JPPIPA 12(2) (2026)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Bibliometric Analysis of Microlearning Research Results in the World of Education

Diana Susanti[1,2], Shakinaz Desa[1*]

[1]Fakulti Sains dan Matematik, Universiti Pendidikan Sultan Idris (UPSI), Tanjong Malim, Perak, Malaysia
[2]Fakultas Sains dan Teknologi, Universitas PGRI Sumatera Barat, Padang, Sumatera Barat, Indonesia

Received: November 06, 2025
Revised: January 05, 2026
Accepted: February 25, 2026
Published: February 28, 2026

Corresponding Author:
Shakinaz Desa
shakinaz@fsmt.upsi.edu.my

DOI: 10.29303/jppipa.v12i2.13372

Abstract: The rapid development of information and communication technology (ICT) has accelerated the adoption of microlearning in education; however, a comprehensive overview of its research trends remains limited. This study aims to examine the development of microlearning research in education over the past decade, with particular attention to publication growth, dominant subject areas, and leading contributing countries. A bibliometric approach was employed to analyze 201 documents indexed in the Scopus database, published between 2016 and 2025. Literature retrieval was conducted using the keywords "microlearning," "micro-learning," and "education." Inclusion criteria covered English-language journal articles and conference proceedings focusing on microlearning applications in educational contexts, while unrelated documents and incomplete records were excluded. Data were analyzed using Bibliometrix (Biblioshiny) and VOSviewer to identify publication trends, subject area distribution, country contributions, and network structures through co-authorship, keyword co-occurrence, and citation analyses. The findings reveal a significant increase in publications, particularly between 2020 and 2025, with strong representation in social sciences, psychology, economics, and politics, surpassing computer science and information technology. The United States, Germany, and China emerged as the most influential contributors. Overall, microlearning demonstrates strong potential to enhance learning outcomes through flexible, concise, and technology-supported instructional approaches.

Keywords: Bibliometric Analysis, Education, Information and communication technology (ICT), and Microlearning.

Introduction

Advances in education have increasingly influenced and been influenced by various scientific fields, particularly information and communication technology, which continues to develop rapidly. Alongside this progress, other disciplines such as learning sciences, biology, data analysis, and economics have also experienced significant development (Hsu & Lin, 2020; Mahapatra, 2020; Pozo-Rico et al., 2020; Vermunt et al., 2019). These dynamics reflect universal scientific values, including innovation, efficiency, and interdisciplinary integration, as education adapts to global technological change and the growing demand for flexible and effective learning systems.

One prominent transformation in digital education is learning delivered in short, focused content, commonly referred to as microlearning, which enhances accessibility and usability for learners (Astiwardhani & Sobandi, 2024; Monib et al., 2025). The widespread use of digital and smart devices among students and teachers has intensified the need for rapidly delivered information. Microlearning addresses this demand by prioritizing time efficiency and flexibility through concise learning resources that can be accessed anytime and anywhere (Cronin & Durham, 2024; Silva et al., 2025; Zrnic, 2024).

Empirical studies indicate that microlearning contributes to improved learning outcomes, increased motivation, enhanced skills, higher learning

How to Cite:
Susanti, D., & Desa, S. (2026). Bibliometric Analysis of Microlearning Research Results in the World of Education. *Jurnal Penelitian Pendidikan IPA*, *12*(2), 235-245. https://doi.org/10.29303/jppipa.v12i2.13372

engagement, and stronger knowledge retention; however, overly complex material is less suitable for microlearning due to its limited capacity for detailed explanation, although it may still be applicable when carefully designed (Al-Zahrani, 2024; Fitria, 2022; Hurtado et al., 2024; Monib et al., 2024; Sankaranarayanan et al., 2024; Zamata-Aguirre et al., 2023).

The popularity of microlearning is closely linked to modern lifestyles that emphasize speed and efficiency (Nurul Fitriah Alias & Rafiza Abdul Razak, 2023; Yeoh, 2022), offering effective learning experiences for individuals with limited time (H. Choudhary & Pandita, 2023; Nurul Fitriah Alias & Rafiza Abdul Razak, 2023). Microlearning has been shown to mitigate two persistent educational challenges: insufficient time for lengthy instruction and reduced comprehension during prolonged learning sessions, as content is delivered through quizzes, infographics, or short videos that are easier to process (Al Husaeni et al., 2022; Mohammed et al., 2018; Monib et al., 2024; Teichgräber et al., 2023).

Numerous studies confirm its effectiveness in enhancing learning efficiency and student retention (H. Choudhary & Pandita, 2023; Garad et al., 2023; Hsu & Lin, 2020; Mahapatra, 2020; Mohammed et al., 2018; Nurul Fitriah Alias & Rafiza Abdul Razak, 2024; Pozo-Rico et al., 2020; Senandheera et al., 2024; Vermunt et al., 2019; Yao & Ho, 2024; Zhang et al., 2019). Nevertheless, challenges remain regarding curriculum integration, resource reliability, and technological infrastructure, particularly in formal education contexts that require structured and comprehensive learning materials (Wright & Schlegel, 2024).

Beyond formal education, microlearning has expanded into professional training and lifelong learning, demonstrating effectiveness in improving workplace performance in technology-driven sectors such as manufacturing, banking, and information technology (P. Choudhary & Potdar, 2024; Emerson & Berge, 2018; Leeder, 2022; Yu et al., 2024). Given its expanding application, understanding the evolution of microlearning research is essential, particularly through bibliometric analysis, which enables systematic mapping of research trends, key contributors, institutional influence, and thematic development (Bernholt et al., 2022; Donthu et al., 2021; Ferdaus et al., 2024; Lazarides et al., 2023; Oliveira et al., 2019; Yun, 2020).

