

## Mapping the Landscape of Micro Learning Research in Education: A Bibliometric Review

Hakan Altınpulluk<sup>1</sup> Lütfi Cem Yener<sup>2</sup> Efgan Kaçar<sup>3</sup>

### To cite this article:

Altınpulluk, H., Yener, L. C., & Kaçar, E. (2026). Mapping the landscape of micro learning research in education: A bibliometric review. *e-Kafkas Journal of Educational Research*, 13, 316-336. doi: 10.30900/kafkasegt.1834237

Review article


Received:01.12.2025


Accepted:05.01.2026


### Abstract

The aim of this study is to determine trends, development trajectories, and structural features in the field by studying the academic publications on micro learning through bibliometric mapping methods. Within the scope of this study, a total of 139 publications that were reviewed in the Web of Science Core Collection between 2015-2025 through the keyword “micro learning” and that were found in the categories of “Educational Research” and “Education Scientific Disciplines” were analyzed. The analysis was carried out through a multi-stage bibliometric mapping process, including data extraction, data cleaning and standardization, network construction, and visualization of relationships across different bibliometric dimensions. In this study, bibliometric data such as co-authorship-countries, co-occurrence-author keyword, citation-documents, bibliographic coupling-documents, bibliographic coupling-organizations, and co-citation – cited authors were mapped. The findings show that publications on micro learning intensified between 2016-2020 but have shown a relative decline in recent years. In the co-authorship analysis, it was determined that China and the USA stand out, while the keyword analysis reveals that concepts of “e-learning”, “online learning”, “flipped classroom”, and “higher education” are frequently used in connection with micro learning. However, the findings should be interpreted in light of certain limitations, including the conceptual ambiguity of micro learning in the literature and the reliance on a single database and quantitative bibliometric indicators. Overall, the findings indicate that micro learning research has developed around a limited number of influential countries, institutions, and authors, with a strong thematic connection to mobile and online learning, highlighting both the growing global interest in the field and the need for more diversified and theory-driven research.

**Keywords:** Micro learning, bibliometric analysis, educational research

<sup>1</sup>  Corresponding Author, hakanaltinpulluk@anadolu.edu.tr, Anadolu University, Faculty of Education, Eskişehir, Türkiye

<sup>2</sup>  Author, Anadolu University, Graduate School, Department of Open and Distance Learning, Eskişehir, Türkiye

<sup>3</sup>  Author, Anadolu University, Graduate School, Department of Open and Distance Learning, Eskişehir, Türkiye

## Introduction

Technology offers various opportunities that make education both more sustainable and universally accessible (Pérez-Juárez et al., 2023). The increasing ease of access to information, the shortening of individuals' attention spans, and the diversification of learning needs have made it compulsory to restructure education approaches. With the advent of mobile devices, people have begun to multitask more. Time has become more important than ever, and people want to spend it more efficiently. The development of social media has enabled people to access more data in shorter times, and this has led to the concept of efficiency being equated with short content. Learning processes have also been affected by this situation. Long lessons are now replaced by short learning processes for acquiring a small piece of information. Learners now find the topics they want in shorter videos, not in long lessons. This abundance of content has led to the emergence of micro learning concept and has sparked a debate about the concept in academia. This concept is a course design technique that emerged due to short attention spans, demand for small chunks of information, and time constraints (Robles et al., 2023). With the rapid development of digital technologies, more flexible, personalized (Mohammed et al., 2018), and shorter learning experiences that have entered learning environments have gradually become the focus of attention. With this respect, micro learning has gained increasing attention as a learning approach in both corporate training and formal education systems. It has also found a practical use in post-school learning processes and in some critical businesses. It is used extensively in health education due to the fact that it is becoming increasingly difficult for healthcare workers to find time for long-term professional training (Wang et al., 2020).

In this restructuring process, micro learning is characterized as an innovative learning approach, offering short and focused content delivered through digital tools. Micro learning that breaks down information into small and meaningful parts (Mohammed et al., 2018) facilitates the learner motivation by delivering individualized and needs-based learning and increases learner motivation.

Current studies in the literature show that micro learning has been used effectively at different educational levels and in different contexts and that it comes to the fore in fields like language learning, mobile learning, and digital content design. Although there are studies that address the limitations of micro learning (Lodge & Harrison, 2019), there are studies, on the other hand, that examine its strengths and benefits (Wang et al., 2020). Meanwhile, it is seen that global production in micro learning is growing increasingly and that this approach contributes to inclusivity, accessibility, and sustainability in education. With this respect, it is of great significance to examine the conceptual framework and practice trends of micro learning in order to contribute to the existing knowledge.

Despite finding a place in academia, the number of comprehensive and updated studies on the scope of academic literature in the field of micro learning, development procedures, collaboration networks, and thematic trends is limited. When the literature is reviewed, it was seen that the studies on micro learning have largely remained experimental and at a conceptual level, while there is a lack of a bibliometric review based on the analysis of temporal, geographical, and thematic analyses of these publications. This condition emerges as a factor that makes it difficult for researchers and practitioners to follow the developments in the field of micro learning easily.

With this respect, bibliometric mapping comes into being. Bibliometric mapping methods have become a significant tool in understanding, comprehending, interpreting, and analyzing the flow of information in the scientific literature (Dereli, 2024). Therefore, examining the publications on micro learning through bibliometric mapping techniques presents a comprehensive point of view on the current state of the field, development trends, prominent actors, and research gaps.

### Conceptual and Theoretical Background of Micro Learning

Micro learning is the presentation of information to learners by breaking it into small pieces to facilitate the learning process. The information in small amounts is conveyed in a way appropriate to learners' characteristics and in a step-by-step manner (Díaz Redondo et al., 2021). The goal in making this is for learners to focus on a single topic or skill and to learn and practice it quickly (Mazohl, 2025). In micro learning, the content presented to the learners is short. Learners have the comfort of having breaks between short contents or of completing the learning process quickly. Therefore, learners can complete

content easily while their mental loads are reduced. Meanwhile, time is allowed for the transfer of learned information from short-term memory to long-term memory (Shail, 2019).

Micro learning is frequently handled together with the concepts of nano-learning and mobile learning in the literature. When these three approaches are examined, it can be stated that they have common features such as flexibility, short-term learning experiences, and learner-centred design. Micro learning refers to the structuring of learning through small and meaningful content units that focus on a specific learning outcome (Cronin & Durham, 2024). Unlike micro learning, nano-learning is defined as a more micro-level learning approach in which a single concept or skill is addressed in very short periods of time (Chamorro-Atalaya et al., 2024). Unlike these two concepts, mobile learning, rather than a pedagogical model, functions as a technological and contextual framework that allows micro and nano learning applications to be presented independently of time and space. From this perspective, it can be said that mobile learning should be considered as an element that facilitates the implementation of micro learning (Kukulka-Hulme & Shield, 2008). The relationship between these three concepts is visualised in Figure 1.

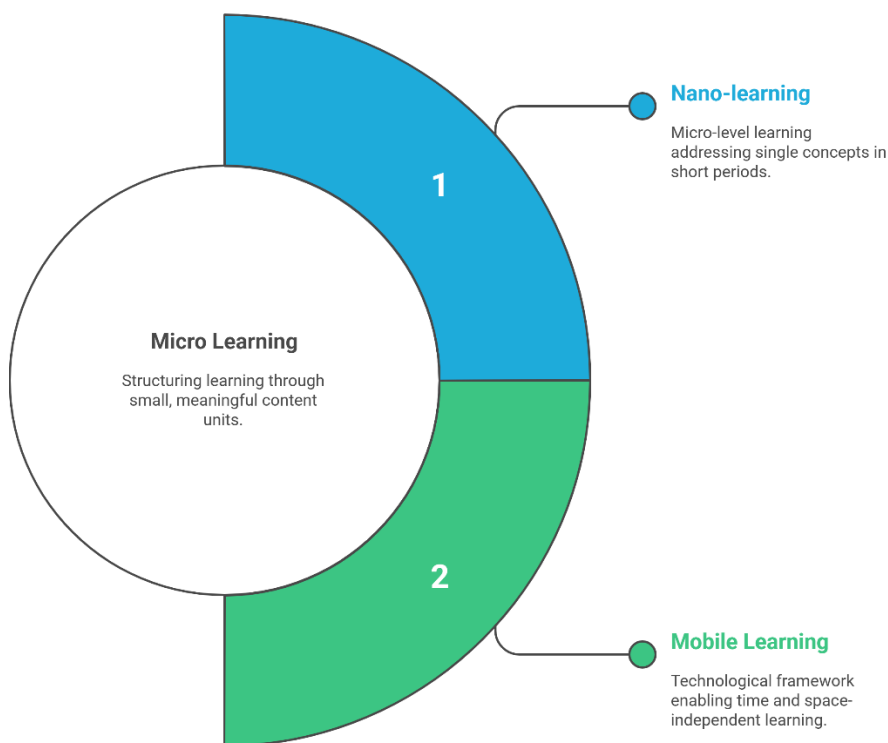


Figure 1. Exploring Micro Learning and Related Concepts

In pedagogical terms, micro learning has a strong relationship with many theories and approaches. Cognitive load theory, self-regulated learning, and constructivist learning approaches are some of them (Zhu et al., 2024). In micro learning, the dividing the content into small and manageable parts aims to reduce the cognitive load of learners and support a meaningful learning experience. In addition, micro learning overlaps with lifelong learning and self-directed learning approaches as it allows learners to manage their own learning pace and needs (Alias & Razak, 2025; Judijanto, 2025). With this respect, micro learning is not only a content delivery strategy. It can also be positioned as a holistic learning approach shaped at the intersection of technological possibilities and pedagogical principles.

