



Digital Media for Beginning Reading in Elementary Schools: A Bibliometric Analysis

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Abstract

Background: With advancements in educational technology and 21st-century literacy demands, research on digital media development for beginning reading instruction in elementary schools has increased.

Objective: This bibliometric study aims to trace the trends, publications, and progress of topics in research on the use of digital media in early literacy instruction.

Methods: Research data were collected from international scientific databases containing articles on reading literacy, digital media, and elementary education within a specific time frame. A total of 1,436 articles were retrieved from the Scopus database (2010–2025) using standardized search strings and PRISMA-based screening. The analysis was conducted using bibliometric methods with the assistance of scientific mapping software to identify the number of publications, most productive authors, influential journals, as well as collaboration networks and keyword occurrences.

Results: The results show a substantial increase in research on reading literacy and digital media over the past decade, with a subsequent surge at its peak after application-based learning technologies, e-books, and interactive multimedia were widely introduced. The most frequently appearing keywords include digital literacy, emergent literacy, interactive reading, and educational technology.

Conclusion: This demonstrates that the integration of digital media has become an important focus in supporting early reading skills in elementary school students. Furthermore, the keyword co-occurrence map indicates a strong relationship between the use of digital technology, the development of literacy skills, and innovations in learning methods.

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INTRODUCTION

Beginning reading ability is a fundamental skill that is very important for elementary school students because it serves as the foundation for the development of literacy skills at subsequent educational levels (Center, 2020). Beginning reading is not only related to the ability to recognize letters and words, but also includes understanding meaning, vocabulary development, and the ability to think critically about the text being read (Fahmiyah et al., 2025; Lane et al., 2025). At the early stages of elementary education, good reading ability will help students understand various subjects and improve the overall quality of learning. Therefore, the development of effective learning strategies and media to support beginning reading skills has

become an important concern in the world of education (Lan S Yu, 2022).

Along with the development of information and communication technology, the use of digital media in learning is increasing. Digital media such as e-books, learning applications, interactive multimedia, and online learning platforms provide new opportunities to improve the quality of reading instruction in elementary schools (Ready et al., 2026; Schotter S Dillon, 2025). These media are able to present material visually, audibly, and interactively so as to increase student motivation and engagement in the learning process. Research shows that the integration of digital technology in elementary education can provide a more engaging and effective learning experience, particularly in the development of reading literacy in early childhood and elementary school students (Boateng et al., 2024; Li et al., 2024).

Furthermore, the development of digital literacy has also become one of the key competencies in the era of 21st-century education (Khan et al., 2022). Digital literacy is not only related to the ability to use technological devices, but also includes the ability to understand, evaluate, and utilize information from various digital media critically. However, a series of studies have reported that well-designed digital media for reading instruction could promote literacy acquisition, increase access to learning resources, and facilitate more innovative solutions through more flexible processes (Wang S Si, 2023; Wu et al., 2025).

More recently, research and studies on reading literacy involving the use of digital media have increased. The growing number of scientific publications focused on technology integration in content areas such as reading instruction at the elementary education level is a demonstration of this. Bibliometric analyses indicate that in recent years, digital literacy, interactive learning, digital reading, and educational technologies are emerging as the focus areas in contemporary education research (Apriwulan et al., 2025; Oktarina et al., 2025). The bibliometric method helps researchers systematically identify research trends, collaboration patterns in the scientific community, and the development of research topics in a field (Donthu et al., 2021).

The present study investigates pedagogical and structural factors associated with the use of digital media in teaching beginning reading. There is a digitized access disparity in that not all elementary school students receive quality digital tools and internet connectivity, which affects the outcomes of digital reading instruments (Boateng et al., 2024). Another concern is teacher readiness; many elementary school teachers do not have the digital competencies needed to successfully implement and assess the use of digital reading media in classrooms. The pedagogical appropriateness of current digital media formats (e-books, apps, interactive multimedia) for young children has not adequately addressed the cognitive and developmental needs typically associated with beginning readers (ages 6–8). These specific issues define the urgency and scope of the bibliometric analysis presented in this study.

Previous research has presented comparative reviews. Lan (2022) described a 14-year bibliometric review of reading literacy broadly, without narrowing trends within elementary education or digital media. Although Wang (2023) investigated digital literacy across educational levels for the years 1990–2022, including COVID-19 as a major inflection point, they broadly excluded early reading contexts predating the digital era. Li (2024) investigated online reading bibliometrically, but included secondary and tertiary learners, thus omitting the distinct developmental needs of early elementary readers.