Method

Time and Location of Research

This study was conducted using articles indexed in the Scopus database. Data collection was carried out on April 14, 2025, at 15:48 WIB, during which a total of 201 document articles were accessed. The analyzed publications were published between 2016 and 2025, covering the last decade of research related to microlearning in science education. Scopus was selected as the data source due to its reputation as a comprehensive and reliable database for high-quality international scientific publications.

Research Methods

This study employs a bibliometric research method to systematically examine trends and developments in microlearning research within the context of science education. Bibliometric analysis enables the quantitative evaluation of scientific publications by mapping publication patterns, research themes, author contributions, and academic networks (Ellegaard, 2017; Hassan & Duarte, 2024; Monib et al., 2024). This approach allows for an objective assessment of the growth, structure, and intellectual landscape of microlearning research across multiple scientific disciplines.

Research Stages

Data Acquisition

The first stage involved retrieving relevant documents from the Scopus database using keywords related to microlearning. The search covered publications in social sciences, biochemistry, genetics and molecular biology, agricultural and biological sciences, immunology, and microbiology, all of which are associated with the implementation of microlearning. Only documents that met the predefined inclusion criteria were considered for further analysis.

Selection and Inclusion Criteri

Articles included in this study were published between 2016 and 2025 to ensure the relevance and sustainability of current research trends. The selected studies discuss the application of microlearning in science education or closely related topics. Only articles and conference proceedings indexed in Scopus, written in English, and published as final versions were included. In addition, articles had to be fully accessible or provide abstracts containing sufficient information regarding research objectives, methodology, and results.

Data Extraction

Following the selection process, data extraction was conducted to obtain essential information from each article. The extracted data included bibliographic details such as article title, author names, journal or proceedings title, year of publication, and journal volume. In addition, the main research topics and author-defined keywords were collected to support thematic and trend analyses.

Data Analysis

The final stage involved data analysis using R Studio and Biblioshiny software. Bibliometric techniques were applied to map authors, keywords, affiliations, and related publications. The analysis included examining the growth of microlearning publications over the past ten years, identifying dominant subject areas, exploring widely discussed research topics, and analyzing conceptual relationships between microlearning and cited references. Further analyses included keyword frequency analysis using WordCloud, keyword structure visualization through treemap analysis, identification of prolific authors and institutions, and analysis of countries contributing the most to microlearning research.

Figure 1. Research Flow

Result and Discussion

Development of microlearning publications in the last ten years.

Judging from the development data in the last ten years. Research related to microlearning until April 2025 has experienced very rapid development. The results of data analysis show that in 2020-2025, research on microlearning has progressed rapidly, as shown in the following diagram.

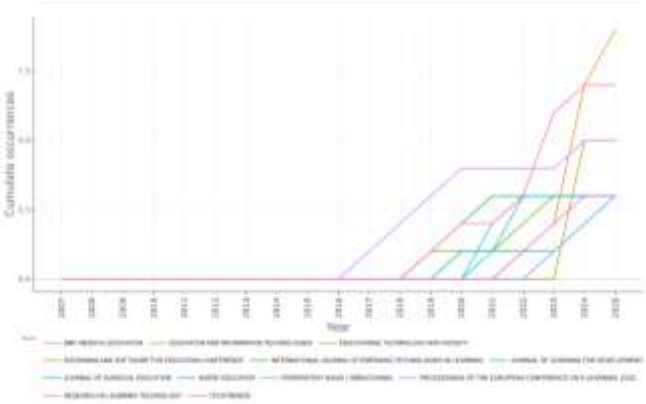

Figure 2. Microlearning Publication Trends from 2016 to 2025.

This graph shows cumulative data by year, with each line representing a different journal. The horizontal axis shows the years observed, while the vertical axis shows the total number of publications or "events" each year. This graph shows that in recent years, some journals have published more articles on microlearning. For example, between 2020 and 2025, educational technology and society (green line) and information technology and education (blue line) show significant increases. This reflects that over time, the topic of microlearning and educational technology has received increasing attention in academic research, especially with the development of digital technologies and the proliferation of online learning platforms. On the other hand, journals such as the Journal of Learning for Development (yellow line) and BMC Medical Education (red line) show more consistent but still increasing increases over time. These journals demonstrate a growing interest in the use of technology in medical education and developmental education. Other journals, such as the Journal of Surgical Education and TechTrends, have recorded more subdued spikes, but still show that awareness of technology in learning has increased, especially in professional education and technology. This graph shows the development of the topic of microlearning in the scientific literature over the years and identifies emerging trends across disciplines.

Determination of research subject areas (social sciences, biochemistry, genetics and molecular biology, agricultural and biological sciences, immunology, microbiology).

The subject areas of this study were limited to Social Sciences, Biochemistry, Genetics and molecular biology, Agricultural and Biological sciences, Immunology and microbiology, and the results of the data analysis showed several sciences related to these subject areas. The subject areas that use microlearning the most relate

to the social sciences. More detailed data can be seen in Figure 3.

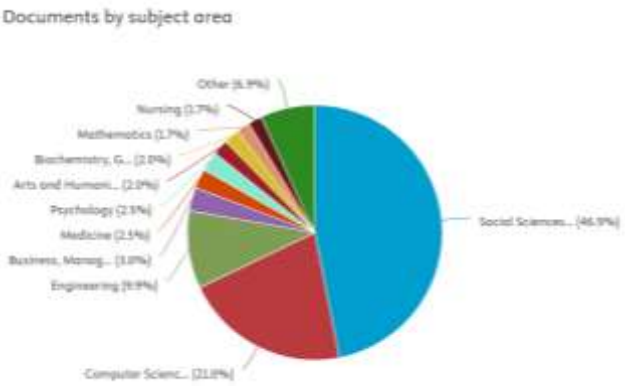

Figure 3. Document Data Based on Subject Area.