### Related Studies

Various advantages, such as accessibility and flexibility that micro learning provides to learning processes, are frequently emphasised in the literature. However, some studies suggest that micro learning has limitations in terms of interaction, engagement, and learner satisfaction (Monib et al., 2024). In particular, excessive shortening of the content can lead to fragmentation of the learning processes and can make it difficult for learners to establish a holistic connection between subjects. For

this reason, it is pointed out that it is important to establish a balance between the brevity of the content and pedagogical depth in micro learning designs. In addition, problems in accessing technological infrastructure and dependence on digital tools are among the other important factors that limit the efficiency of micro learning applications.

In this context, bibliometric analyses and systematic reviews of the literature on micro learning provide an important frame of reference in terms of revealing the development trends, thematic foci, and research gaps in the field. A general summary of these studies is presented in Table 1.

Table 1.

**Bibliometric Analyses or Systematic Review Studies on Micro Learning**

Study	Scope	Type	Studied and Indexes	Database	Number of Reviews studied
The effects of micro learning on EFL students' English speaking: A systematic review and meta-analysis (Prasittichok & Smithsarakarn, 2024).	2018-2023	Systematic Review and Meta Analysis	ERIC, Science Direct, Scopus, Scholar	Google	10
Science mapping the knowledge base on micro learning: Using Scopus database between 2002 and 2021 (Pham et al., 2024).	2002-2021	Bibliometric Analysis	Scopus		297
Exploring the pedagogical aspects of micro learning in educational settings: A systematic literature review (Alias & Razak, 2023).	2014-2023	Systematic Review	Scopus		11
Contribution of micro learning in basic education: A systematic review (Silva et al., 2025).	2015-2024	Systematic Review	Web of Science, Scopus, ERIC, Xplore	IEEE	14
Exploring the role of micro learning in lifelong learning: A bibliometric review (Judijanto, 2025).	2005-2025	Bibliometric Analysis	Scopus, Science, Scholar	Web of Google	-
A review of the trend of micro learning (Leong et al, 2020).	2006-2019	Systematic Review	Scopus		476
Micro learning and nanolearning in higher education: A bibliometric review to identify thematic prevalence in the covid-19 pandemic and post-pandemic context (Chamorro-Atalaya et al., 2024).	2020-2024	Bibliometric Analysis	Scopus		90
Mobile micro learning: A systematic literature review and its implications (Lee, 2023).	2015-2020	Systematic Review	Google Scholar, ERIC, ProQuest, Xplore	PubMed, IEEE	26
Micro learning beyond boundaries: A systematic review and a novel framework for improving learning outcomes (Monib et al., 2025).	2020-2024	Systematic Review	SAGE, Francis, SpringerLink, Xplore, Scopus, ERIC	Taylor & Emerald,	40
Micro learning: Transforming education with bite-sized learning on the go insights and applications (Samala et al., 2023).	2010-2022	Systematic Review	Scopus		80
Micro learning in diverse contexts: A bibliometric analysis (Sankaranarayanan et al., 2023).	2005-2021	Bibliometric Analysis	Scopus		208
Micro-learning design and micro-course structuring: a systematic literature review (Boumalek et al., 2025).	2019-2023	Systematic Review	Scopus		56

When the studies on the topic are reviewed, in their systematic review and meta-analysis study, Prasittichok and Smithsarakarn (2024) investigated the effect of micro learning on learning English as a second language. According to the results of the research, it was concluded that micro learning was found to be more advantageous than traditional learning and that it helps learners develop speaking

skills. Pahn et al. (2024) conducted a scientific mapping study on micro learning. According to the findings of this study, there was a decline in the number of publications on micro learning from 2002 to 2021. Even though the publications are produced with contributions from other countries, 15 of them produced approximately 70% of the total publications. In the study, publications were categorized according to educational levels, and it was concluded that prominent levels were lifelong learning, higher education, and all educational levels (with no specific scope). Also, it was noted that there were 6 themes in the related publications on micro learning. These themes are design and assessment of mobile learning, adaptation of micro learning in MOOCs, language teaching and learning, micro learning system workflow, content design, health literacy, and health behaviors. Alias and Razak (2023) state that content design and teaching flow must be prioritized in order to provide an effective and engaging micro learning experiences in higher education. Accordingly, content must be short, topic focused, and easy to digest during the micro learning process. Thus, the information learned can be linked to daily life. In addition to this, instructional design should be compatible with learning objectives. Also, the teaching materials used should increase interaction. When micro learning is embedded into digital tools such as online and mobile apps, it increases learners' success, interaction, and motivation. Meanwhile, short content ensures that information is retained and connected to life itself. Micro learning promotes participation, accessibility, and critical thinking by offering a personalized learning opportunities and therefore provides an inclusive and sustainable education (Silva et al., 2025). Additionally, micro learning has a growing popularity since it offers flexible, accessible, and engaging learning opportunities, and this enables lifelong learning. Because the content is presented in a small and manageable format, learners have the flexibility of learning the content on their own conditions. Therefore, developments in the field of micro learning will support both the continuous development of learners as well as the innovations in the field of lifelong learning (Judijanto, 2025). Research on micro learning was mostly examined from the perspective of e-learning and mobile learning. A probable reason for this is that mobile technologies have a large share in the development of micro learning. Research has been mostly conducted with higher education students. A probable reason for this is that higher education students have self-efficacy skills and therefore are more predisposed to micro learning (Leong et al., 2020).

### **Purpose of the Research and Research Questions**

The purpose of this study is to set forth the scientific production trends, development trajectories, and structural features of scientific production in micro learning by analyzing the academic publications in micro learning using the bibliometric mapping methods. To this end;

1. The fields' development curve was assessed by analyzing the annual distribution of publications on micro learning;
2. Collaboration networks among different countries, institutions, and authors were examined;
3. Thematical focuses were determined by analyzing the most frequently used keywords in the literature as well as their co-occurrences;
4. Leading studies, authors, and institutions were identified through citation analysis.

In this regard, this study aims to present the current state of literature in the field of micro learning from a holistic point of view and to serve as a guiding resource for future research. In this context, the research questions of this study are listed as follows:

1. What was the distribution of academic publications on micro learning annually like between 2015 and 2025?
2. Which countries stand out in micro learning studies, and what structure do these collaboration networks between countries exhibit?
3. What are the most frequently used words in studies on micro learning, and what kind of network of connections exists between these keywords?

4. Which studies receive the most citations in the micro learning studies and how are the citation relationships between these studies shaped?
5. How are the publications on micro learning clustered in terms of the sources they cite in common, and what are the thematic similarities between the documents?
6. Which institutions stand out in micro learning studies, and how are the knowledge based relationships between these institutions shaped?
7. Which authors are most frequently cited together in the micro learning literature, and how do these intellectual networks that are formed by these authors appear?

### Method

#### Inclusion/Exclusion Criteria

The selection of studies was carried out in accordance with PRISMA guidelines. Within the scope of the Core Collection in the Web of Science database, a search was conducted using the All Editions option. In the search process, the keyword ‘micro learning’ was used in quotation marks and in the topic field in order to eliminate off-topic studies. In the first stage, a total of 19,538 records were reached with this search strategy. Then, the search results were narrowed down and only the records containing the relevant keyword were taken into consideration. The number of results was determined as 333. The period 2015-2025 was selected as the publication year filter. As a result of this filtering, 283 studies were obtained. In the last stage, in order to ensure that micro learning studies are compatible with the context of educational sciences, ‘Educational Research’ and ‘Education Scientific Disciplines’ were selected from the Web of Science category filters, and off-topic publications were eliminated; a total of 139 studies that met the inclusion criteria were included in the bibliometric analysis. The screening process was carried out on 01 January 2026, and the study selection process is summarised in the PRISMA flow diagram presented in Figure 2.