Boateng (2024) reviewed educational technologies dedicated to elementary education but were not driven by a specific pedagogical domain—in this case, beginning reading. Yu (2025) examined digital reading from a bibliometrics-based perspective that focused on user behavior rather than instructional media design. By comparison, the current study focuses on digital media for foundational reading (phonics, emergent literacy, and early decoding) in elementary schools—a focus that has not been systematically examined in any existing bibliometric work across these subfields.

Unlike previous bibliometric studies focused on digital literacy or educational technology broadly, the present study addresses a distinct research subfield: the use of digital media for elementary students' reading and writing during the initial period of literacy development. It outlines a distinct thematic structure and publication trajectory by concentrating on 2020–2025 to reflect cutting-edge developments that earlier reviews were ill-equipped to capture—such as the acceleration in use driven by COVID-19's impact on education—as well as the growing

integration of AI-based tools into classroom practices.

Although recent literature has addressed a wide range of topics related to the association between digital media and literacy instruction, systematic bibliometric mapping of research on digital media for beginning reading instruction (including phonics, emergent literacy, and decoding skills) in elementary schools (ages 6–8) is still lacking. To the best of our knowledge, while existing bibliometric reviews either cover digital literacy in a broader sense (across age groups and subjects) or educational technology in elementary school (across subjects), none has specifically and solely explored this research space on digital media and beginning reading. This gap is the main reason for the current study.

From this context emerges the need to conduct a bibliometric study on the development of digital media for beginning reading in elementary schools. The purpose of the current study is to map research developments, publication trends, and prominent topics in research on digital media and early literacy. This research is expected to provide an overview of the direction of research development and serve as a reference for developing more innovative and effective digital learning media to improve beginning reading ability among elementary school students.

METHOD

The bibliometric method was utilized to analyze the development of digital media in terms of beginning reading within elementary schools in this study. Data were gathered from different materials, including journal articles, conference papers, and research reports published within the range of 2020 to 2026. Data were acquired from academic databases such as Scopus. This review included articles focusing on the use of digital media in reading instruction, as well as research examining their efficacy in enhancing reading skills.

Pacheco (2025) state corresponding methodological considerations for applying the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol in education-based systematic reviews. These modifications are needed in order to recognize the differences between qualitative and quantitative data specific to pedagogical research, making the literature selection and synthesis process more iterative and scientifically defensible. These adapted guidelines expect educational researchers to adhere to stricter reporting procedures in order to decrease bias and increase the generalizability of findings from prior research metadata.

Data collection was performed through a document review with the keywords "digital media," "beginning reading," "elementary school," and "educational technology." Subsequently, all selected articles were explored to highlight the major themes, techniques employed, and outcomes generated. The review considered both the method and methodology, including research design and the instruments used to measure student learning outcomes of the studies analyzed.

Data analysis was conducted using bibliometric software tools, such as VOSviewer and Biblioshiny, which comprehensively visualize different topic trends in research across years, author collaborations, and publication distribution (Van Eck S Waltman, 2019). Citation analysis was also conducted to extract the most contributing articles in this area. This strategy allows for a full overview of the development of digital media use in early reading in elementary schools.

For the assurance of data validity and reliability, the researchers carried out source triangulation by cross-comparing results from different databases, whereas a stringent peer-review evaluation ensured that all of the analyzed articles were as reliable as possible. Qualitative content analysis of the articles was also carried out to facilitate understanding of the context and the interpretation related to reported results. Therefore, the approach employed in this research is anticipated to generate a comprehensive understanding of the clear importance of digital media for early reading in elementary schools.

According to Kuzior (2022), VOSviewer is used as a bibliometric mapping tool to visualize the global scientific landscape and identify trends in the development of publications in a research field comprehensively. This software functions to group keywords into various topic clusters to determine the areas dominating the literature, while simultaneously mapping the structure of relationships and collaborations among researchers worldwide. Furthermore, the utilization of VOSviewer is crucial for researchers to identify research gaps that have not been extensively explored, thus providing strategic guidance for the development of future studies.