In this diagram, 190 documents are in social sciences (social sciences), occupying the highest position with 46.9%. This shows that the literature evaluated is dominated by social sciences such as sociology, psychology, economics, and political science. Computer science is in second place with a contribution of 21.0% and 85 documents. This shows that technology and topics related to computers, artificial intelligence, and data are very important in the research analyzed. Engineering (Engineering) contributed 9.9 percent, with 40 documents showing interest.

With 40 documents showing interest in engineering topics and the application of technology in various engineering fields, engineering contributed 9.9 percent. Business, management, and accounting also contributed 3.0 percent or twelve documents, psychology (psychology) with 2.5 percent, and medicine (doctors) with 2.5 percent. This shows that, although these topics do not dominate, they still contribute to the literature analyzed. The contributions from mathematics, biochemistry, genetics, molecular biology, and the arts and humanities were lower, at 1.7% and 2.0%, respectively. However, these lower contributions show how diverse the disciplines involved in the research are. Overall, this diagram clearly shows how the analyzed literature divides the subjects. While contributions from engineering and other sciences are more limited but still significant, the dominance of social sciences and computer science shows a strong focus on social and technological research.

Topic trends widely discussed in microlearning research.

The trend of topics discussed in microlearning research in the last ten years can be seen in the following graph.

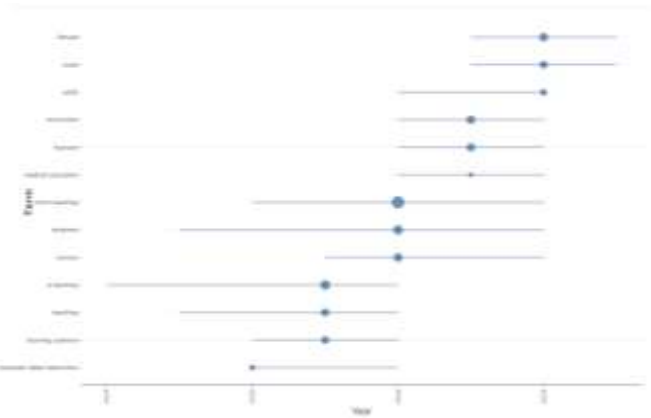

Figure 4. Trends in Microlearning Research Topics

The Trend Topics visualization above depicts the development of specific topics in the scientific literature from year to year. In this visualization, a horizontal bar chart represents the terms most discussed in the research. The X-axis defines time (year), and the Y-axis represents relevant topics or terms. In the chart, each dot indicates the frequency or relevance of the topic in a given year.

This chart shows several prominent topics: micro-learning, students, humans, and e-learning. The term micro-learning has increased significantly in recent years, with the dots moving further to the right in 2022 and 2023. This shows that microlearning has become one of the fastest-growing topics in the technology-based education literature. Likewise, the term student shows significant growth, indicating that research focusing on student-centered or personalized learning approaches is gaining interest.

In addition, topics such as teaching and learning systems also show consistent trends and have recently begun to grow. In contrast, medical education, curriculum, and computer-assisted learning have not experienced significant increases. However, significant educational literature still exists. Compared to newer topics such as microlearning, these terms are more stable.

Overall, this figure clearly shows how the various subjects in technology-based education have evolved. One of the main trends in education is the massive increase in new subjects such as microlearning and e-learning. The use of technology to support more flexible and practical learning is increasing.

Relationship between the concept of microlearning and references used in scientific publications.

The relationship between the references used in publications discussing microlearning in education and the various elements can be seen in the following figure.

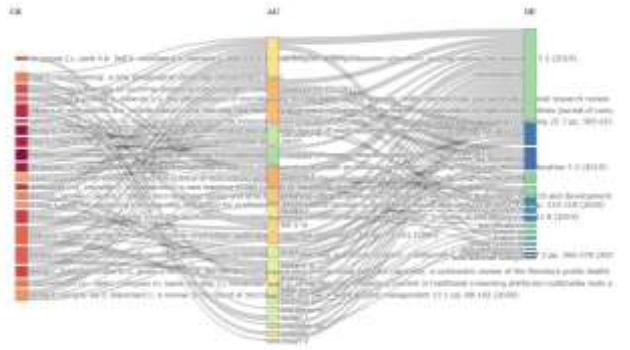

Figure 5. Relationship between Concepts Relevant to Microlearning and Scientific Articles.

This graph shows a clear relationship between the references in publications discussing microlearning in education and other related elements, such as authors and relevant research fields. Each color on the graph represents a different category, making it easier to distinguish between reference groups and topics of scientific literature. Many articles refer to journals related to professional education, such as health education and learning technology, as shown on the left side of the graph (CR—References Used). Microlearning and technology-based teaching methodologies are among the most frequently cited references. We can see the various authors who have contributed to this field in the middle of the graph (AU - Authors), with their names linked to works on technology-based education and microlearning. This demonstrates how important a role these writers play in influencing advances and trends in this industry.

As seen on the right side of the graph (DE - Document Type), a large number of documents address the usage and application of microlearning in science education as well as other professional disciplines, such as technical and health education.. The authors refer to various publications, including scientific journals and research reports, to show how vital this literature is to improving our understanding of microlearning and how it impacts learning. This graph provides an obvious picture of how research topics, authors, and types of documents relevant to using microlearning relate. It also shows how this data can create strategies for further research and development in technology-based education.

Analysis of terms or words related to microlearning research.

Terms or words about microlearning research are also highlighted in a study. Because of the terms used, researchers know how microlearning relates to other sciences. The data can be seen in the following image.