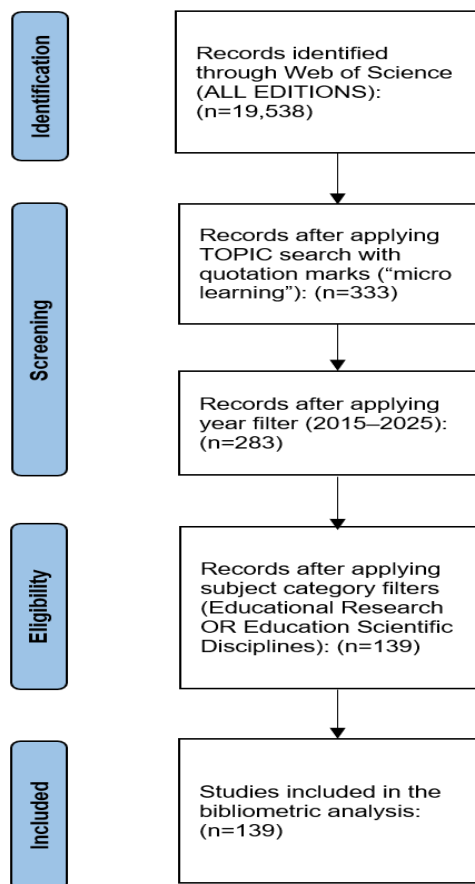


Figure 2. PRISMA Flow Diagram of the Study Selection Process

Table 2 shows the distribution of 139 publications analysed within the scope of bibliometric analysis according to publication types. The findings reveal that the studies in the field of micro learning are largely concentrated in the proceeding paper type (n=73). This situation suggests that micro learning is a relatively new and developing research area that is discussed especially through conferences and scientific meetings. Proceeding papers are followed by refereed journal articles (n=63), and the presence of these publications indicates that the field has started to move towards more mature and theoretically based studies over time. However, the limited number of book chapters (n=1), editorial materials (n=1), and letters (n=1) indicates that micro learning has not yet been the subject of comprehensive book studies or editorial discussions. In general, this distribution of publication types shows that micro learning research is largely progressing through academic platforms focused on sharing and discussion, and that the field is in the process of development.

Table 2.  
Distribution by Publication Type

Publication Type	n
Proceeding Paper	73
Article	63
Book Chapters	1
Editorial Material	1
Letter	1
Total	139

### Data Analysis

In this study, 139 studies published on micro learning between 2015 and 2025 on the Web of Science database were analyzed using bibliometric mapping. Bibliometric mapping is the visualization of scientific literature by analyzing it through quantitative methods (Chen, 2017). Bibliographic data is analyzed at various contexts such as co-authorship, keyword co-occurrence, citation, bibliographic coupling or co-citation through which relationships, trends, and themes in the literature are revealed. In this study, bibliometric data such as co-authorship-countries, co-occurrence – author keyword, citation-documents, bibliographic coupling-documents, bibliographic coupling-organizations and co-citation – cited authors were mapped, and trends were studied from an international perspective.

The data retrieved from the Web of Science database was exported as a tab-delimited file in .txt format. The bibliometric data related to the studies were downloaded as full records. VOSviewer 1.6.20 software was used to map the data and the relationship between the data. The analysis process of the data collected was reviewed by three different researchers. Each researcher reviewed the data extraction, data cleaning and mapping stages separately. The findings obtained as a result of VOSviewer analyses were compared between the researchers, and possible inconsistencies were identified. When disagreements arose regarding the data interpretation or the determination of analysis parameters, consensus was reached through discussion. This multi-investigator moderation mechanism was implemented to minimise researcher bias and to ensure the consistency and accuracy of the analysis process.

The analyses are generally based on the default settings of VOSviewer. Association strength normalisation method was used to normalise the networks. The ‘merge small clusters’ feature was enabled to prevent small and dispersed clusters from complicating the analysis results. In the clustering process, the minimum cluster size was set as 1 within the scope of advanced clustering parameters. In addition, the threshold values and analysis criteria used for each type of analysis are presented in detail under the relevant sub-headings. This approach was adopted both to ensure transparency of the analysis process and to increase the interpretability of the bibliometric maps obtained.

## Findings

### Distribution of Publications by Year

An analysis of the distribution of academic publications on micro learning over the 10-year period between 2015-2025 shows that interest in this field has fluctuated over the years. The number of publications, which was 7 in 2015, nearly doubled to 15 in 2016 and rose to 19 in 2017, showing a remarkable increase. However, there was a significant decline in 2018, and the number of publications fell to 8. An increasing trend was observed in 2019 (16 publications), while the number reached its highest level again in 2020 with 19 publications. In 2021 and 2022, the number of publications was 14 and 13, respectively, maintaining a relative trend during these years. The downward trend observed in previous years persisted in 2023, with the number of publications decreasing to 11, followed by a further decline to 9 publications in 2024. This decreasing pattern continued into 2025, during which only 8 new publications were added to the micro learning literature. Generally speaking, it can be said that academic production in the field of micro learning intensified, particularly between 2016 and 2020, and has shown a partial downward trend in recent years (Table 3).

Table 3.  
Distribution of Publications by Year

Year	n
2015	7
2016	15
2017	19
2018	8
2019	16
2020	19
2021	14
2022	13
2023	11
2024	9
2025	8
Total	139

### Co-authorship and Countries Map

In the study, co-authorship-country analysis visualizes international collaboration networks based on micro learning research published jointly by researchers from different countries. Through this analysis, information on global scientific collaborations and the centrality level of specific countries was obtained. Within the scope of this analysis, the minimum number of documents for a country to be included in the network was set as 1, and the minimum number of citations was set as 1. In line with these thresholds, 46 of the 51 countries in the data set were included in the analysis. However, it was observed that not all countries were connected to each other in the created network structure. It was seen that the largest connected component consisted of 20 countries. In order to increase the interpretability of the network and to reveal the inter-country cooperation relations more clearly, the analyses are based on the largest connected component. This exclusion prevented marginal connections from complicating the network structure and provided a clearer visualisation of the dominant and significant patterns of international cooperation in the domain of micro learning.

In this study, China and the USA are the largest nodes when publications on micro learning were examined via the co-authorship-countries analysis. In terms of the number of publications, while China has 38, the USA has 21, and Germany has 10 publications; in terms of citation numbers, China has 595, Spain has 312, and India has 276. In terms of total strength, the first three were shared by China with a score of 16, Spain with 12, and India with 12. When the map (Figure 3) is examined, it is seen that the

Chinese authors have the most connections with Japan, Taiwan, New Zealand, Spain, the Netherlands, the US, South Korea, India, and Australia.

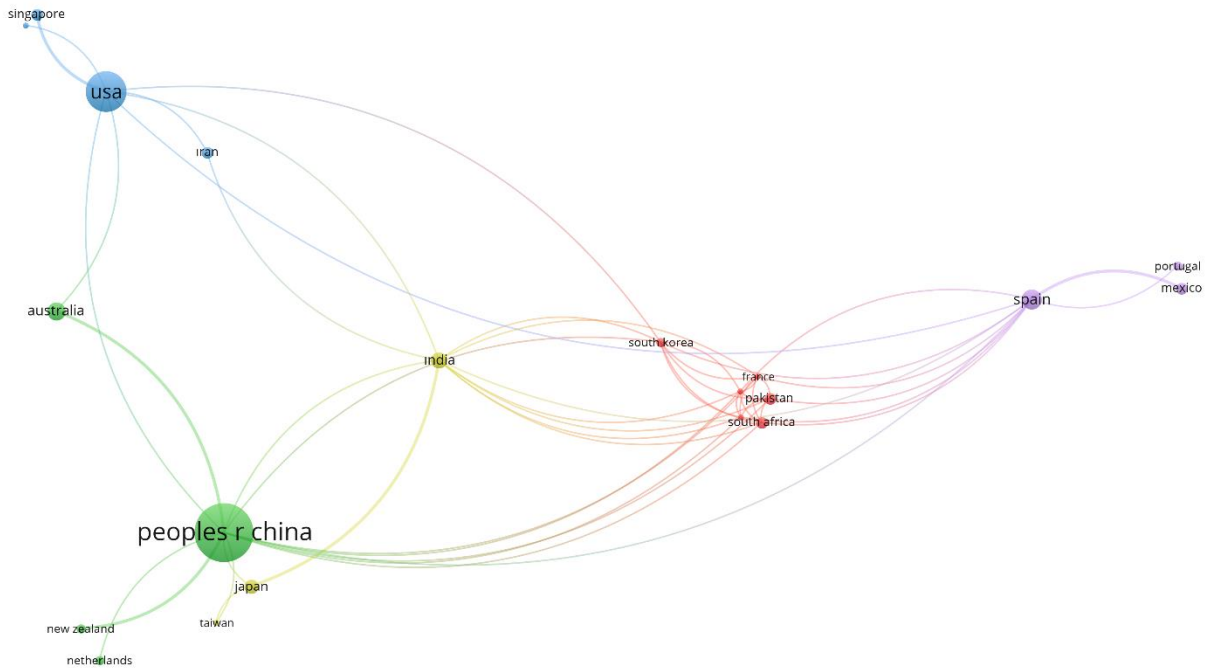


Figure 3. Co-authorship and Countries Map

China's central position in co-authorship networks can be attributed to national policies supporting digital transformation in higher education, increasing institutional investments in educational technologies and academic performance systems that encourage research productivity. Especially in recent years, a growing importance given by Chinese universities to international publications has strengthened the visibility of digital learning approaches such as micro learning in the global literature. The intensive collaborations of Chinese researchers with both Asian countries, the US and European institutions show that micro learning research has developed in an international and multicentre structure.

