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A Bibliometric Analysis of Trends, Research Focus, and Research Development on E-Modules as Learning Media in Education

[1]Dian Ayu Agustin, [2]Heni Purwa Pamungkas, [3]Retno Mustika Dewi

[1]Economic Education, Surabaya State University, Indonesia
E-mail: dianayu.22004@mhs.unesa.ac.id
[2]Economic Education, Surabaya State University, Indonesia
Email: henipamungkas@unesa.ac.id
[3]Economic Education, Surabaya State University, Indonesia
Email: retnomustika@unesa.ac.id

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Abstract. *This study aims to analyze publication trends, research focus, and the development of e-module research as learning media in the field of education through a bibliometric approach. Data were obtained from the Scopus database, with a total of 83 open-access English-language articles from the period 2015–2024 analyzed using Biblioshiny. The analysis results indicate that publication trends have experienced a significant increase, particularly during the period 2022–2024. In terms of research focus, the conceptual structure is dominated by the themes of e-learning, education, and human interaction, which reflects the role of e-modules as learning media in the context of educational technology. Meanwhile, the topics of e-modules, critical thinking, and problem-based learning were identified as emerging themes, indicating that e-module research is still in a strengthening phase and has not yet fully become mainstream in research. From the developmental perspective, the study shows an increase in global research contributions involving various countries, with dominant contributions coming from Indonesia. Overall, the findings of this study affirm that research on e-modules as learning media is in a developmental phase with great potential for further investigation, particularly in strengthening the position of e-modules as learning media in technology-based educational research.*

Keywords: *Bibliometric Analysis; E-Modules; Learning Media; Research Trends; Research Focus; Research Development.*

Abstrak. *Penelitian ini bertujuan untuk menganalisis tren publikasi, fokus kajian, dan perkembangan penelitian e-modul sebagai media pembelajaran di bidang pendidikan melalui pendekatan bibliometrik. Data diperoleh dari database Scopus dengan total 83 artikel akses terbuka berbahasa Inggris pada periode 2015-2024 yang dianalisis menggunakan Biblioshiny. Hasil analisis menunjukkan bahwa tren publikasi mengalami peningkatan signifikan, khususnya pada periode 2022-2024. Dari sisi fokus kajian, struktur konseptual didominasi oleh tema e-learning, education, serta interaksi manusia, yang mencerminkan peran e-modul sebagai media pembelajaran dalam konteks teknologi pendidikan. Sementara itu, topik e-modul, critical thinking, dan problem–based learning teridentifikasi sebagai tema berkembang (emerging), yang menunjukkan bahwa kajian e-modul masih berada pada tahap penguatan dan belum sepenuhnya menjadi arus utama penelitian. Dari aspek perkembangan, penelitian menunjukkan peningkatan kontribusi global penelitian yang melibatkan berbagai negara, dengan dominasi kontribusi dari Indonesia. Secara keseluruhan, hasil penelitian ini menegaskan bahwa kajian e-modul sebagai media pembelajaran berada dalam fase berkembang dengan potensi yang besar untuk dikaji lebih lanjut, terutama dalam memperkuat posisi e-modul sebagai media pembelajaran dalam penelitian pendidikan berbasis teknologi.*

Kata kunci: *Analisis Bibliometric; E-Modul; Media Pembelajaran; Tren Penelitian; Fokus Kajian; Perkembangan Penelitian*

INTRODUCTION

The rapid development of digital technology has brought significant changes to various aspects of life, including education. Recent studies have shown that digital learning environments have experienced rapid global expansion, particularly after the COVID-19 pandemic, making online learning systems an essential component of educational continuity in many countries (Fauzi, 2022). The integration of information and communication technology (ICT) into the learning process has encouraged a shift from conventional learning models toward digital learning that is more flexible, interactive, and learner-centered. This transformation became more prominent during the pandemic period, when educational institutions in many countries were required to implement online and distance learning. Several studies emphasize that this situation increased the need for digital media and teaching materials capable of effectively supporting learning continuity while overcoming the limitations of face-to-face interaction (Hodges et al., 2020; Moore et al., 2011). One of the rapidly growing forms of digital learning media is the e-module (*electronic module*). E-modules are electronic-based teaching materials that are systematically designed, structured, and intended for independent learning. They integrate various multimedia elements such as images, text, audio, animations, videos, and are also equipped with interactive features that enable direct feedback between learners and learning content (Mayer & Fiorella, 2022; Herwandi, 2024). These characteristics make e-modules highly adaptive to the needs of education in the digital era, particularly in online and blended learning environments. This trend is consistent with the broader transformation of digital learning media, where interactive and technology-supported resources are increasingly emphasized to improve learner engagement and accessibility (Mishra et al., 2022).