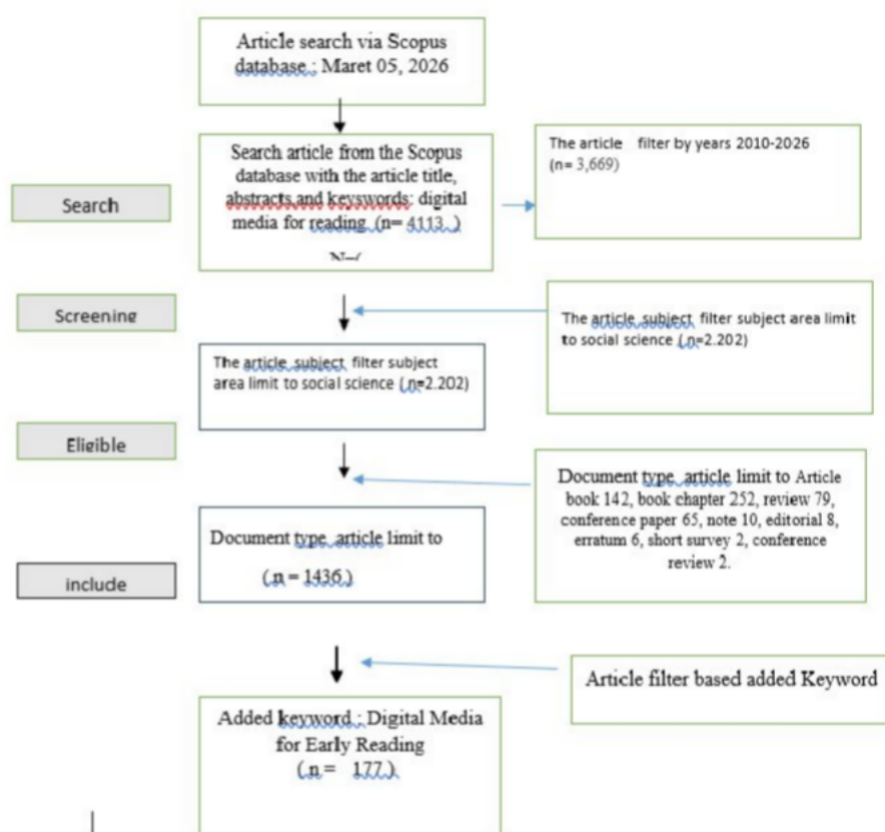


Figure 1. Digital Media and Early Reading publication
Source: Personal Data

Based on the development of educational technology and the increasing need for digital media in teaching beginning reading in elementary schools, bibliometric research is necessary to map the research trends that have been conducted by researchers. Digital media such as e-books, flipbooks, reading applications, and interactive multimedia are increasingly being developed to improve students' basic literacy skills. However, not much research has specifically mapped the development of scientific publications related to this topic systematically.

RESULTS AND DISCUSSION

Results

The publication trend reveals a non-linear pattern; the increase in publications over time is non-linear and warrants substantive academic analysis beyond merely reporting numbers in a table. The peak in 2018, following five years of steady growth (2013–2018), corresponds to the international surge in tablet-based educational applications and Bring Your Own Device (BYOD) initiatives in schools. The renewed interest observed in 2020 was attributable to the mandatory adoption of distance learning technologies prompted by COVID-19. The trough in publications for 2023 indicates an ongoing consolidation phase, which is a common bibliometric pattern following rapid initial growth — one that moderates as methodological refinements occur and quality thresholds are established. Analytically, the 2025 spike is significant: it coincides precisely with the period in which AI-based adaptive reading platforms entered the mainstream.

Research Publication Trends

Based on data retrieved through keyword searches conducted in the Scopus database during the 2020–2025 period, several scientific articles were identified using referenced

keywords. The results of the analysis indicate that the number of publications on the development of digital media for beginning reading has grown at a fairly rapid rate each year. A growing number of both international and national publications demonstrates that the theme of developing digital media in early literacy learning is becoming increasingly relevant within the educational research landscape. This is consistent with the accelerated development of educational technology and the emerging demand for learning innovations aimed at improving the literacy skills of students. Research by Maureen (2018) demonstrates that interactive digital media in reading instruction can make a meaningful difference, showing that students are able to improve their early literacy skills when using interactive digital media designed specifically for learning purposes. Digital media can not only be more engaging, but it also fosters independent, self-directed learning.