Figure 6. Microlearning Research WordCloud

This figure clearly shows that the word "micro-learning" has the largest size. This shows that this subject is very important in the research conducted. Microlearning is a learning method that divides learning materials into small and focused parts, which is very relevant to the trend of modern technology-based learning (Alias & Razak, 2023b; ALshammari, 2024; Marcelle & Brahim, 2023; Mercan et al., 2023; Silva et al., 2025b; Sozmen, 2022; Susilana et al., 2022). The word "e-learning" appears quite a lot in the WordCloud, indicating that electronic or distance learning is the main subject that is often discussed together with microlearning. The term "student" is used quite a lot, indicating that subjects related to student experience, interaction, and needs are the focus of this research. Concepts such as "learning systems" and "curriculum" appear significantly in this literature, indicating that the development of learning systems and curricula that can support micro-learning and e-learning is an important topic in this literature. In contrast, terms such as "learning", "human", and "women" appear in smaller numbers, but are still prominent, indicating that there is attention to teaching methods, the human aspect of learning, and research involving gender in education. In addition, terms such as "technical education" and "computer-assisted education" also appear, albeit in smaller numbers, indicating that more specific topics about technical education and the use of computer-assisted teaching are also receiving attention in this literature. All things considered, this WordCloud indicates that the focus of this study is on the application of technology in the classroom.

The primary focus of this research is on e-learning and microlearning, their effects on students, and the development of curricula and learning systems.

Treemap analysis to visualize the structure and relationships among keywords

According to the treemap data, "micro-learning" is the largest block, accounting for 12% of all phrases that

were recorded. The complete data can be seen in the Figure 7.

Figure 7. Microlearning Research TreeMap

Each block provides a complete overview of the most frequently occurring topics or keywords in the literature studied, and its size is proportional to the number of terms appearing in the dataset. Terms with smaller blocks indicate higher frequency, while terms with larger or broader blocks indicate higher frequency. According to this TreeMap, the term "micro-learning" is the largest block, accounting for 12% of all recorded terms. This shows that microlearning is the main subject of this study, indicating a great interest in technology-based learning approaches that divide the material into smaller, more concentrated parts. It is followed by students with 6%, which also shows that the element of students and their learning experiences is very important in this literature. Terms such as e-learning and teaching also have significant contributions, with 5% and 4% respectively, indicating an emphasis on e-learning methodologies and learning related to technology-based learning trends. In addition, this TreeMap shows variations in the topics covered, such as people, curriculum, and learning systems, which each contribute around 3-4%. This shows that many people are talking about developing learning systems and curricula that support microlearning and understanding the role of humans in learning. Other related terms, such as gamification, medical education, and social media, have a smaller meaning, but are still relevant to technology-based education. Although some terms make significant contributions, they still provide an overview of the various topics related to this education and technology literature. Overall, this TreeMap visualization provides a good overview of how the analyzed research divides important topics in technology-based education.

Analysis of affiliations and researchers who publish the most articles on microlearning

Affiliations that research microlearning can be seen in Figure 8.

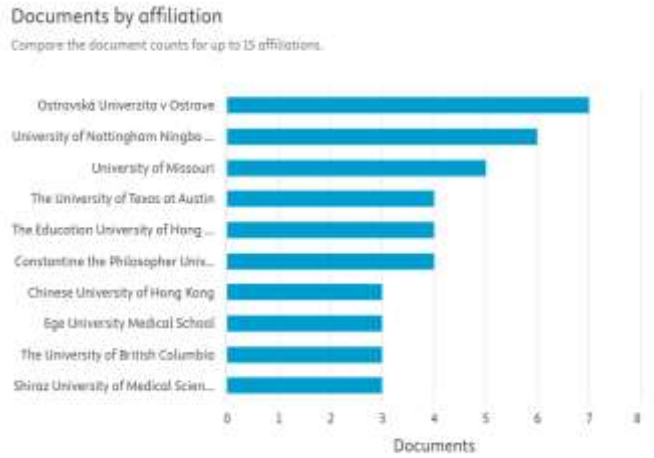

Figure 8. Affiliate Graph Examining Microlearning.

Authors	Articles	Articles Fractionalized
JAVORCIK T	7	3.46
TOWEY D	6	1.05
ZHANG Y	6	1.00
GILL AS	6	0.71
IRWIN D	4	0.67
LEE YM	4	2.53
POLASEK R	4	2.00
SANKARANARAYANAN R	4	1.53
SKALKA J	4	1.36
DRLIK M	3	0.88

Figure 9. Most relevant authors in microlearning research and a number of published articles.

Based on the uploaded images, information about the authors and affiliations involved in microlearning research shows that many people and institutions have made significant contributions. The most relevant authors in microlearning research are shown in the first table. Javorcik T is the author with the largest number of articles (7 articles) and the highest fractional article value (3.46), indicating his major contribution to the field. Other authors, such as Towey D, Zhang Y, and Gill AS, also played important roles, although they each published six articles. The fractional article value indicates how much they played a role in the broader article or in collaboration with other authors, and authors with higher values tend to have made greater contributions. In contrast, the second image shows the academic affiliations supporting microlearning research. Ostravská Univerzita v Ostravě is the institution with the most publications, with seven documents. Other universities active in this research include the University of Nottingham Ningbo China and the University of Missouri, which published 6 and 5 documents, respectively. This shows that international collaboration between leading universities from different countries is involved in microlearning research. Ostravská Univerzita v Ostravě acts as a leader in publications on this topic. Overall, these data show that individuals and institutions are driving microlearning research. These

organizations and individuals also have a great contribution to enriching the literature and the development of this field in educational contexts worldwide (Baena et al., 2023; Billert et al., 2022; Burguete et al., 2024; Cai et al., 2024; De Gafenco et al., 2023; Karlsen et al., 2023; Lee et al., 2023; Sankaranarayanan et al., 2024b).