Compared with conventional printed modules, e-modules offer several advantages, including flexible access, ease of distribution, and the ability to present materials in a more engaging and contextual manner. Learners can access e-modules anytime and anywhere through digital devices, allowing learning to be independent of time and place (Mishra et al., 2022). In addition, e-modules support self-paced learning, thereby increasing learner autonomy and responsibility. The integration of multimedia, simulations, and adaptive technologies in digital learning materials has been widely recognized as an effective strategy to improve higher-order thinking skills and active participation (Shofiyah et al., 2025). Wulandari et al. (2021) reported that interactive e-modules can improve motivation, understanding of learning materials, and student learning outcomes in distance learning settings. As the adoption of e-modules as learning media continues to increase, studies related to their development and implementation have also grown rapidly. These studies cover various research focuses, including interactive e-modules, model-based e-modules, and the integration of e-modules with STEM approaches, problem-based learning (PBL), and creative thinking skills (Rambe et al., 2026; Rofikoh & Farisi, 2024). Other studies indicate that PBL-based e-modules can improve scientific literacy, digital literacy, and learning effectiveness (Henirayuza & Aeni, 2025; Arifin & Habibi, 2024). In addition, multimedia-based e-modules have also been reported to support contextual and independent learning (Yuniar et al., 2021). These findings indicate that e-modules function not only as learning media but also as tools that encourage active engagement and learner autonomy.

The growing number of scientific publications related to e-modules indicates that this topic has become an important concern in education. However, most previous studies have focused on product development, effectiveness testing, or implementation in specific subjects. To date, there has been no bibliometric study that specifically and comprehensively maps publication trends, research focuses, and the overall development of e-module research as learning media in education. Several previous bibliometric studies have been conducted on topics related to digital educational transformation. For instance, Etivali et al. (2025) mapped research trends in online learning, while Siregar (2025) analyzed the development of digital technology in education. These studies provide important insights into technology-based educational innovation. Nevertheless, they addressed broader themes and did not specifically position e-modules as the main focus of bibliometric analysis. Previous bibliometric studies mainly focused on broader digital learning topics such as e-

learning adoption, open educational resources, and technology integration, rather than specifically examining e-modules as an independent research domain (Fauzi, 2022; Mishra et al., 2022; Shofiyah et al., 2025). Therefore, a dedicated bibliometric study focusing on e-modules is still needed to provide a comprehensive understanding of the knowledge structure, thematic development, and future research opportunities in this field. Bibliometric analysis is a quantitative method used to evaluate and map scientific literature based on publications, keywords, and citations (Passas, 2024). According to Ozturk et al. (2024), bibliometric analysis enables researchers to systematically examine publication trends, key research themes, and the development of a research field.

The novelty of this study lies in three main aspects. First, it analyzes publication trends in e-module research as learning media in education. Second, it identifies the main research focuses and thematic developments related to e-modules. Third, it maps the overall development of this research area and highlights future research opportunities. Based on the above discussion, this study aims to conduct a bibliometric analysis of publication trends, major research focuses, and the development of e-module research as learning media in education to provide a comprehensive understanding of future research directions and opportunities.

METHODS

This study employed a quantitative approach using bibliometric analysis. Bibliometric analysis is a method used to systematically examine and map the development of scientific literature based on publication data, citations, keywords, and author collaboration networks (Donthu et al., 2021). This method was selected because it provides an objective overview of publication trends, dominant research focuses, and research development directions in a particular scientific field, including education.

