation and the complementary development of theory and practice, with a total of 61 and 43 citations respectively. Research by Triviño-Cabrera et al., (2021) and Bel-Martínez (2017) also emphasizes the importance of sustainability in education, reflecting the relevance of this aspect in teaching innovation. Overall, this analysis shows not only the quantitative contribution but also the significant qualitative impact of the most cited literature on global educational practices.

### Country Scientific Production



Gambar 1. Country Scientific Production

Analysis of scientific production by country shows significant variation in research contributions to educational innovation and primary education. Each country plays a role in shaping this research landscape, with some countries dominating publications in the fields of “educational innovation” and “primary education.” Countries with robust education systems and research support tend to produce a higher number of publications, reflecting a commitment to developing new methodologies and technologies in education. In addition, international cooperation between countries is also evident, with some publications involving collaboration between researchers from different countries. This not only improves the quality of research but also broadens perspectives on effective educational innovations. While some countries excel in terms of the quantity of publications, it is essential to also consider the

quality and impact of the research on educational practice in the field. By understanding patterns of scientific production by country, we can identify emerging trends, as well as areas that still require attention and further development in the context of global educational innovation.

### Co-occurrence Network

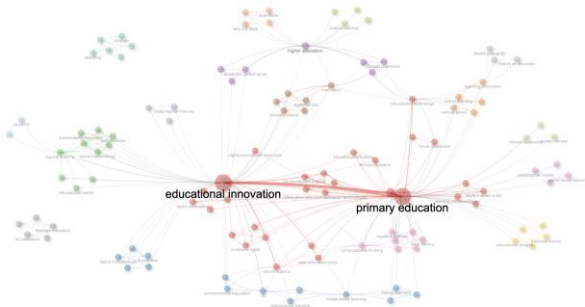


Gambar 2. Co-occurrence Network

The co-occurrence network shown provides a deep insight into the relationship between keywords in the context of “educational innovation” and “primary education.” In this network, “primary education” and “educational innovation” are at the center, indicating that these two themes are at the core of the analyzed literature, with close links to each other. The network also shows connections with different keywords, such as “educational technology,” “secondary education,” and “teacher training,” indicating that educational innovation at the primary level not only involves new teaching methods, but also requires the use of educational technology and appropriate training for teachers to implement these innovative approaches. The presence of the keyword “natural science” highlights the importance of innovation in science teaching, suggesting that changes in the curriculum should include new ways of delivering content. In addition, the emphasis on “educational technology” in this network reflects that the integration of information and communication technology (ICT) is critical to improving student interaction and engagement in learning. This network also indicates further research opportunities regarding the relationship between the various themes, particularly between “teacher training” and “educational technology,” to understand how teacher training can influence the use of technology in the classroom. Overall, this co-occurrence network reflects the complexity of

relationships that exist in educational innovation at the primary level, emphasizing the need for a multidimensional and collaborative approach to achieve optimal educational outcomes.

### Thematic Map

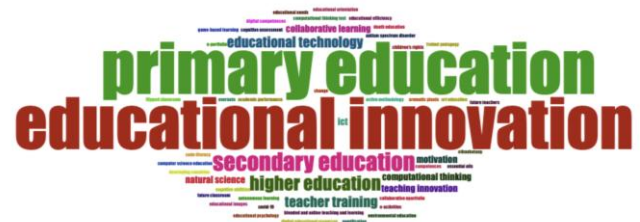


Gambar 3. Thematic map

The thematic map shows the close relationship between “educational innovation” and “primary education,” reflecting the importance of innovation in the context of primary education. The intense interaction between these two themes indicates that any changes in innovation practices can significantly impact students' learning experiences at this level. The map also highlights several relevant sub-themes, such as “educational technology,” “teaching innovation,” and “digital educational resources,” which show that educational innovation involves not only new teaching methods but also the integration of digital technologies to improve engagement and learning outcomes. There is excellent attention to aspects such as “teacher training” and “motivational factors,” indicating that teacher preparation and development, as well as student motivation, are vital in implementing effective innovations. In addition, a variety of themes such as “collaborative learning,” “active methodology,” and “sustainability education” illustrate the trend towards more active and collaborative approaches to learning, as well as an awareness of the importance of integrating sustainability values. The influence of the COVID-19 pandemic is visible in related themes, highlighting the changes needed in educational practices to meet new challenges, such as distance learning. Finally, the map identifies opportunities for further research in less explored areas, such as “heritage education” and “gamification,” which can provide new insights

into supporting learning innovation in primary schools. Overall, this thematic map reflects the complexity and dynamism of educational innovations that need to be further researched to improve the quality of education in the modern era.