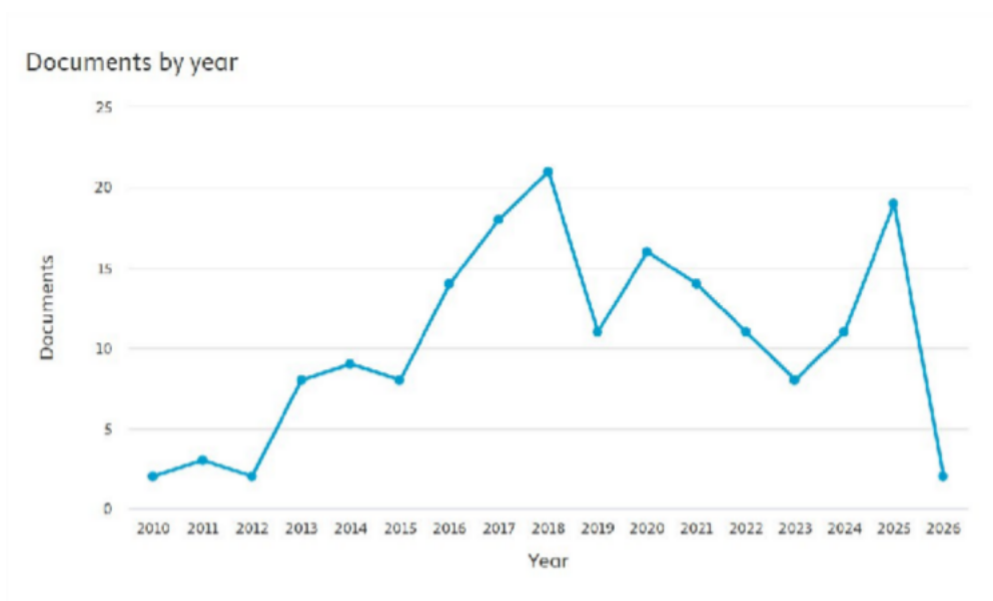


Figure 2. Digital Media and Early Reading publication
Source: Scopus database

Discussion

The graph shows the publication trend regarding "Development of Digital Media for Beginning Reading" from 2010 to early 2026. Overall, this topic has experienced fluctuations but shows a significant growth trend in the last decade. The following is a detailed reading of the graph:

1. Initial Phase (2010–2012)

In this period, publication interest was very low and stagnant, with the number of documents below 5 per year. This indicates that digital media for beginning reading was not yet a major research focus at that time.

2. Rapid Growth (2013–2018)

There was a fairly consistent increase starting in 2013. The peak was in 2018 with a total of 21 documents, which was the highest number throughout the observation period. This surge was likely triggered by the massive digitalization of education and the development of tablets/smartphones.

3. Decline and Fluctuation (2019–2023)

a) 2019: There was a sharp decline to 11 documents.

b) 2020: It rose again to 16 (possibly the impact of the COVID-19 pandemic which forced a shift to digital media).

c) 2021–2023: Experienced a consecutive downward trend, reaching the lowest point in the last 10 years in 2023 with 8 documents.

4. Resurgence (2024–2025)

There was a significant surge in 2025 with 19 documents. This indicates a strong new interest, possibly related to the integration of AI (Artificial Intelligence) or more sophisticated interactive technologies in reading learning media.

5. 2026 Data

The number drops drastically to 2 documents in 2026. However, it should be noted that because it is still early 2026, this data is not yet final and will likely continue to increase as the year progresses.

The topic of developing digital media for beginning reading is dynamic. Although it declined in 2023, the surge in 2025 proves that this topic is still highly relevant and has great research potential in the future.

Keyword Co-occurrence Network Visualization

Co-occurrence keywords analysis using VOSviewer software shows that there are several main keyword clusters that are interconnected in research on digital media for beginning reading. Some of the most frequently appearing keywords include: early literacy, digital learning, reading skills, educational technology, and elementary education.