The data source used in this study was the Scopus database, which was selected due to its broad coverage of peer-reviewed international publications. The literature search was conducted in the Scopus database open access using the following query: TITLE (“e-module” OR “electronic module” OR “digital module”). The initial search in the Scopus database yielded 997 documents based on the keyword “e-module OR “electronic module” OR “digital module” in the title field. The selection process was then carried out systematically through several filtering stages. First, the publication period was limited to 2015-2024, resulting in 596 documents. Second, filtering based on subject area was applied, reducing the dataset to 139 documents. Third, the document type was restricted to articles, resulting in 113 documents. Subsequently, the language filter was applied to include only English-language publications, resulting in 110 documents. Finally, the open access filter was applied, yielding a final dataset of 83 documents. The entire selection process is illustrated in Figure 1.

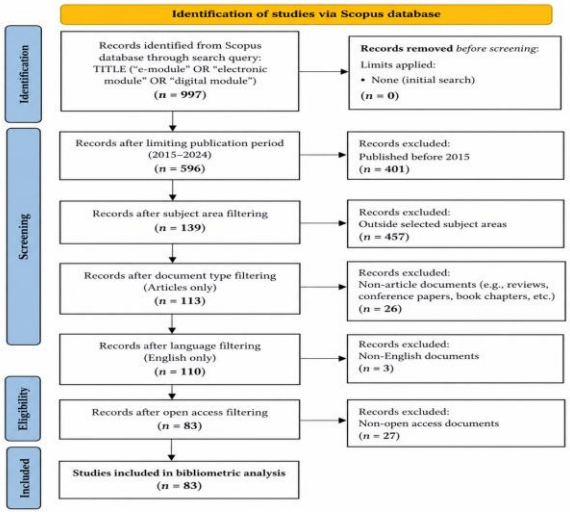

Figure 1. PRISMA flow diagram of the study selection process.

The data analysis in this study employed two main approaches, namely descriptive bibliometric analysis and scientific network analysis. Based on the established search criteria, a total of 83 articles relevant to the topic of e-modules as learning media were obtained. All bibliometric data from the selected articles were exported in RIS and CSV formats, then analyzed using the biblioshiny software. Descriptive bibliometric analysis was used to identify research patterns and characteristics, including trends in the number of publications per year, productivity of authors and journal sources, citation distribution to determine the most influential articles, and keyword analysis to map research focuses and dominant research topics (Passas, 2024). Meanwhile, scientific network analysis was conducted to examine intellectual relationships among research elements, such as keyword Co-Occurrence and author collaboration patterns through co-authorship analysis. The results were visualized using bibliometric mapping techniques, including network visualization, overlay visualization, and density visualization, to facilitate the interpretation of knowledge structure, topic interconnectedness, and the dynamics of e-module research development in the field of education (Ahmad et al., 2025). All results were presented both descriptively and quantitatively using tables, graphs, and scientific maps, which were interpreted to identify publication trends, main research focuses, and the direction of e-module research development as learning media in a systematic and comprehensive manner. This study has several limitations. First, the dataset was limited to the Scopus database, which may exclude relevant studies indexed in other databases such as Web of Science, Dimensions, or Google Scholar. Second, only open-access English-language articles were included, potentially omitting subscription-based and non-English publications. Third, the search strategy was restricted to the title field, which may not capture relevant studies using alternative terminology in abstracts or keywords. Therefore, the findings of this study should be interpreted within these methodological boundaries.

RESULTS AND DISCUSSION

1. MAIN INFORMATION

Table 1. Main Bibliometric Information

Table 1 presents the general characteristics of publications on e-modules as learning media in education indexed in Scopus during 2015-2024. A total of 83 documents were distributed across 56 sources, indicating that this research area remains relatively fragmented and has not yet been concentrated in a few dominant journals. This pattern commonly characterizes an emerging field in which knowledge structures remain fragmented and dispersed across multiple disciplinary outlets, as highlighted in bibliometric mapping and clustering studies (Donthu et al., 2021; Behl et al., 2022). The annual publication growth rate of 44.81% demonstrates a rapid increase in academic interest in e-modules. This trend suggests that e-modules are increasingly recognized as effective learning media in response to the continuing digital transformation of education. The expansion of online, blended, and flexible learning environments following the COVID-19 pandemic likely strengthened

this trend (Hodges et al., 2020). From the authorship perspective, 350 authors contributed to the dataset, with an average of 4.42 authors per document. This indicates that research on e-modules is predominantly collaborative rather than individual. Such collaboration is likely influenced by the interdisciplinary nature of e-module development, which often requires expertise in pedagogy, instructional design, subject content, and educational technology (Donthu et al., 2021).