The dynamics of cooperation between the USA and China provide an opportunity for different academic traditions in the fields of educational sciences and educational technologies to come together. The combination of the theoretical and pedagogical-based research accumulation of the USA and China's technology, application, and scalability-oriented research approach contributes to the enrichment of micro learning studies both theoretically and practically. This situation reveals that knowledge production in the field of micro learning is increasingly shaped through international academic networks and that cooperation between countries plays a decisive and potential role in the development of the field.

However, it is understood that international collaborations in the field of micro learning are not only bilateral, but also exhibit a network structure shaped through multi-layered and regional bridges. In particular, India and South Korea seem to play a broker role between the China-centred cluster and Europe and other Asian countries. These countries facilitate the circulation of knowledge by linking different research clusters and contribute to the adaptation of micro learning studies to different contextual needs. In the European cluster, the centrality of Spain indicates the strengthening of collaborations between Southern European countries and Latin America. The fact that countries such as France, Pakistan and South Africa are located in the same sub-cluster proves that micro learning is not limited to high-income countries. It is understood that micro learning is also attracting attention as a research topic in developing countries, especially due to its access, flexibility and cost advantages. Interpreting these findings, it can be stated that co-authorship relationships in the field of micro learning

are shaped by the global digitalisation agenda, regional education priorities and research capacities of countries. In addition, it can be said that the field has evolved into a more inclusive and multi-centred scientific cooperation structure.

### Co-occurrence and Author Keyword Map

With co-occurrence – author keyword analysis, the co-occurrence frequency analysis of keywords used by researchers in the scientific literature can be analyzed. In this analysis, the relationships between the concepts that stand out in the literature as well as the knowledge clusters that these concepts form are visualized based on the keywords determined by the authors. In the analyses, the full counting method was adopted and all repetitions of each keyword in the documents were evaluated with equal weight. The minimum number of occurrences for a keyword to be included in the scope of the analysis was set as 1 and all 466 keywords in the data set were included in the scope of the analysis according to this threshold value. In the network structure created, it was observed that not all of the keywords were connected to each other. It was determined that the largest connected component consisted of 323 keywords. In order to present the network in a more readable and interpretable structure, the analyses were based on the largest connected component. As seen on the map, the largest node is the subject of this study, micro learning. The other keywords that were used frequently with micro learning are e-learning, mobile learning, online learning, flipped classroom, and higher education (Figure 4).

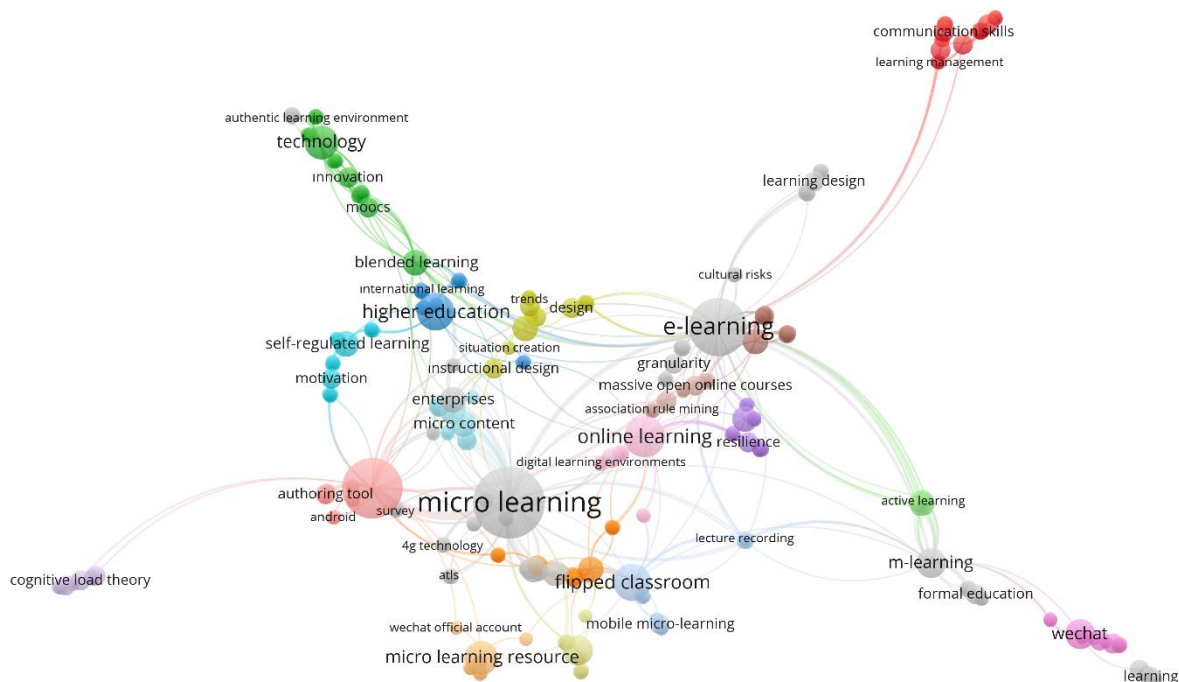


Figure 4. Co-occurrence and Author Keyword Map

When the map is analysed, it can be seen that research in the field of micro learning is structured around distinct thematic clusters. The concept of micro learning at the centre of the map reveals the digital and pedagogical foundations of the field by establishing strong links with concepts such as e-learning, online learning, higher education and instructional design. This central cluster can be directly related to the Cognitive Load Theory, especially through the granularity of learning content and its integration into instructional design. The feature of micro learning to provide short, focused, and structured content is theoretically supported by the more limited but meaningful position of the keyword cognitive load theory on the map. In addition, the sub-cluster formed by the concepts of self-regulated learning, motivation and active learning points to the aspects of micro learning that support individual learning processes and establishes a strong relationship with the Self-Regulated Learning Theory. The keywords in this cluster highlight the flexible and learner-centred nature of micro learning by emphasising the

ability of learners to manage the learning pace and content according to their own needs. In particular, the fact that m-learning and mobile micro learning concepts are linked to this cluster shows that micro learning supports self-regulation skills by providing learning opportunities independent of time and space.

The coexistence of concepts related to higher education, lifelong learning and business keywords such as enterprises on the map also reveals that micro learning is not only limited to the formal education context, but also finds an important application area in corporate and professional learning environments within the framework of lifelong learning perspective. This situation shows that micro learning is considered as a multidimensional pedagogical approach that intersects with different learning theories and its theoretical foundations are becoming more and more evident in the literature. In general, this map shows that micro learning research is progressing in an integrated structure with cognitive, motivational and contextual learning theories and that the field is enriched theoretically.

### Citation and Documents Map

With citation – documents analysis, a map was generated based on the total number of citations that publications on micro learning have received from each other. This analysis aims to identify the most influential publications that receive the most citations in the literature and to visualize the citation relationships with each other. Within the scope of this analysis, the minimum number of citations for a document to be included in the network structure was set as 0 and all 139 documents in the data set were included in the scope of the analysis in line with this threshold value. However, it was observed that not all documents were connected to each other in the citation network. The largest connected component detected in the network structure consists of 30 documents. In order to examine citation relationships in a more meaningful and interpretable way, the analyses were based on the largest linked component. This approach prevented documents with limited or singular citation relationships from complicating the network visualisation and provided a clearer representation of the main studies where citation-based interaction in the field of micro learning is concentrated. When the map is studied, the study by Nikou and Economides (2018) stands out with 106 citations and 14 links. However, the link number of Yin et al. (2021) is just 2 even though it has a large node. The reason why this study has a large node is that it received 166 citations. With this respect, the most cited study is by Yin (Figure 5).