Analysis of countries contributing the most research on microlearning

Furthermore, the distribution of researchers, if analyzed based on the researcher's country, can be seen in Figure 10.

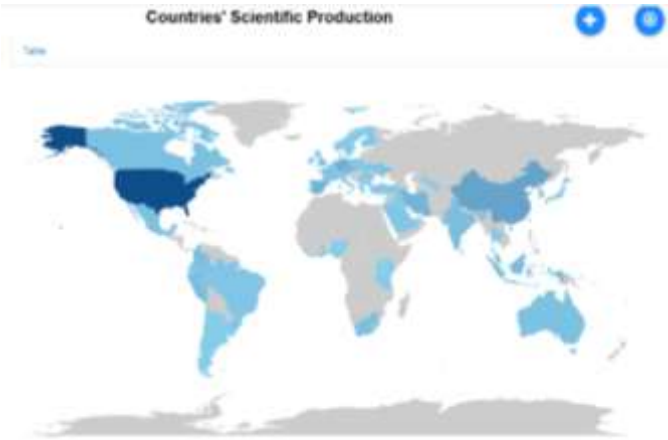

Figure 10. List of Countries Researching Microlearning

The data shows that the United States is the country with the highest scientific production, with 129 publications. China has 41 publications and Germany has 29. These countries contribute greatly to the development and dissemination of scientific knowledge around the world. Below them, there are other countries that also have a fairly high number of publications. For example, the Czech Republic has 28 publications, Spain has 26 publications, and Iran, Malaysia, and Peru have 24 publications each. These countries play an important role in scientific production, but not as big as the United States and China. Indonesia and Colombia also have 16 and 15 publications, respectively, which show significant contributions.

The subsequent table depicts the worldwide allocation of scientific contributions. Nations with fewer publications possess the potential for greater contributions in the future. Nations with a greater volume of publications also make substantial contributions to global technical and scientific progress. This information can be employed to assess opportunities for international scientific collaboration and examine the caliber of research across various countries.

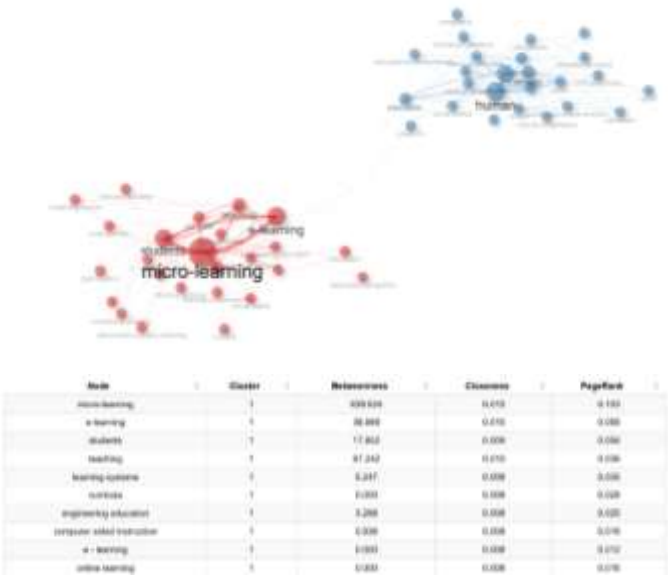

Figure 11. Analysis of co-occurrence.

The Co-occurrence Network displayed a densely interconnected red cluster comprising students, e-learning, and microlearning. This illustrates the interconnection of these three concepts, which often appear concurrently in the literature. This indicates that microlearning is a method of education that utilizes little quantities of information. This method primarily centers on students and is intricately linked to e-learning and the technology that enables it. Furthermore, this cluster contains terms like teaching, learning systems, and curriculum, suggesting that microlearning is closely connected to existing curriculum frameworks and teaching systems. This emphasizes the significance of combining technology with learning design. The betweenness, or the degree to which an idea links the different themes in the study network, is displayed in the following table. Microlearning acts as a bridge or link between other educational concepts, as seen by its extremely high betweenness value of 639.524. This implies that microlearning is applicable to teaching and curriculum design, among other facets of learning, in addition to the e-learning setting. Conversely, ideas like students and e-learning have smaller difference values but nevertheless exhibit noteworthy connections within this study network.

The level plot graph shows how the nodes in this network are connected to one another. A sharp decline is observed at the outset, suggesting that some ideas, like microlearning, are highly correlated with one another. However, a lot of concepts have weaker associations, which means that even while other concepts can be important, they aren't frequently linked to one another in this study. Along with a number of other compelling and closely connected concepts, this demonstrates that microlearning is at the center of this study network.

All things considered, these numbers demonstrate how important microlearning is to research on technology-based education. Despite its ties to other subjects including e-learning, students, and teachers, microlearning remains the most commonly used and associated idea in study. This is because it is current and evolving quickly in the field of digital education. Additionally, this network demonstrates how microlearning links a greater variety of ideas, making it a central theme in the development of technology-based education.