The average number of citations per document (11.66) suggests a moderate academic impact, indicating that this research area is still in a developing stage compared to more established topics in educational technology. Furthermore, the presence of 300 author keywords reflects substantial thematic diversity, suggesting that research on e-modules spans various educational contexts, subjects, and pedagogical approaches. This diversity indicates that the research focus remains evolving, with no single dominant theme, which is typical of a developing research domain and highlights opportunities for future consolidation and specialization of topics (Donthu et al., 2021; Waltman, 2016).

2. PUBLICATION TRENDS

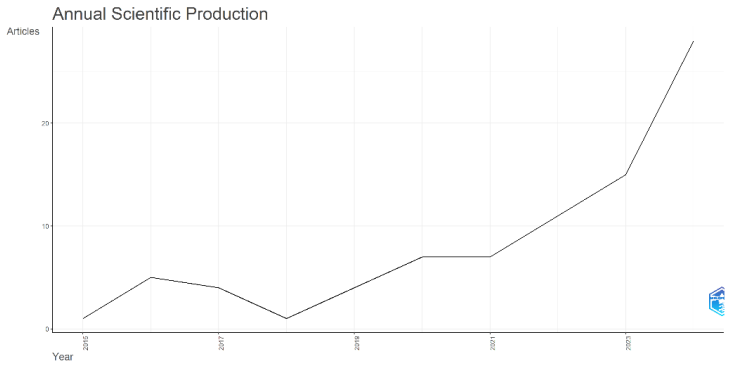

Figure 2. Annual Scientific Production

Figure 2 shows a clear upward trend in publication output, with the most substantial growth occurring between 2022 and 2024. During the early period (2015-2018), publication numbers were relatively low and unstable, indicating that e-modules had not yet become a mainstream research topic. At this stage, studies were largely exploratory and focused primarily on initial product development and limited implementation. The more consistent growth from 2019 onward suggests a transition from exploratory research toward broader academic acceptance. This period coincides with the intensified digital transformation of education worldwide, where accessible and technology-enhanced learning resources became increasingly important (Hodges et al., 2020). This trend is further supported by the global shift toward e-learning during the COVID-19 pandemic, which significantly accelerated the adoption of digital learning technologies across educational contexts (Levidze, 2024). The sharp rise during 2022-2024 suggests that e-modules are no longer viewed merely as supplementary teaching materials, but as strategic learning media that support technology-enhanced education. This pattern indicates that publication growth reflects not only scholarly interest but also practical educational demand for interactive and flexible learning resources (Mayer & Fiorella, 2022).

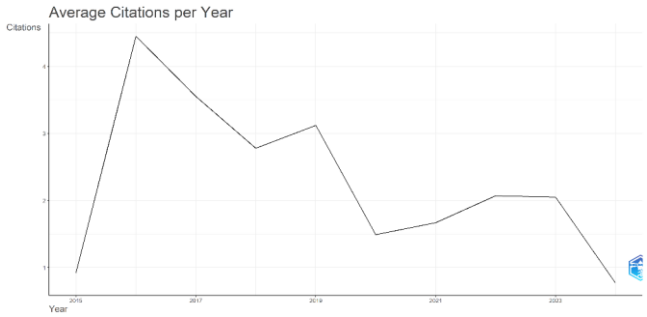

Figure 3. Average Citations Per Year

Figure 3 reveals that average citation rates were higher in earlier years but appear lower in recent years. This pattern should not be interpreted as a decline in research quality. Rather, it reflects the citation lifecycle effect, in which older publications have had more time to accumulate citations than newly published studies (Bornmann & Mutz, 2015). The relatively higher citation rates in the earlier years suggest that pioneering studies played a significant role in shaping subsequent research on e-modules. These early works likely provided foundational models for design, implementation, and evaluation. In contrast, the low citation count in 2024 is expected because recent publications require additional time before being cited by later studies. Similar citation delay patterns are common in rapidly growing scientific fields (Waltman & Eck, 2019). These findings indicate that the field is growing rapidly in terms of publication volume, while its long-term intellectual influence is still developing.