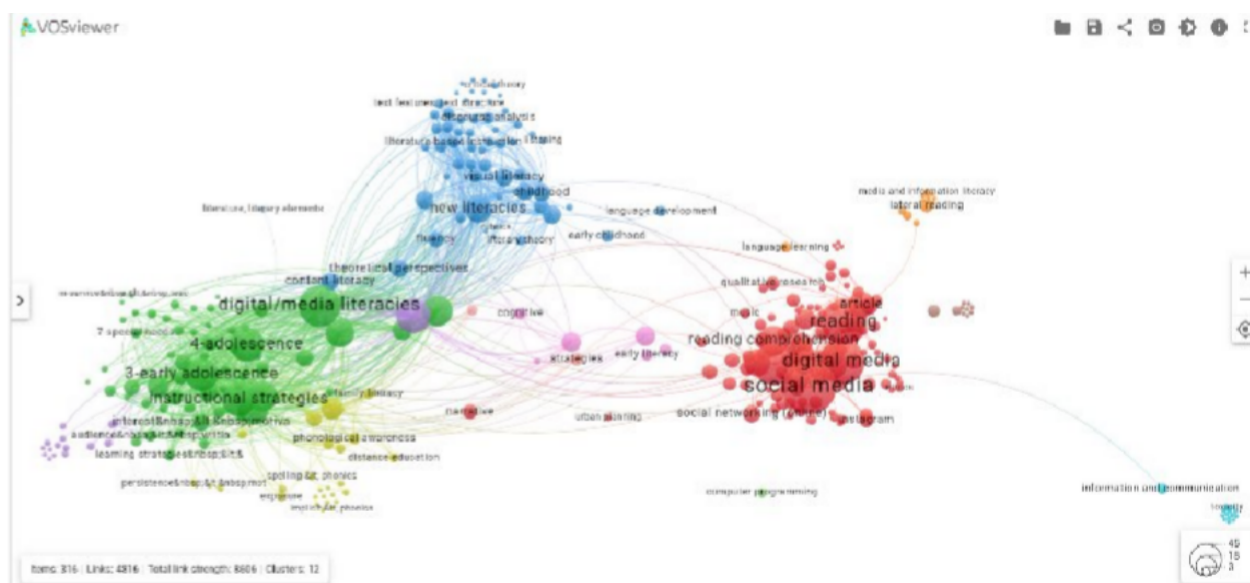


Figure 3. Analysis by keyword
Source: Vosviewer database

Based on the VOSviewer visualization you uploaded, the following is an analysis of the keyword mapping on the topic of Developing Digital Media for Beginning Reading:

- 1) Mapping Structure (Network Visualization): Overall, there are 316 keyword items divided into 12 color clusters. This shows that this research topic has a very broad and multidisciplinary scope, ranging from aspects of literacy, developmental psychology, to media technology.
- 2) Dominant Clusters and Main Keywords: Based on the size of the nodes representing the frequency of occurrence, there are three main focus areas:
 - a) Red Cluster (Focus on Social Media & Digital Literacy): Dominated by keywords such as "social media", "reading", "digital media", and "reading comprehension". This indicates a shift in research focus from conventional media to interactive digital platforms and social networks (such as Instagram) in the context of reading comprehension.
 - b) Green Cluster (Focus on Learning Strategies): Focused on "instructional strategies", "digital/media literacies", and the subject "adolescence". This section emphasizes how teaching methods are integrated with technology to build literacy skills.
 - c) Blue Cluster (Focus on Literacy Foundations): Includes keywords such as "new literacies", "visual literacy", "childhood", and "discourse analysis". This is closely related to new theories about how children process visual information in the digital age.
- 3) Relevance to Beginning Reading: Although the graph shows a large focus on adolescents, there are specific areas that are highly relevant to Beginning Reading:
 - a) Light Purple/Pink Cluster: Keywords "early literacy" and "early childhood" appear. These

keywords are directly connected to "strategies" and "cognitive", indicating that research on beginning reading explores more of the cognitive aspects of children when interacting with digital media. b) Yellow Cluster (Literacy Technicalities): At the bottom, specific keywords such as "phonological awareness", "spelling S phonics", and "distance education" appear. These are core components of beginning reading which are now starting to be widely developed through distance learning systems.

- 4) Connectivity Analysis (Link Strength): The total link strength reaches 8606, indicating a very strong relationship between disciplines. For example, "digital media" has a thick connecting line to "reading comprehension", indicating that the development of digital media is currently not just a tool, but has become an integral part of how people understand text.

Research on digital media for beginning reading is currently evolving towards the use of social media and visual platforms as aids, with a strong emphasis on phonological awareness and adaptive instructional strategies for early childhood.