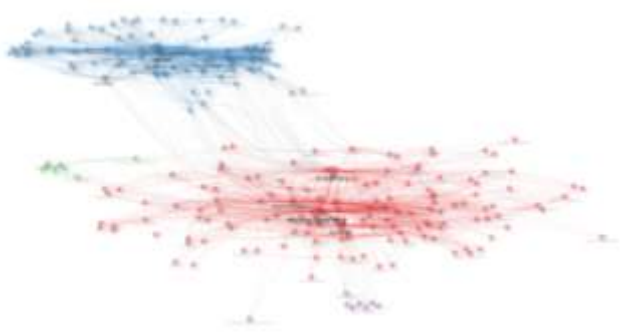

Figure 12. Thematic Map of Microlearning Research in Bibliometrics

This thematic map demonstrates the connections between ideas or terms that are commonly used in the examined texts as well as the ways in which these subjects are related to one another throughout the study. Each dot on this map represents a term or concept, while the connecting lines indicate their relationships or co-occurrence throughout the investigated literature. The map's colors categorize the sentences based on relevant themes or categories. This map is primarily characterized by three predominant color groups. The central concept of micro-learning is depicted by the red cluster located at the bottom and middle of the map. At the core of this cluster is micro-learning, associated with terms such as digital learning, e-learning, and online education. This illustrates the close connection between technology-driven education and teaching strategies that utilize simpler learning modules and micro-learning. The blue cluster at the top of the map contains terms related to human learning, focusing on the understanding of how individuals acquire knowledge. Neurology, cognitive learning, and cognitive science are pertinent to these terms. The relationships among these terms and concepts suggest that the literature prioritizes cognitive and scientific methodologies to understand and improve human learning. The green cluster in the lower left of the map features terms associated with artificial intelligence (AI) and learning analytics. These two concepts pertain to advancements in educational technology that utilize learning data analysis to improve students' educational experiences. AI denotes the utilization of artificial intelligence to provide more personalized and effective learning experiences, whereas "learning analytics" pertains to the collection and analysis of data to understand student learning processes. This green cluster illustrates an evolving research trend that prioritizes the application of advanced technology to improve learning. In the contemporary educational landscape, technology such as artificial intelligence (AI) and analytics can be integrated to enhance learning outcomes. This thematic map illustrates the complex and unified framework of technology-based learning. This aligns with a trend in the literature that emphasizes the relationship between learning analytics, human learning, micro-learning, and the increasing application of AI and other technologies in research to improve learning. Another form of data in the form of a map display can be seen in Figure 12.

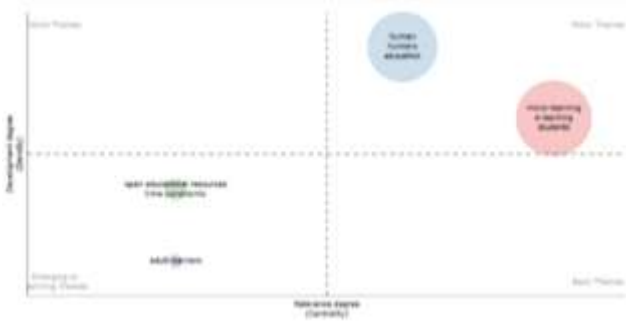

Figure 12. The map displays the existing themes in four quadrants.

This map categorizes the present themes into four quadrants according to two principal dimensions: level of development (density) and level of importance (centrality). The significance and degree of advancement of each theme in the assessed literature dictate its placement on this map. The first quadrant, situated at the upper right, encompasses subjects that are pertinent and exhibit a high degree of advancement. This map shows that microlearning, e-learning, and students are in this quadrant. This shows that these topics are relevant and developing rapidly in technology-based education and learning. Located in the Motor quadrant, these three themes show that they are the main topics driving the trend of technology-based education. In the second quadrant on the upper left, you will find the niche themes. These themes are still far from developed, although they are very important. The human, people, and education quadrants appear on this map. This indicates that despite their importance, these subjects are continually being researched and explored. This demonstrates that even though these topics are highly significant, further study is required before they can be applied in the classroom. Emerging or decreasing

themes, which include subjects that are growing significantly but are not as essential, are located in the bottom left quadrant. According to this map, adult learners are located in this area. This demonstrates that, despite this topic's relative lack of importance, research on it is expanding quickly**.** Themes that are still in the research stage but have recently emerged or declined are depicted in this quadrant.

Finally, key topics, such as time constraints and open educational resources, are in the bottom right quadrant and are irrelevant and underdeveloped. These themes indicate that although they are important in some contexts, they are not the focus of the current literature and research on them is still limited. This map shows how the various themes are positioned in technology-based education research and shows where the current literature is developing.

Conclusion

The conclusions drawn from the development of microlearning research over the past few years indicate that this field has experienced significant growth, especially between 2020 and 2025. Based on the data analysis, many journals show an increase in the number of publications on microlearning, especially in the context of educational technology and e-learning. The trend is becoming increasingly important with the advancement of digital technologies and online learning platforms.

Some of the main findings of this analysis are as follows:

1. Dominance of social sciences. Based on the data of the study areas, the literature analyzed mostly comes from social science disciplines, including sociology, psychology, economics, and politics. This shows that microlearning is more often used in the context of professional and social development than in other study areas.
2. Main topics in microlearning research. Three main topics that are often discussed in the literature on microlearning are microlearning itself, e-learning, and students' learning experiences. This illustrates the importance of microlearning as a technology-based teaching approach that is more flexible and easier for students to use.
3. National and institutional contributions. The country with the largest contribution to knowledge is the United States, followed by China and Germany. Universities such as the University of Nottingham Ningbo China and Ostravská Univerzita v Ostravě are actively involved in the development of this topic. This data highlights the importance of international collaboration in microlearning research.
4. Trends in the use of advanced technologies. In addition, research shows an increasing interest in using advanced technologies, such as artificial intelligence (AI) and educational analytics, to improve student learning. These technologies are increasingly being used to design better curricula and improve technology-based education.
5. Thematic map and development. The research themes show that e-learning and microlearning are positioned in a highly relevant and effective field. However, despite their importance, topics related to humans and education still require further in-depth research. On the other hand, despite their importance, topics such as education and time management are not very popular in the current literature.

Microlearning has emerged as a major topic in technology-based education, particularly through the increasing use of e-learning, microlearning, and technology to enhance learning. This study highlights the importance of this topic in promoting more effective, flexible, and user-friendly learning, as well as creating opportunities for deeper exploration in several relevant subject areas.