1) Top Authors

Table 2. List of prominent authors and their impact

Author	Articles	Fractionalized Articles	Year
Aliman M	3	0.65	2021-2023
Kurniawan Da	3	0.53	2019-2024
Anggereini E	2	0.53	2021-2023
James H	2	0.42	2022-2024
Lewin W	2	0.42	2022-2024

Table 2 shows that no single author dominates the field, as the most productive authors published only three articles each. This suggests that research on e-modules remains decentralized, with contributions spread across many scholars rather than concentrated among a few leading researchers. Such a pattern is common in developing research areas where author networks are still forming and intellectual leadership has not yet become consolidated (Donthu et al., 2021). It may further indicate that many researchers examine e-modules as part of broader interests in digital learning, instructional media, or curriculum innovation. Fractional counting scores further indicate that productivity should not be assessed solely through publication counts. Some authors demonstrate stronger individual contributions despite having fewer total publications, highlighting the collaborative nature of research on e-modules as learning media (Leydesdorff & Park, 2016).

2) Top Source

Table 3. List of top sources and their impact on e-module

Source	h_index	g_index	m_index	TC	NP	PY_start
BMC MEDICAL EDUCATION	8	9	0.667	226	9	2015
INTERNATIONAL JOURNAL OF EVALUATION AND RESEARCH IN EDUCATION	3	3	1.000	11	4	2024
ONLINE LEARNING IN EDUCATIONAL RESEARCH	3	3	0.500	22	3	2021

Table 3 identifies BMC Medical Education as the most influential source in terms of productivity and citation impact. This finding suggests that studies on e-modules have gained significant relevance in health and medical education, where self-paced, interactive, and technology-supported learning resources are highly valuable. The prominence of journals related to educational evaluation and online learning indicates that e-modules are increasingly positioned within broader discussions of digital pedagogy, rather than being viewed solely as instructional materials. This finding also implies that future studies on e-modules are likely to gain stronger academic visibility when linked to wider educational issues such as learning effectiveness, student engagement, digital literacy, self-regulated learning, and assessment outcomes (Mayer, 2005).

3. SECONDARY INFORMATION

1) Knowledge Structure Analysis
   - Conceptual Structure

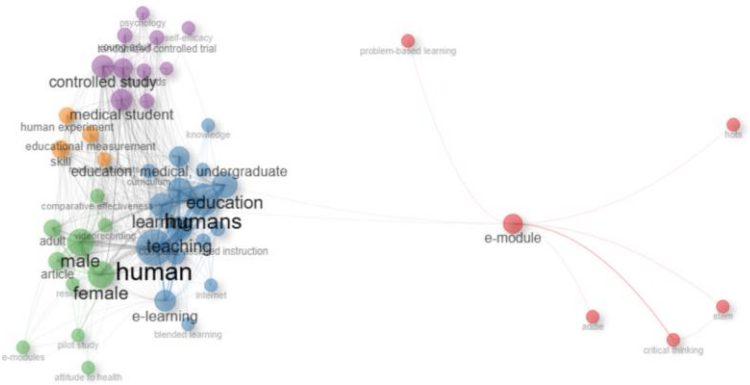

Figure 4. Co-Occurrence Network

The co-occurrence network (Figure 4) shows that dominant keywords such as education, learning, human, and e-learning occupy central positions. This indicates that research on e-modules is strongly embedded within the broader discourse of educational technology and digital learning. However, the keyword “e-module” appears more peripheral and is associated with terms such as critical thinking, STEM, HOTS, and problem-based learning. This suggests that e-modules are currently studied more as pedagogical tools used to support specific learning outcomes than as an independent theoretical domain. The relative separation of the e-module cluster from the core digital learning cluster implies that the topic has not yet reached full academic maturity. To become more central in future scholarship, stronger theoretical integration between e-modules and mainstream digital learning frameworks will be necessary (Ozturk et al., 2024).