Author Collaboration Analysis (Co-authorship)

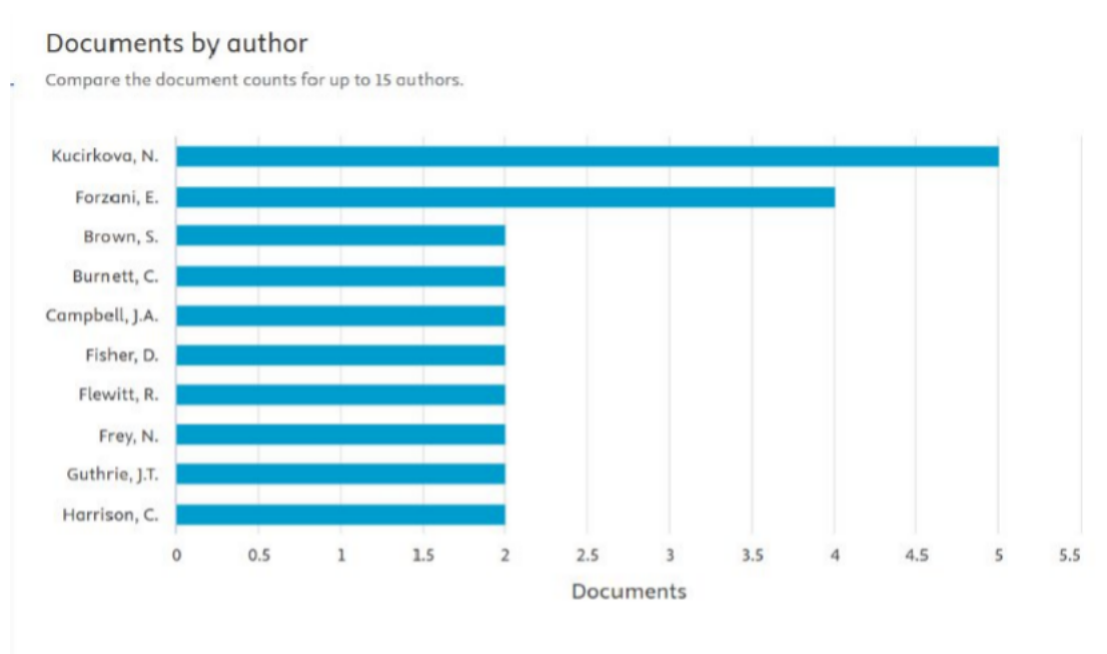


Figure 4. Analysis by author
Source: Scopus database

Based on the "Documents by Author" graph data sourced from Scopus, the following is an analysis of the most productive authors in research on the development of digital media for beginning reading:

1. Most Influential Authors (Top Authors)

There are two central figures who have a higher number of publications compared to other authors in this list: (a) Kucirkova, N. ranks first with a total of 5 documents. She is internationally recognized as an expert in early childhood digital literacy and the use of interactive e-books. (b) Forzani, E. is in second place with 4 documents. Her research focus often relates to evaluation and reading strategies in digital environments.

2. Distribution of Other Authors

Besides the two main authors above, there is a group of authors with equal productivity, each contributing 2 documents: Brown, S., Burnett, C., Campbell, J.A., Fisher, D., Flewitt, R., Frey, N., Guthrie, J.T., and Harrison, C.

3. Relationship Between Authors and Research Topics

If this author data is connected to the previous keyword analysis in the VOSviewer visualization: (a) The prominence of Kucirkova, N. is highly relevant to the emergence of

keywords "early childhood," "digital media," and "reading" in the network map. (b) The appearance of names such as Frey, N. and Fisher, D.—who frequently collaborate on instructional strategies—strengthens the presence of the green cluster on "instructional strategies" observed in the keyword mapping.

Author productivity on this topic remains relatively competitive and evenly distributed. Although Kucirkova leads, the number of documents per author—ranging from 2 to 5—indicates that this field is still wide open for new researchers to increase their publication contributions and establish themselves as emerging authorities in the development of digital media for beginning reading.