### WordCloud



Gambar 4. wordCloud

The word cloud provides a clear visual representation of the themes and keywords that appear most frequently in the context of “educational innovation” and “primary education.” With their dominant size, these two terms emphasize the importance of educational innovation at the primary level as a significant area of research. In addition, the presence of the keyword “secondary education” indicates that attention to innovation is not only limited to primary education but also extends to secondary education, reflecting continuity in innovative approaches in the education system. Educational technology, represented by the terms “educational technology” and “ICT,” also emerged as a key element, emphasizing the role of digital tools in improving teaching methods and student engagement. Innovative teaching methods, such as “teaching innovation,” “active methodology,” and “collaborative learning,” indicate that educational innovation involves significant changes in teaching strategies, promoting higher student engagement. In addition, keywords related to skills and competencies, such as “competencies,” “code literacy,” and “computational thinking,” indicate a focus on developing 21st-century skills that are critical to preparing students for future challenges. The word map also reflects responses to global challenges, such as “covid-19,” indicating that educational innovation serves as a response to fundamental changes in the social and economic context. Overall, this word cloud highlights the complexity and interconnectedness of educational

innovation themes, which are constantly evolving to meet dynamic educational needs and support student development in the modern era.

## Discussion

### Publication and Collaboration Patterns in Learning Innovation in Primary Schools

Over the period 2014-2024, bibliometric analysis shows that publication patterns in the area of learning innovations in primary schools have remained stable with no significant increase in the number of annual publications. While this stability indicates consistent academic interest in the topic, there is potential to increase the quantity of research through increased cross-country and cross-institutional collaboration. Currently, international collaborations in the analyzed literature show limited results, with no firm evidence of increased research networks between countries. This may be due to challenges in harmonizing education policies and different local contexts in each country. Researchers can encourage cross-border collaboration to enrich research perspectives and expand the impact of studies through more coordinated cooperation. Strengthening collaborative networks among researchers can also be vital in overcoming local biases and promoting innovative practices in different regions.

### Key Topics and Issues in Research Related to Educational Innovation

The keyword co-occurrence analysis and thematic map revealed some of the main topics that are the focus of research in learning innovation in primary schools. The most dominant themes are “educational innovation” and “primary education,” which are directly linked to other sub-themes such as “educational technology,” “teacher training,” and “collaborative learning.” This suggests that the main issues receiving attention are the application of educational technology, improving teacher competencies, and developing interactive and collaborative learning approaches. Educational technology such as ICT and digital tools are often identified as a means to enhance student engagement and learning quality. At the same time, teacher training is considered essential to ensure that educators have adequate skills to

implement new learning methods. In addition, topics such as “sustainability education” and “active methodology” indicate a trend towards more contextualized and value-based learning, with a focus on sustainability and the application of active methodologies that encourage direct student engagement. While these themes have started to gain attention, in-depth research is still needed to understand the complex relationships between technology, pedagogy and learning outcomes.

### Adoption of New Learning Technologies and Methods in Basic Education

The adoption of technology in primary education has shown significant growth, with a strong emphasis on the use of digital tools to enhance teaching methods. Analysis shows that “educational technology” often appears as a key topic in publications, reflecting ongoing efforts to integrate information and communication technology (ICT) into the primary school curriculum. However, the successful adoption of technology relies heavily on teacher readiness, which is the focus of the theme “teacher training.” Studies show that adequate training for teachers in the use of digital technology is necessary to ensure effective implementation in the classroom. In addition, new learning methodologies such as “collaborative learning” and “gamification” have been adopted as part of innovation strategies to improve student motivation and learning outcomes. Nonetheless, challenges such as disparities in technology access and variability in teachers' digital competencies are still crucial barriers that need to be overcome for technology adoption to have a broader and more equitable impact.

## Conclusions

The analysis shows that although the number of publications on this topic is stable, the topic of learning innovation continues to be relevant and has a significant academic impact. The main themes identified include “educational technology,” “teacher training,” and “collaborative learning,” highlighting the importance of

technology integration and teacher capacity building through training to improve learning effectiveness. Despite progress and development in technology adoption, gaps in teachers' digital access and competencies remain and require special attention for innovations to be implemented equitably and optimally.

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