Acknowledgments

The author would like to thank the Sultan Idris Educational University (UPSI) which has provided support for the research conducted.

Author Contributions

All authors were involved in determining the research concept, methodology, and implementation of the study. DS drafted the article, and SD reviewed and edited the manuscript. All authors approved the final version.

Funding

This research received no external funding

Conflicts of Interest

The authors declare no conflict of interest.

References

Al-Zahrani, A. M. (2024). Enhancing postgraduate students' learning outcomes through Flipped Mobile-Based Microlearning. *Research in Learning Technology*, *32*(1063519), 1–16. https://doi.org/10.25304/rlt.v32.3110

Al Husaeni, D. F., Budisantoso, E. N. Q., Urwah, M. A., Azizah, N. N., Dinata, P. Z., Apriliany, S., & Siregar, H. (2022). The Effect of Using Web-Based Interactive Learning Media for Vocational High School Students to Understanding of Looping:

Qualitative Approach. *Journal of Science Learning*, *5*(1), 115–126. https://doi.org/10.17509/jsl.v5i1.35534

Astiwardhani, W., & Sobandi, A. (2024). Transforming Educational Paradigms: How Micro Learning Shapes Student Understanding, Retention, and Motivation? *Journal of Education Action Research*. https://doi.org/10.23887/jear.v8i2.77711

Bernholt, S., Härtig, H., & Retelsdorf, J. (2022). Reproduction Rather than Comprehension? Analysis of Gains in Students' Science Text Comprehension. *Research in Science Education*, *53*, 493–506. https://doi.org/10.1007/s11165-022-10066-6

Blakeman, K. (2018). Bibliometrics in a Digital Age: Help or Hindrance. *Science Progress*, *101*, 293–310. https://doi.org/10.3184/003685018X15337564592469

Choudhary, H., & Pandita, D. (2023). Unlocking E-Learning Power: Employee Perspectives on Microlearning Effectiveness. *2023 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT)*, 427–432. https://doi.org/10.1109/3ICT60104.2023.10391766

Choudhary, P., & Potdar, P. (2024). The Impact of Microlearning on Employee Training and Development in Corporate Settings. *International Journal of Advanced Research in Science, Communication and Technology*. https://doi.org/10.48175/ijarsct-22671

Cronin, J., & Durham, M. (2024). Microlearning. *CIN: Computers, Informatics, Nursing*, *42*, 413–420. https://doi.org/10.1097/CIN.0000000000001122

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, *133*, 285–296. https://doi.org/10.1016/J.JBUSRES.2021.04.070

Ellegaard, O. (2017). The application of bibliometric analysis: disciplinary and user aspects. *Scientometrics*, *116*, 181–202. https://doi.org/10.1007/s11192-018-2765-z

Emerson, L. C., & Berge, Z. L. (2018). Microlearning: Knowledge management applications and competency-based training in the workplace. *Knowledge Management and E-Learning*, *10*(2), 125–132. https://doi.org/10.34105/j.kmel.2018.10.008

Ferdaus, J., Rochy, E. A., Biswas, U., Tiang, J.-J., & Nahid, A. Al. (2024). Analyzing Diabetes Detection and Classification: A Bibliometric Review (2000–2023). *Sensors (Basel, Switzerland)*, *24*. https://doi.org/10.3390/s24165346

Fitria, T. N. (2022). Microlearning in Teaching and Learning Process: A Review. *Bahasa Dan Pendidikan*, *2*(4).

Garad, A., Jaboob, M., Al-Ansi, A., & Al-Ansi, A. (2023). Analyzing augmented reality (AR) and virtual reality (VR) recent development in education. *Social Sciences & Humanities Open*. https://doi.org/10.1016/j.ssaho.2023.100532

Hassan, W., & Duarte, A. E. (2024). Bibliometric Analysis: A Few Suggestions. *Current Problems in Cardiology*, 102640. https://doi.org/10.1016/j.cpcardiol.2024.102640

Hsu, Y.-Y., & Lin, C. (2020). Evaluating the effectiveness of a preservice teacher technology training module incorporating SQD strategies. *International Journal of Educational Technology in Higher Education*, *17*. https://doi.org/10.1186/s41239-020-00205-2

Hurtado, G. P. G., Puente, S., & Gómez-Álvarez, M. C. (2024). Microlearning strategy in the promotion of motivation and learning outcomes in software project management. *Computer Applications in Engineering Education*, *32*. https://doi.org/10.1002/cae.22717

Kumar, R. (2025). Bibliometric Analysis: Comprehensive Insights into Tools, Techniques, Applications, and Solutions for Research Excellence. *Spectrum of Engineering and Management Sciences*. https://doi.org/10.31181/sems31202535k

Lazarides, M., Lazaridou, I., & Papanas, N. (2023). Bibliometric Analysis: Bridging Informatics With Science. *The International Journal of Lower Extremity Wounds*, 15347346231153538-. https://doi.org/10.1177/15347346231153538

Leeder, T. M. (2022). Behaviorism, Skinner, and Operant Conditioning: Considerations for Sport Coaching Practice. *Strategies*, *35*(3), 27–32. https://doi.org/10.1080/08924562.2022.2052776

Mahapatra, S. (2020). Impact of Digital Technology Training on English for Science and Technology Teachers in India. *RELC Journal*, *51*, 117–133. https://doi.org/10.1177/0033688220907401

Mohammed, G., Wakil, K., & Nawroly, S. (2018). The Effectiveness of Microlearning to Improve Students' Learning Ability. *International Journal of Educational Research Review*, *3*, 32–38. https://doi.org/10.24331/IJERE.415824

Monib, W. K., Qazi, A., & Apong, R. (2024). Microlearning beyond boundaries: A systematic review and a novel framework for improving learning outcomes. *Heliyon*, *11*. https://doi.org/10.1016/j.heliyon.2024.e41413

Monib, W. K., Qazi, A., Mahmud, M. M., Apong, R. A., & Santos, J. H. (2025). *The MIND model a microlearning AI-integrated instructional design for enhanced learning outcomes*. 1–14.