Analysis by affiliation

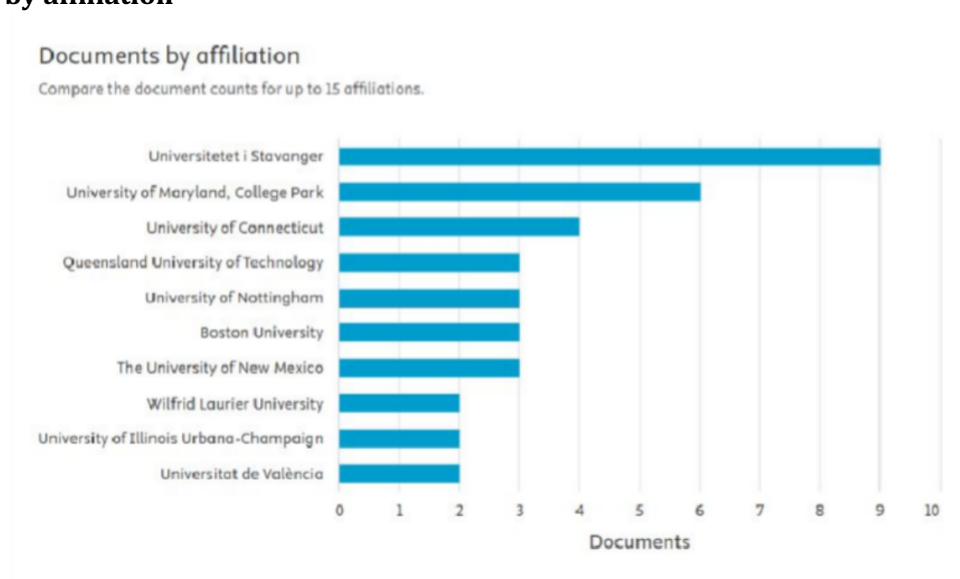


Figure 5. Analysis by Affiliation
Source: Scopus database

Based on the "Documents by Affiliation" graph data sourced from Scopus, the following is an analysis of the institutions or affiliations that contribute the most to research on the development of digital media for beginning reading.

1. Leading Research Institution

Universitetet i Stavanger (University of Stavanger) is the most dominant institution, with a total of nine documents. This indicates that the university is the primary research center for this topic, which is likely closely related to the productivity of its leading author, N. Kucirkova.

2. Contribution of Global Institutions

Several other well-known universities show significant contributions in mapping digital literacy and learning media: (a) University of Maryland, College Park ranks second with six documents; (b) University of Connecticut contributes four documents; and (c) four institutions share the same number of publications, with three documents each — namely, Queensland University of Technology, University of Nottingham, Boston University, and The University of New Mexico.

3. Distribution of Other Affiliations

This list also includes institutions with a consistent contribution of two documents each: Wilfrid Laurier University, University of Illinois Urbana-Champaign, and *Universitat de València*. The dominance of institutions from Norway (Stavanger) and the United States (Maryland, Connecticut) indicates that the research focus on developing digital media for reading is largely driven by educational standards in these developed countries. When connected to the VOSviewer analysis, these institutions are likely the primary drivers behind the "digital/media literacies" and "instructional strategies" clusters that represent major focal points in the research.

map. *Universitetet i Stavanger* is a key collaboration partner and reference point for researchers seeking to delve deeper into research on digital media for beginning reading.

According to Neumann (2020), digital technology can help students understand the relationship between letters and sounds through interactive and enjoyable learning activities. The integration of digital devices in early literacy learning allows children to explore phonics through multimedia elements such as audio, animation, and direct visual feedback. This approach not only increases students' intrinsic motivation but also strengthens their memory retention of grapheme–phoneme correspondence compared to conventional methods, which tend to be static. By actively manipulating digital symbols, students can build a stronger foundation of reading skills in a supportive and adaptive learning environment.