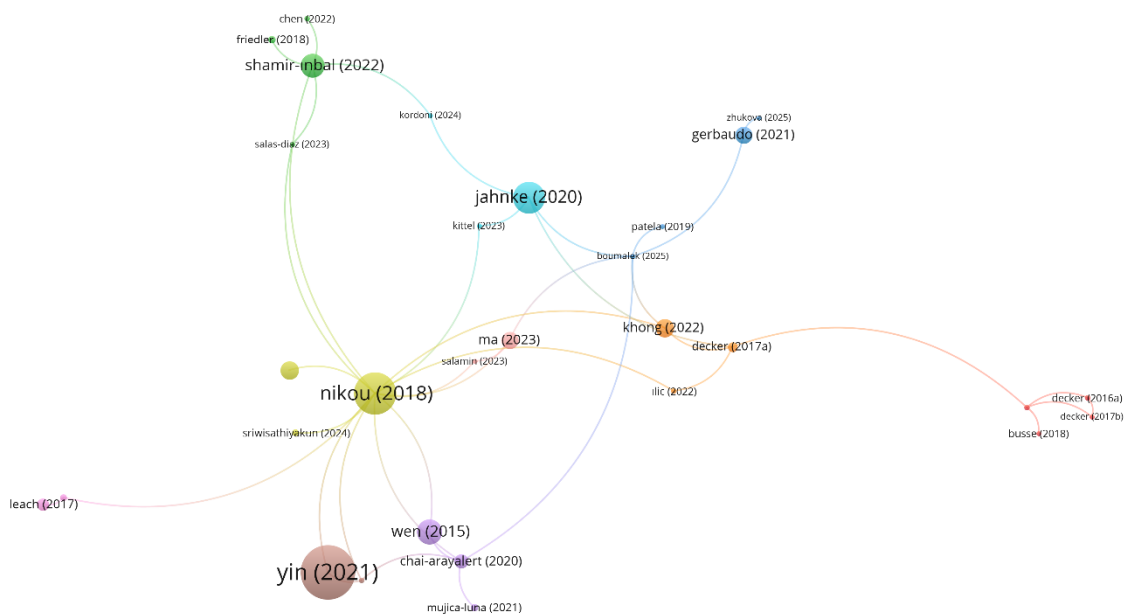


Figure 5. Citation and Documents Map

When the citation and documents map is analysed, it is seen that the citation relationships in the field of micro learning are concentrated around certain studies, such as Nikou and Economides (2018) and Yin et al. (2021). However, the fact that more recent studies such as Jahnke et al. (2020) and Khong and Kabilan (2022) are bridged in the network shows that the micro learning literature has expanded around different research foci over time. In general, the structure of the citation network reveals that both early foundational studies and new approaches that have emerged in recent years have been effective together in the field of micro learning.

### Bibliographic Coupling and Documents Map

Bibliographic coupling – documents analysis reveals the proximity of information between two publications if two or more scientific publications on micro learning cite the same references. During the analyses, the minimum number of citations for a document to be included in the network structure was set as 0 and all 139 documents in the data set were included in the scope of the analysis in line with this threshold value. However, it was determined that not all documents were linked to each other in the bibliographic coupling network. The largest connected component detected in the network structure consists of 93 documents. In order to examine bibliographic coupling relationships in a more meaningful way, the analyses were based on the largest linked component.

In this analysis, documents on micro learning were linked to each other through the common sources they cited and thematic similarities in the field were mapped over these links. In this study, Nikou and Economides (2018) and Yin et al. (2021) again formed the largest node. In terms of total connection length, the study by Chai-Arayalert (2020) ranks first with 90 connections. Bibliographic coupling analysis establishes a similarity relationship according to the sources used by the documents. Using this technique, documents on micro learning and similar studies were grouped and analyzed, revealing the conceptual proximity of the documents (Figure 6).

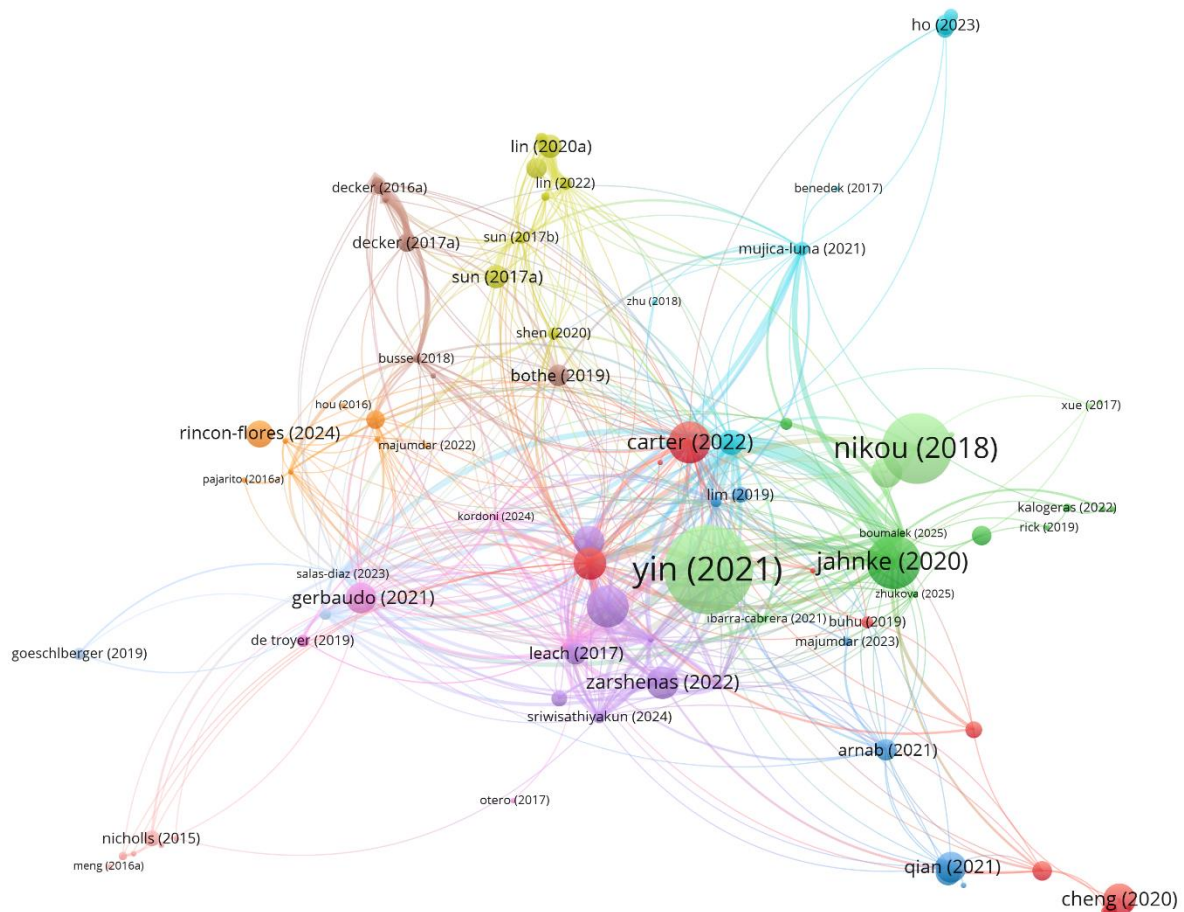


Figure 6. Bibliographic Coupling and Documents Map

When the map is reviewed, it is seen that studies in the field of micro learning form distinct clusters that are connected to each other through common references at the centre of studies such as Nikou and Economides (2018), Yin et al. (2021) and Jahnke (2020). These studies constitute the basic knowledge structure of the field by being at the centre of the network with high connection strength. However, more recent studies, such as Carter and Youssef-Morgan (2022) and Gerbaudo et al. (2021), play a bridging role between different clusters, indicating that micro learning research is diversifying around new thematic orientations. Overall, the map reveals that the micro learning literature exhibits a dynamic structure with both a stable core based on foundational studies and emerging subfields of research.

### Bibliographic Coupling and Organizations Map

Bibliographic coupling-organization analysis reveals the information proximity between scientific organizations, such as universities, institutes, and research centers, based on the condition that publications on micro learning from these organizations cite the same references. Within the scope of this analysis, the minimum number of documents for an organization to be included in the network structure was determined as 1 and the minimum number of citations as 1. In line with these thresholds, 166 of the 219 organizations in the dataset were included in the analysis. For the selected institutions, total link strength, which reflects the strength of bibliographic coupling relationships with other institutions, was calculated and institutions were included in the network structure based on this criterion. However, it was determined that not all institutions were connected to each other in the network. The largest connected component was found to consist of 135 institutions. In order to examine the relationships between institutions based on common references in a clearer and more interpretable way, the analyses were based on the largest connected component. This approach aims to reveal more clearly the collaborations and common knowledge bases concentrated at the institutional level in the field of micro learning. In this analysis, the structural relationship between micro learning studies was visualized over the common literature that micro learning studies published by these organizations. According to this, Beijing Normal University ranked first in term of both citation ( $n=286$ ) and total link strength ( $n=753$ ). In terms of document count, the University of Wollongong ( $n=6$ ) ranked first. Even though direct collaboration between different organizations could not be found, indirect scientific connections and usage practices could be revealed thanks to this analysis (Figure 7).

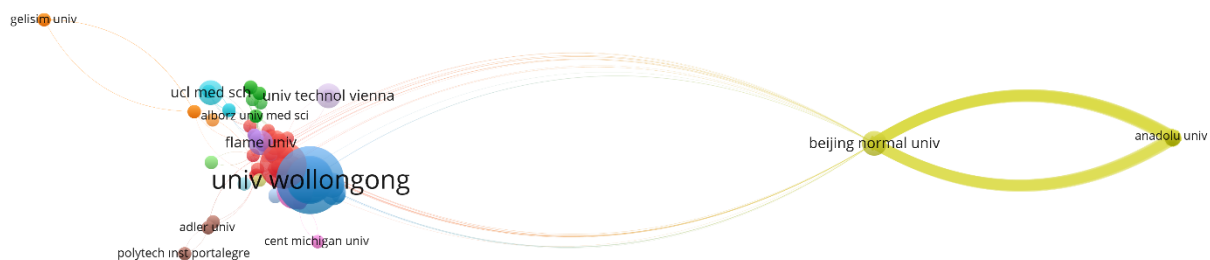


Figure 7. Bibliographic Coupling and Organizations Map

When the map is examined, research in the field of micro learning exhibits a structure concentrated around certain institutions. The University of Wollongong plays an important role in shaping institutional knowledge production in the field by positioning itself at the focal point of the network with its high connectivity. On the other hand, the strong bibliographic link between Beijing Normal University and Anadolu University shows that geographically distant institutions develop common research orientations through similar theoretical and thematic references. This view reveals that micro learning studies have a research network that diversifies and expands through international interactions rather than being monocentric at the institutional level.