Naidu, S. (2019). The changing narratives of open, flexible and online learning. *Distance Education*, *40*,

149–152. https://doi.org/10.1080/01587919.2019.1612981

Nakunsong, T. (2024). Evolving K-12 Digital Education: Enhancing Flexibility and Access through Online Learning and Virtual Programs. *Journal of Education and Learning Reviews*. https://doi.org/10.60027/jelr.2024.791

Nurul Fitriah Alias, & Rafiza Abdul Razak. (2023). Enhancing Classroom Learning: Exploring the Synergy of Microlearning and the Community of Inquiry. *International Journal of Advanced Research in Education and Society*. https://doi.org/10.55057/ijares.2023.5.4.11

Nurul Fitriah Alias, & Rafiza Abdul Razak. (2024). Leveraging Microlearning: A Comprehensive Guide through Merrill's First Principle of Instruction. *Asian Journal of Research in Education and Social Sciences*. https://doi.org/10.55057/ajress.2024.6.1.43

Oliveira, O., Da Silva, F. F., Juliani, F., Barbosa, L., & Nunhes, T. (2019). Bibliometric Method for Mapping the State-of-the-Art and Identifying Research Gaps and Trends in Literature: An Essential Instrument to Support the Development of Scientific Projects. *Scientometrics Recent Advances*. https://doi.org/10.5772/intechopen.85856

Pozo-Rico, T., Gilar-Corbí, R., Izquierdo, A., & Castejón, J. (2020). Teacher Training Can Make a Difference: Tools to Overcome the Impact of COVID-19 on Primary Schools. An Experimental Study. *International Journal of Environmental Research and Public Health*, *17*. https://doi.org/10.3390/ijerph17228633

Sankaranarayanan, R., Yang, M., & Kwon, K. (2024). Exploring the role of a microlearning instructional approach in an introductory database programming course: an exploratory case study. *Journal of Computing in Higher Education*. https://doi.org/10.1007/s12528-024-09408-2

Santiago, C., Leah, M., Ulanday, P., ZarahJane, R., Centeno, M., Cristina, D., BaylaJoseph, S., & Callanta. (2021). *Flexible Learning Adaptabilities in the New Normal: E-Learning Resources, Digital Meeting Platforms, Online Learning Systems and Learning Engagement*. https://consensus.app/papers/flexible-learning-adaptabilities-in-the-new-normal-santiago-leah/1ddc281953c35c849bed6f7d6aaadd3b/

Senandheera, V. V, Muthukumarana, C. K., Ediriweera, D. S., & Rupasinghe, T. P. (2024). Impact of microlearning on academic performance of students in higher education: A systematic review and meta-analysis. *Journal of Multidisciplinary & Translational Research*. https://doi.org/10.4038/jmtr.v9i1.2

Silva, E. S., Da Costa, W. P., De Lima, J. C., & Ferreira, J. (2025). Contribution of Microlearning in Basic Education: A Systematic Review. *Education Sciences*. https://doi.org/10.3390/educsci15030302

Teichgräber, U., Ingwersen, M., Ehlers, C., & Spreckelsen, C. (2023). Microlearning for faculty development: Concentrate on what really counts. *Medical Education*, *57*, 771–772. https://doi.org/10.1111/medu.15105

Vermunt, J., Vrikki, M., Van Halem, N., Warwick, P., & Mercer, N. (2019). The impact of Lesson Study professional development on the quality of teacher learning. *Teaching and Teacher Education*. https://doi.org/10.1016/J.TATE.2019.02.009

Wright, B., & Schlegel, E. (2024). Micro-Integration: A Process for Integrating Multiple Discipline-Specific Learning Objectives for Enhanced Co-Teaching of Medical Education Sessions. *Physiology*. https://doi.org/10.1152/physiol.2024.39.s1.1295

Yao, S.-Y., & Ho, Y. Y. (2024). Evaluating the Usefulness of Microlearning to Adult Students in Higher Education: An Empirical Study in Singapore. *Adult Learning*. https://doi.org/10.1177/10451595241280672

Yeoh, A. (2022). Reflections on microlearning in the social media age. *Medical Education*, *57*. https://doi.org/10.1111/medu.14939

Yu, L., Ho, T. C. F., Teo, P.-C., & Baskaran, S. (2024). Microlearning Implementation Strategies and their Impact on Talent Retention. *International Journal of Academic Research in Business and Social Sciences*. https://doi.org/10.6007/ijarbss/v14-i10/23302

Yun, E. (2020). Correlation between concept comprehension and mental semantic networks for scientific terms. *Research in Science & Technological Education*, *38*, 329–354. https://doi.org/10.1080/02635143.2020.1777095

Zamata-Aguirre, H. R., Choquehuanca-Quispe, W., Machaca-Huamanhorcco, E., Begazo, A. N. S., & Málaga, V. W. B. (2023). Towards the development of learning through microlearning. *Ciencia Latina Revista Científica Multidisciplinar*. https://doi.org/10.37811/cl_rcm.v7i1.4711

Zhang, J., Burgos, D., & Dawson, S. (2019). Advancing open, flexible and distance learning through learning analytics. *Distance Education*, *40*, 303–308. https://doi.org/10.1080/01587919.2019.1656151

Zrnic, D. (2024). Enhancing Education and Training for Professionals and Formal Carers: Implementing Microlearning. *Age and Ageing*. https://doi.org/10.1093/ageing/afae178.211