Analysis by territory

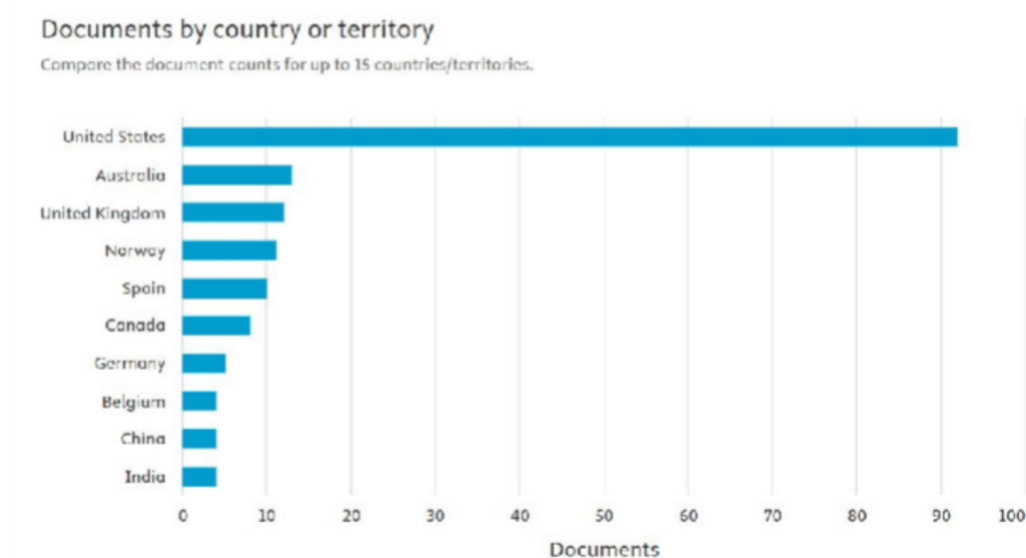


Figure 6. Analysis by Country

Source: Scopus database

Based on the "Documents by Country or Territory" graph data sourced from Scopus, the following is an analysis of the geographical distribution of publications on the topic of developing digital media for beginning reading:

1. Global Dominance: United States

The United States holds the primary position in this research area with a notably high number of publications, reaching 92 documents. This figure far exceeds the contributions of other countries, indicating that the center of innovation and development of digital learning media for reading is currently concentrated there.

2. Contributions from Other English-Speaking Countries

After the United States, several countries have made significant contributions:

- a) Australia: Ranks second with a total of 13 documents.
- b) United Kingdom: Ranks third with 12 documents.
- c) Canada: Contributes 8 documents.

3. European and Asian Representation

This research landscape is also supported by countries from other regions, with the following distribution:

- a) Europe: Norway contributes 11 documents (consistent with the prominence of the University of Stavanger), followed by Spain with 10 documents, and Germany and Belgium with 5 and 4 documents, respectively.
- b) Asia: China and India are beginning to establish their presence in this topic, each contributing 4 documents.

If this territorial data is connected to the VOSviewer keyword analysis, the dominance of Western countries (United States, United Kingdom, Australia) explains why keywords such as "social media," "new literacies," and "digital media" are highly prominent in English-language scholarship. This also reflects that the robust digital literacy trends in these countries are the primary drivers for the emergence of new research in this field.

Research on digital media for beginning reading is still heavily dominated by the United States. This opens up considerable opportunities for researchers from other regions (such as Southeast Asia or Indonesia) to conduct similar research to address local context gaps that may not be well represented in the global data.

The bibliometric findings carry several theoretically significant implications. First, the emergence of phonological awareness and phonics as core keywords in the yellow cluster confirms that digital media research on beginning reading is increasingly anchored in evidence-based reading science — consistent with the Science of Reading movement that has gained momentum in English-speaking countries since 2019. This aligns with Neumann's (2020) argument that digital technology can effectively mediate phoneme-grapheme correspondence through interactive feedback.

Second, the dominance of United States institutions (University of Maryland, University of Connecticut) reflects the concentration of research capacity in countries with strong reading policy infrastructure (e.g., the U.S. Reading Excellence Act and structured literacy mandates). In contrast, the absence of Indonesian and Southeast Asian institutions is striking given the region's scale and literacy challenges, suggesting that local researchers must prioritize bibliometric and primary research in local-language contexts. Future research should focus on experimental and longitudinal studies in non-Western contexts examining the effectiveness of culturally adapted digital beginning reading media.

CONCLUSION

Based on the results of the bibliometric analysis conducted using VOSviewer software and publication data from the Scopus database, research on the development of digital media for beginning reading in elementary schools has increased significantly in the last five years. Keyword analysis shows that the most dominant research topics relate to early literacy, digital learning, and educational technology. Furthermore, the study of interactive learning media and mobile learning has also begun to grow increasingly prominent in recent years (Xu et al., 2025).

The author collaboration analysis on the topic of digital media for beginning reading suggests that it is a major issue within the research area, and researchers from different regions collaborate globally. Limitation: This study is restricted to publications in the English language and indexed by Scopus, meaning that relevant articles could potentially be missing from non-English papers or research conducted outside of developed countries. While the time frame of 2020–2025 is recent, it does not encompass foundational literature that predates the period of accelerating digital proliferation. Therefore, research on the development of digital media for beginning reading is a promising area that can be further developed, especially in the context of integrating contemporary educational technology.

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AUTHOR CONTRIBUTION STATEMENT

Eka Kurnia contributed to the conceptualization of the study, research design, data collection, and manuscript drafting. Diding Bajuri was responsible for methodology development, data analysis, and validation of the findings. Devi Afriyuni Yonanda contributed to the literature review, interpretation of results, and critical revision of the manuscript. All authors have read and approved the final version of the manuscript.

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