### Co-citation and Cited Authors Map

With co-citation – cited authors analysis, the intellectual relationship network between authors who are frequently mentioned together (that is, cited in the same document) was revealed. Influential authors on

micro learning and the clusters they form could be visualized through this analysis. Co-citation was chosen as the type of analysis, and cited authors as the unit of analysis. The full counting method was adopted as the counting method and the citations received by each author were evaluated with equal weight. The minimum number of citations for an author to be included in the analysis was set as 5. In line with this threshold, 41 of the 2919 authors in the dataset were included in the analysis. The obtained network structure shows that the intellectual structure and theoretical interactions in the field of micro learning are clustered around certain authors. In addition, it was taken into consideration that only the first authors of the cited studies were taken into consideration in the co-citation analyses due to the Web of Science data structure, and the results of the analysis were interpreted within the framework of this limitation. During the analysis, it was determined that an author has at least 5 citations, and only 41 out of 2919 authors could pass this threshold. In this context, the author Hug, T ranked first with 37 citations and 273 total link strength (Figure 8).

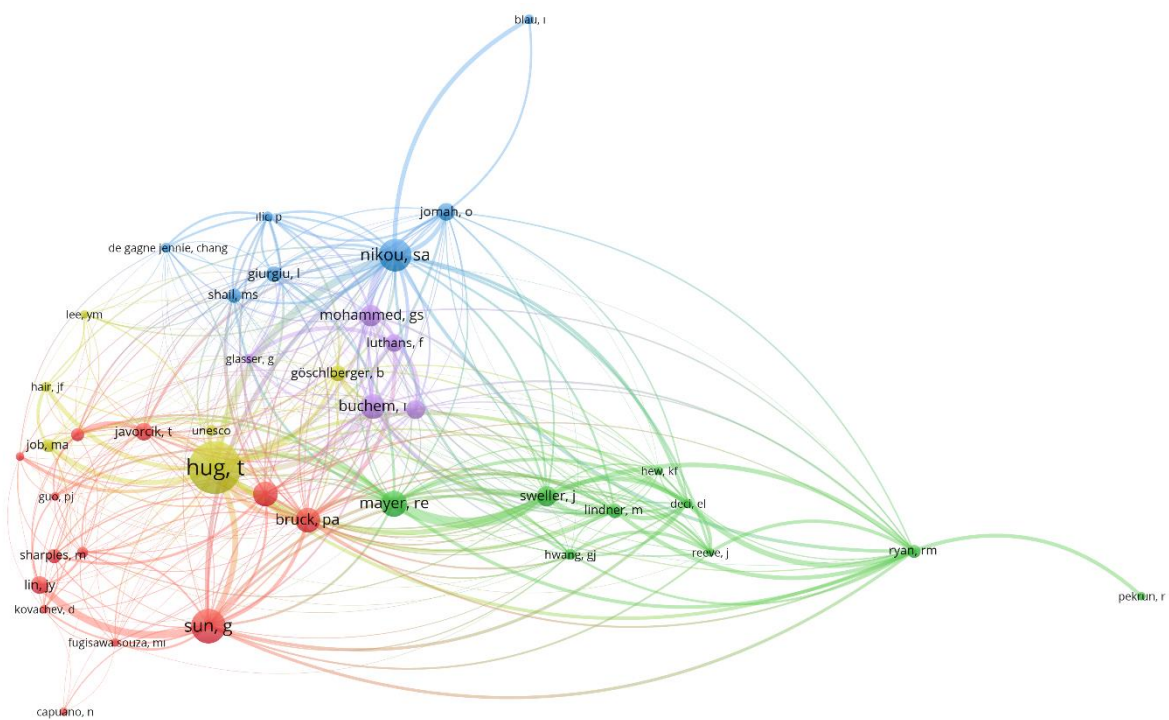


Figure 8. Co-citation and Cited Authors Map

When the co-citation and cited authors map is examined, it is seen that the theoretical and conceptual foundations in the field of micro learning are centred around specific authors such as Hug, T., Sun, G., and Nikou, S.A.. These authors constitute the intellectual core of the field by being positioned at the centre of the network with high co-attribution values. The clusters represented by different colours on the map show that the pedagogical, technological and theoretical dimensions of micro learning have developed around subfields that complement each other but are based on different research traditions. In addition, the dense connections between clusters reveal that interdisciplinary interaction is strong in the micro learning literature and that the field exhibits a theoretically integrated structure.

### Discussion, Conclusion, and Suggestions

The aim of this study is to reveal the trends, development trajectories and structural features of the scientific production on micro learning by analyzing the academic publications on micro learning through bibliometric mapping methods. Thus, it aims to examine the current state of research on micro learning in the literature from a holistic perspective. Meanwhile, it was aimed that the results of the

study provide guidance for future research. According to the findings obtained from the bibliometrical analysis in this study, the period between 2016 and 2020 was the period with the highest number of publications on micro learning. According to the research shown on Table 2, it can be said that there was an increasing trend since 2014. However, similar to the findings in this study, there is also a study indicating that the number of publications declined in 2024 (Chamorro-Atalaya et al., 2024). When Table 2 is examined, it can be seen that the numbers are in a declining trend since 2020. After 2020, the relative decline in the number of publications on micro learning may be related to the fact that micro learning has become an integrated concept within broader digital learning approaches rather than the loss of importance of the field. In particular, the prominence of meta-concepts such as mobile learning, online learning, and AI-supported learning environments may have led micro learning to be considered as a component of these approaches rather than as an independent research focus. This situation suggests that micro learning has moved to a more mature and integrated research phase rather than a decrease in its pedagogical value.

As far as the countries that publish the most on micro learning are concerned, the USA, China, Germany, Australia, and the UK stand out. Therefore, it can be said that these countries make a significant contribution to the literature on micro learning. According to the findings of this study, China, Spain, and India are the countries that have the highest total connection strength in terms of collaboration. However, according to the study by Pham et al. (2024), these three countries are the USA, China, and Australia. As far as results by Samala et al. (2023) are concerned, China and Australia are the countries that collaborate the most. China's central position in co-authorship networks can be attributed to the country's increasing institutional investment in educational technologies and national policies supporting digital transformation in higher education. The intense academic interaction between the USA and China brings together different academic traditions in the fields of learning sciences and instructional technologies. This cooperation dynamic shows that micro learning research is shaped not only regionally but also globally, and knowledge production is increasingly taking place through international partnerships.

While Beijing Normal University is the organization that rose to prominence in this study, the Delft University of Technology in the Netherlands was the university that stood out in the study of Leong et al. (2020). According to Samala et al. (2023), Wollongong University is the organization that published the most documents related to micro learning. Following it come Coventry University, Henan University of Science and Technology, and Shanghai Medical and Health Sciences University, respectively. The reason behind the difference in findings may be due to the fact that different databases and different year ranges were selected. These differences reveal that the results of bibliometric analyses are context sensitive and may vary according to the database used, time period and inclusion criteria. However, the diversification of the institutions featured in different studies shows that micro learning research is not limited to a specific geography or institutional structure. On the contrary, it can be stated that it exhibits a multi-centred development on a global scale. The fact that especially higher education, health and technology-oriented institutions come to the fore in micro learning studies suggests that this approach has an interdisciplinary application area. The findings obtained in this context indicate that micro learning research exhibits a dynamic and variable structure at the institutional level and that new centres may emerge in different academic ecosystems in the future.

The terms micro learning and e-learning gain prominence both in this study and that of Judijanto (2025). According to Samala et al. (2023), the most frequently used keywords are micro learning, e-learning, and mobile learning. According to Chamorro-Atalaya et al. (2024), the most frequently used keyword was e-learning when synonyms for micro learning were excluded. The terms with the highest connection strength were e-learning, students, and teaching, respectively. The fact that micro learning is frequently discussed together with e-learning, mobile learning and higher education in keyword analyses indicates that this approach is pedagogically flexible, learner-centred and compatible with digital environments. This finding supports that micro learning offers an effective teaching strategy in contexts where learners need short-term but goal-oriented learning experiences in line with cognitive load theory and self-regulated learning approaches. Therefore, micro learning should be considered not only as a content chunking technique but also as an approach that supports meaningful learning when integrated with pedagogical design principles.