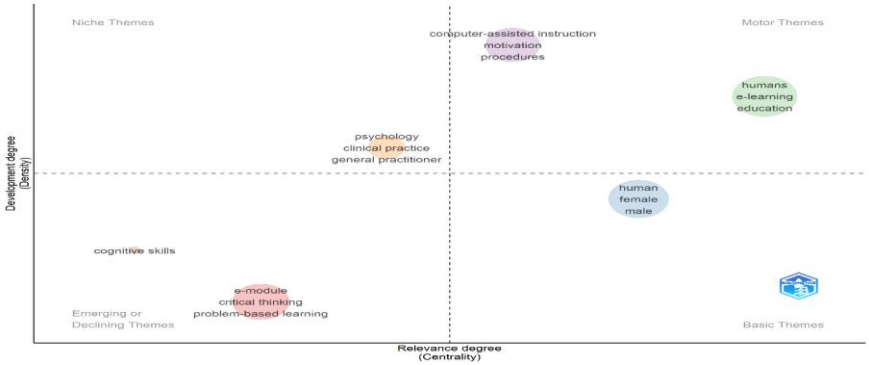

Figure 5. Thematic Map

Figure 5 shows that e-learning, education, and humans function as motor themes, meaning that they are both central and well-developed. These themes currently drive the intellectual structure of the field and provide the broader context in which e-modules are studied. By contrast, e-module, critical thinking, and problem-based learning are categorized as emerging themes. This indicates increasing academic attention, but still relatively limited maturity and network integration. In other words, these themes are promising but still require further empirical validation and stronger conceptual development (Donthu et al., 2021). This finding suggests an important opportunity for future research. E-modules can be positioned not only as learning media, but also as instruments for promoting higher-order thinking skills, active learning, learner autonomy, and problem-solving competencies.

- Social Structure

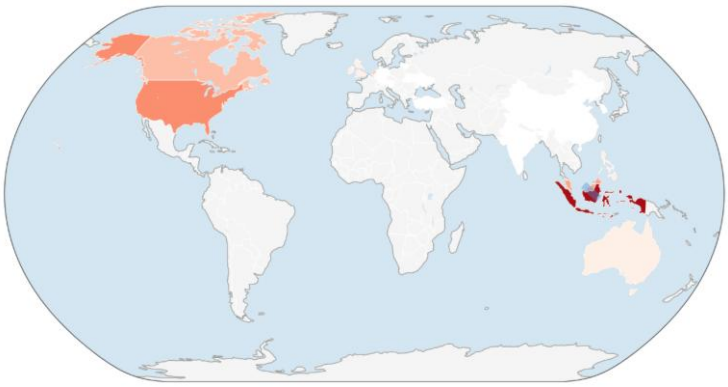

Figure 6. Distribution of Research Publications by Country

Figure 6 indicates that Indonesia is one of the leading contributors to research on e-modules. This may reflect strong national interest in digital education reform, curriculum innovation, and the need for accessible learning resources across diverse educational settings. The contributions of countries such as the United States, Canada, China, and Malaysia indicate that e-modules research has international relevance, although global research participation remains unevenly distributed. Developed countries may place greater emphasis on innovation and evaluation, whereas developing countries may focus more on accessibility, implementation, and classroom integration (Etivali et al., 2025). Indonesia's prominence also suggests that the country has the potential to become a regional leader in e-module scholarship, provided that future studies strengthen international collaboration, methodological rigor, and publication visibility in high-impact journals.

CONCLUSION

Based on the bibliometric analysis, research on e-modules as learning media shows a publication trend that has increased significantly, especially in the 2022-2024 period, which indicates growing research interest in this field. From the research focus perspective, studies are dominated by main themes such as e-learning, education, and human interaction in digital learning, which are central to the knowledge structure of this field. Meanwhile, topics such as e-module, critical thinking, and problem-based learning are still classified as emerging themes, which indicates that studies related to e-modules have not been fully integrated into the mainstream of research and still have great opportunities for further development. In addition, the development of research is also shown through the increase in publication contributions distributed globally with the involvement of various countries and the dominance of contributions from Indonesia. Overall, the results of this analysis confirm that e-module research is in a growth phase with a continuously developing study structure, thus opening up opportunities for deeper exploration. This finding strengthens the position of e-modules as a main focus in technology-based educational research and highlights their strong potential to be continuously developed as effective learning media.

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