According to Samala et al. (2023), the article “Mobile-based micro-learning and assessment: Impact on learning performance and motivation of high school students” by Nikou and Economides (2018) is the most cited article worldwide with a total of 69 citations. While Sun, G. is the most prolific author with 12 publications, the author was followed by Cui T. and Shen J. with 11 publications. Sun, G. is the most cited author with 120 citations. Following Sun, Cui, T and Shen, J. are the most cited authors with 118 citations. In the study of Chamorro-Atalaya et al. (2024), it was determined that the most influential studies in the field of micro learning were conducted by Aguilera-Hermida et al. (2021) and Díaz Redondo et al. (2021). The study by Aguilera-Hermida et al. (2021) received 5.29 times more citations than the average number of citations in this field. This ratio for Díaz Redondo et al. (2021) is 4.18. In another study, the most prolific authors in terms of total citation count were Bruck, P.A., Zhang Y., and Skalla, J, respectively. These findings show that studies and authors who have made an impact in the field of micro learning stand out not only with the number of publications they made but also with their pedagogical focus and contextual contributions to the domain. In particular, Nikou and Economides' (2018) study focuses on both learning performance and motivation dimensions may have contributed to its central position in the literature in terms of directly addressing the pedagogical effectiveness of micro learning. Similarly, the above-average citation rate of the studies by Aguilera-Hermida et al. (2021) and Díaz Redondo et al. (2021) suggests that the integration of micro learning into the digital and online learning environments has increased the visibility and impact in the field.

On the other hand, the fact that authors such as Sun, Cui, and Shen stand out in terms of both productivity and citation level indicates that continuous research programmes and specific academic networks have been formed in micro learning research. This situation shows that the development of the field is shaped by long-term and systematic research, rather than individual studies. Therefore, it can be said that the influential studies in the micro learning literature are centred around research that establishes strong links with pedagogical theories, presents experimental findings, and contributes directly to digital learning contexts.

In conclusion, this bibliometric review shows that micro learning has evolved beyond being an emerging trend on a global scale into a research field structured around specific countries, institutions and research networks. Bibliographic coupling and organization map analyses show that the development of micro learning research is closely related not only to individual academic interest but also to national digitalisation policies, institutional research capacity and international collaboration dynamics. Keyword co-occurrences and citation-based analyses reveal that micro learning is not treated as a standalone teaching approach, but rather has developed in an integrated approach with broader digital learning paradigms such as e-learning, mobile learning, instructional design and learner autonomy. However, the findings show that the theoretical underpinnings of micro learning are mostly implicitly addressed, and frameworks such as cognitive load theory, self-regulated learning and lifelong learning are not systematically used as an explicit pedagogical model in many studies. In addition, the distribution of publication types shows that the field is largely paper-based, indicating that micro learning is still in the process of maturing conceptually and methodologically. In this context, micro learning research needs to be developed in the future with studies that are grounded in strong pedagogical theories, include interdisciplinary approaches, and are comparatively examined in different learning contexts, rather than focusing only on technological innovations. Overall, this study presents the current state of the micro learning field in a holistic manner and provides a concrete roadmap for strengthening the theoretical depth and research orientations of the field.

### **Suggestions**

This study presents a general framework for the field by revealing the trends in scientific publications in the field of micro learning using bibliometric mapping methods. However, the findings show that micro learning is still a developing field and that it has many dimensions that require in-depth analysis. Accordingly, future studies should take these different dimensions into account. Above all, it is of great importance to increase the number of experimental research that reveal the effects of micro learning. A comparative study focusing on micro learning applications across different age groups can provide insights into the groups for which this approach is most effective. Such practice-based studies will reveal the pedagogical and androgogical effects of micro learning with clearer data. Furthermore, it is a requirement to test the long-term effects of micro learning in terms of language learning through

experimental methods. Although it is reported in the literature that micro learning has short-term positive effects on micro learning, the sustainability and permanence of these effects remain uncertain. Therefore, research based on follow up studies is recommended. While a general bibliometric analysis was carried out in this study, it is also significant to deepen the knowledge on micro learning through specific subfields. In particular, by making bibliometric analyses where micro learning can be used intensively, such as mobile learning, health education, and institutional training, research trends can be revealed in these fields in more detail. Through this, practice forms and effects of micro learning on different disciplines will be more apparent.

When evaluated in the context of teacher education, these findings suggest that micro learning can be used as an effective supportive tool, especially in the development of digital pedagogical competencies, course design, and technology integration processes. The use of micro learning-based content in teacher training programmes can contribute to the development of prospective teachers' self-regulation skills through short, goal-oriented, and flexible learning experiences.

In the context of corporate training and in-service training, it can be put forward that micro learning offers a strategic learning approach that can support the continuous professional development of employees, thanks to its structure that reduces time and space constraints. Especially in sectors where rapid knowledge updates are required, integration of micro learning applications with performance support systems can enable learning to be adapted more effectively into business processes.

From the perspective of policymakers, the trends revealed by this study suggest that digital learning policies should focus not only on technological infrastructure but also on pedagogically based micro learning models. Considering micro learning within the scope of lifelong learning and continuous professional development policies can contribute to the creation of flexible and inclusive learning ecosystems. With regards to this, it is recommended that policy-level arrangements should be made for micro learning practices in terms of quality assurance, standardization, and effectiveness monitoring.

In future studies, it is recommended that more comprehensive bibliometric mapping be conducted, not only on the Web of Science but also by including different databases like Scopus and ProQuest. Field based studies should be conducted in fields like engineering and medicine, where micro learning is used outside the field of education. It is recommended that research be conducted on micro learning using not only bibliometric mapping but also similar methods such as systematic reviews and meta-analyses, and that the findings be compared. Also, qualitative studies focusing on content analysis should be conducted in order to support this study which maps quantitative data. Finally, potential international partnership research opportunities on micro learning should be evaluated by examining the collaboration networks at the author, institution, and country levels that emerged in this study.

### **Limitations of the Study**

This study has some limitations. In the first place, the concept of micro learning has not yet been defined clearly in the literature (Mohammed et al., 2018). The relative novelty of the concept may lead to it being approached in different ways across different disciplines. This situation causes various difficulties, particularly in creating the conceptual framework and in the analysis of the literature. The majority of the studies on micro learning have not been grounded on a common conceptual base; instead, the concept is sometimes used in different contexts and with different connotations. Therefore, the definition of micro learning used in this study was structured on certain assumptions.

In the second place, during the data collection process, a literature review based on the database of Web of Science was conducted. As a result of the review in this database, it was observed that a small number of publications on micro learning came from non-education related disciplines. Moreover, although several international databases such as Scopus, Dimensions, Lens, and PubMed are available, the present study is limited to the Web of Science database due to technical and structural differences in metadata formats, citation structures, and data export schemes across databases, which constrain the integration of multiple sources within a single VOSviewer-based bibliometric analysis. In terms of software, the fact that alternative maps from other bibliometric mapping tools like Bibliometrix and CiteSpace could not be generated except for the ones from VOSviewer can also be seen as a limitation. Methodologically,

since the bibliometric mapping depends on the analysis of publications through quantitative data, qualitative features, depth of contents, educational contributions or application processes of these publications are not evaluated. Finally, this bibliometric mapping study is limited to 139 publications on micro learning published between 2015 and 2025.

### **Acknowledgment**

**Copyrights:** The works published in the e-Kafkas Journal of Educational Research are licensed under a Creative Commons Attribution-Non-commercial 4.0 International License.

**Ethics statement:** In this study, we declare that the rules stated in the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with and that we do not take any of the actions based on "Actions Against Scientific Research and Publication Ethics". At the same time, we declare that there is no conflict of interest between the authors, which all authors contribute to the study, and that all the responsibility belongs to the article authors in case of all ethical violations.

**Author Contributions:** Conceptualization, methodology, data collection, validation, formal analysis, and supervision: H.A.; validation, writing – review and editing: L.C.Y.; validation, writing – original draft: E.K.

**Funding:** This research received no funding.

**Institutional Review Board Statement:** No data were collected from human participants in this study. Since the research was conducted through bibliometric review, ethical approval was not required.

**Data Availability Statement:** The datasets used and analyzed for this bibliometric study were obtained from the Web of Science (WoS) database. As the data consist of publicly available bibliographic metadata.

**Conflict of Interest:** There is no conflict of interest.

**Informed Consent:** All participants in this study participated voluntarily and completed a consent form.

**Generative Artificial Intelligence Statement:** The AI visualization tool Napkin was used in the production of Figure 1. DeepL and Grammarly was used for language editing and proofreading. No other generative AI tools were used in the preparation of this manuscript. The authors declare that all content presented in the manuscript was not generated by artificial intelligence and take full responsibility for its accuracy, interpretation, and scientific integrity.

## References

- Aguilera-Hermida, A. P., Quiroga-Garza, A., Gómez-Mendoza, S., Del Río Villanueva, C. A., Avolio Alecchi, B., & Avci, D. (2021). Comparison of students' use and acceptance of emergency online learning due to covid-19 in the USA, Mexico, Peru, and Turkey. *Education and Information Technologies*, 26(6), 6823-6845. <https://doi.org/10.1007/s10639-021-10473-8>
- Alias, N. F., & Razak, R. A. (2023). Exploring the pedagogical aspects of microlearning in educational settings: A systematic literature review. *Malaysian Journal of Learning and Instruction*, 20(2), 267-294. <https://doi.org/10.32890/mjli2023.20.2.3>
- Alias, N. F., & Razak, R. A. (2025). Revolutionizing learning in the digital age: A systematic literature review of microlearning strategies. *Interactive Learning Environments*, 33(1), 1-21. <https://doi.org/10.1080/10494820.2024.2331638>
- Boumalek, K., Bakki, A., El Mezouary, A., Hmedna, B., & Eddahibi, M. (2025). Micro-learning design and micro-course structuring: A systematic literature review. *Interactive Learning Environments*, 1-27. <https://doi.org/10.1080/10494820.2025.2545955>
- Carter, J. W., & Youssef-Morgan, C. (2022). Psychological capital development effectiveness of face-to-face, online, and micro-learning interventions. *Education and Information Technologies*, 27(5), 6553-6575. <https://doi.org/10.1007/s10639-021-10824-5>
- Chai-Arayalert, S., & Puttinaovarat, S. (2020). Designing mangrove ecology self-learning application based on a micro-learning approach. *International Journal of Emerging Technologies in Learning (IJET)*, 15(11), 29-41. <https://www.learntechlib.org/p/217112/>
- Chamorro-Atalaya, O., Flores-Velásquez, C. H., Olivares-Zegarra, S., Dávila-Ignacio, C., Flores-Cáceres, R., Arévalo-Tuesta, J. A., Cruz-Telada, Y., & Suarez-Bazalar, R. (2024). Microlearning and nanolearning in higher education: A bibliometric review to identify thematic prevalence in the COVID-19 pandemic and post-pandemic context. *International Journal of Learning, Teaching and Educational Research*, 23(4), 279-297. <https://doi.org/10.26803/ijlter.23.4.15>
- Chen, C. (2017). Science mapping: A systematic review of the literature. *Journal of Data and Information Science*, 2(2), 1-40. <https://doi.org/10.1515/jdis-2017-0006>
- Cronin, J., & Durham, M. L. (2024). Microlearning: A concept analysis. *CIN: Computers, Informatics, Nursing*, 42(6), 413-420. <https://doi.org/10.1097/CIN.0000000000001122>
- Dereli, A. B. (2024). Vosviewer ile bibliyometrik analiz. *Communicata*, 2024(28), 1-7. <https://doi.org/10.32952/communicata.1517725>
- Díaz Redondo, R. P., Caeiro Rodríguez, M., López Escobar, J. J., & Fernández Vilas, A. (2021). Integrating micro-learning content in traditional e-learning platforms. *Multimedia Tools and Applications*, 80, 3121-3151. <https://doi.org/10.1007/s11042-020-09523-z>
- Gerbaudo, R., Gaspar, R., & Gonçalves Lins, R. (2021). Novel online video model for learning information technology based on micro learning and multimedia micro content. *Education and Information Technologies*, 26(5), 5637-5665. <https://doi.org/10.1007/s10639-021-10537-9>
- Jahnke, I., Yen-Mei, L., Minh, P., He, H., & Austin, L. (2020). Unpacking the inherent design principles of mobile microlearning. *Technology, Knowledge and Learning*, 25(3), 585-619. <https://doi.org/10.1007/s10758-019-09413-w>
- Judijanto, L. (2025). Exploring the role of microlearning in lifelong learning: A bibliometric review. *The Eastasouth Journal of Learning and Educations*, 3(1), 42-55. <https://doi.org/10.58812/esle.v3i01.497>
- Khong, H. K., & Kabilan, M. K. (2022). A theoretical model of micro-learning for second language instruction. *Computer Assisted Language Learning*, 35(7), 1483-1506. <https://doi.org/10.1080/09588221.2020.1818786>

- Kukulska-Hulme, A., & Shield, L. (2008). An overview of mobile assisted language learning. *ReCALL*, 20(3), 271–289. <https://doi.org/10.1017/S0958344008000335>
- Lee, Y. M. (2023). Mobile microlearning: A systematic literature review and its implications. *Interactive Learning Environments*, 31(7), 4636-4651. <https://doi.org/10.1080/10494820.2021.1977964>
- Leong, K., Sung, A., Au, D., & Blanchard, C. (2020). A review of the trend of microlearning. *Journal of Work-Applied Management*, 13(1), 88-102. <https://doi.org/10.1108/JWAM-10-2020-0044>
- Mazohl, P. (2025). *What is micro-learning (ML)?* EPALE - Electronic Platform for Adult Learning in Europe. <https://epale.ec.europa.eu/en/blog/what-micro-learning-ml>
- Mohammed, G. S., Wakil, K., & Nawroly, S. S. (2018). The effectiveness of microlearning to improve students' learning ability. *International Journal of Educational Research Review*, 3(3), 32-38. <https://doi.org/10.24331/ijere.415824>
- Monib, W. K., Qazi, A., Apong, R. A., & Mahmud, M. M. (2024). Investigating learners' perceptions of microlearning: Factors influencing learning outcomes. *IEEE Access*, 12, 178251-178266. <https://doi.org/10.1109/ACCESS.2024.3472113>
- Monib, W. K., Qazi, A., & Apong, R. A. (2025). Microlearning beyond boundaries: A systematic review and a novel framework for improving learning outcomes. *Heliyon*, 11(2), 1-29. <https://doi.org/10.1016/j.heliyon.2024.e41413>
- Nikou, S. A., & Economides, A. A. (2018). Mobile-based micro-learning and assessment: Impact on learning performance and motivation of high school students. *Journal of Computer Assisted Learning*, 34(3), 269-278. <https://doi.org/10.1111/jcal.12240>
- Pérez-Juárez, M. Á., González-Ortega, D., & Aguiar-Pérez, J. M. (2023). Digital distractions from the point of view of higher education students. *Sustainability*, 15, 1-22. <https://doi.org/10.3390/su15076044>
- Pham, H. H., Nguyen, N. T. N., Hai, L. D., Nguyen, T. T., & Nguyen, V. A. L. (2024). Science mapping the knowledge base on microlearning: Using Scopus database between 2002 and 2021. *Journal of Research in Innovative Teaching & Learning*. 1-23. <https://doi.org/10.1108/JRIT-09-2023-0132>
- Prasittichok, P., & Smithsarakarn, P. (2024). The effects of microlearning on EFL students' English speaking: A systematic review and meta-analysis. *International Journal of Learning, Teaching and Educational Research*, 23(4), 525-546. <https://doi.org/10.26803/ijlter.23.4.27>
- Robles, H., Jimeno, M., Villalba, K., Mardini, I., Vilorio-Nuñez, C., & Florian, W. (2023). Design of a micro-learning framework and mobile application using design-based research. *PeerJ Computer Science*, 9, 1-31. <https://doi.org/10.7717/peerj-cs.1223>
- Samala, A. D., Bojic, L., Bekiroğlu, D., Watrionthos, R., & Hendriyani, Y. (2023). Microlearning: Transforming education with bite-sized learning on the go—insights and applications. *International Journal of Interactive Mobile Technologies (iJIM)*, 17(21), 4-24. <https://doi.org/10.3991/ijim.v17i21.42951>
- Sankaranarayanan, R., Leung, J., Abramenka-Lachheb, V., Seo, G., & Lachheb, A. (2023). Microlearning in diverse contexts: A bibliometric analysis. *TechTrends*, 67(2), 260-276. <https://doi.org/10.1007/s11528-022-00794-x>
- Shail, M. S. (2019). Using micro-learning on mobile applications to increase knowledge retention and work performance: A review of literature. *Cureus*, 11(8), 1-7. <https://doi.org/10.7759/cureus.5307>
- Silva, E. S., Costa, W. P. d., Lima, J. C. d., & Ferreira, J. C. (2025). Contribution of microlearning in basic education: A systematic review. *Education Sciences*, 15(3), 1-20. <https://doi.org/10.3390/educsci15030302>

- Wang, C., Bakhet, M., Roberts, D., Gnani, S., & El-Osta, A. (2020). The efficacy of microlearning in improving self-care capability: A systematic review of the literature. *Public Health, 186*, 286-296. <https://doi.org/10.1016/j.puhe.2020.07.007>
- Yin, J., Goh, T. T., Yang, B., & Xiaobin, Y. (2021). Conversation technology with micro-learning: The impact of chatbot-based learning on students' learning motivation and performance. *Journal of Educational Computing Research, 59*(1), 154-177. <https://doi.org/10.1177/0735633120952067>
- Zhu, B., Chau, K. T., & Mokmin, N. A. M. (2024). Optimizing cognitive load and learning adaptability with adaptive microlearning for in-service personnel. *Scientific Reports, 14*(1), 1-18. <https://doi.org/10.1038/s41598-024-77122-1>