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Visualizing Global Educational Research Trends in Digital Social-Emotional Learning: A Bibliometric Analysis 2015-2025

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Abstract

Digital transformation in education is driving the integration of social-emotional aspects into learning, forming the field of Digital Social Emotional Learning (Digital-SEL). This study aims to map global trends in Digital-SEL research from 2015 to 2025 using bibliometric analysis. Data was obtained from Google Scholar and Scopus via Publish or Perish, curated with Mendeley, and visualized using VOSviewer. Results indicate that "social-emotional learning" is the dominant keyword, with strong associations to school contexts and teaching. Five thematic clusters were identified, reflecting a focus on student emotional well-being, digital technology integration, and innovative pedagogy. Terms like digital storytelling and online learning are gaining attention but have not yet demonstrated strong conceptual depth. This study confirms that Digital-SEL is an evolving interdisciplinary field and encourages cross-disciplinary collaboration to strengthen technology-based pedagogical frameworks.

Keywords: Informatics Education, Social Emotional Learning, Bibliometrycs Analysis, Reseacrh Trend.

1. Introduction

21st-century education does not only focus on academic achievement but also emphasizes the importance of social and emotional skills as the foundation for students' success. Competencies such as self-awareness, emotional regulation, empathy, social skills, and ethical decision-making have been shown to support academic achievement, psychological well-being, and social participation [1], [2]. Several longitudinal studies indicate that students with strong social-emotional skills are more likely to complete their education successfully, form healthy interpersonal relationships, and have more positive career prospects [3], [4], [5]. The COVID-19 pandemic has underscored the urgency of strengthening this aspect, given the increasing psychosocial pressures and social disruptions in the global educational environment [6].

The conceptual framework for Social and Emotional Learning (SEL) developed by CASEL places five core competencies in a social context involving the classroom, school, family, and community [7]. Technological developments have driven the transformation of the SEL approach into the digital space, giving rise to the concept of Digital Social Emotional Learning (Digital-SEL). This concept integrates SEL principles with digital technology, such as AI-based applications, virtual reality, online learning platforms, and educational games [8], [9], [10]. This digitalization creates a new paradigm in the development of social-emotional skills through a more flexible and adaptive medium suited to the dynamics of contemporary education.

Figure 1. Social Emotiolional Learning Concept

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Digital-SEL is an extension of SEL practices facilitated by technology to strengthen mastery of five key competencies in various learning formats such as online, offline, and hybrid [11], [12] . Innovations in Digital-SEL include interactive platforms, educational games, reflective apps, and automated feedback systems that support the development of self-awareness through emotion tracking, self-management through digital time management, and relationship skills through virtual collaboration [13], [14], [15]. Additionally, the use of interactive simulations based on ethics and global social networks enables the strengthening of responsible decision-making and social awareness [16]. This approach creates space for real-time assessment, personalized interventions, and higher emotional engagement of students during the learning process.

The Digital-SEL concept can be understood as part of a technology-based learning approach that supports the development of students' social and emotional skills. In educational studies, Digital-SEL contributes to strengthening a holistic approach that not only emphasizes cognitive aspects but also accommodates affective and social needs relevant to the challenges of 21st-century learning [17]. Through digital media such as educational games, reflective platforms, and social simulations, this approach supports the application of constructivist and humanistic values in learning that emphasizes interaction, empathy, and self-reflection [18], [19]. Therefore, Digital-SEL is relevant in the context of curriculum development, instructional design, and adaptive learning strategies that address students' social-emotional needs in digital educational environments [20].

Studies on Digital-SEL over the past decade have shown a trend toward increasingly diverse growth, both in terms of approach, technology used, and context of application. This diversity has created a need for systematic literature mapping to identify thematic patterns, collaborative engagement among researchers, and conceptual areas that have not been widely explored. Bibliometric analysis, as proposed offers a quantitative method for structurally mapping these developments, thereby providing an initial overview of the evolving research dynamics and potential gaps that remain open for further exploration [21]. Through techniques such as co-authorship analysis, co-citation, bibliographic coupling, and keyword co-occurrence, bibliometrics can reveal the intellectual structure, collaboration networks, and thematic trends of a field of study [22], [23].

Although the number of publications on Digital-SEL has increased in recent years, studies that specifically apply bibliometric analysis to map the global landscape of this field are still very limited. Most previous research has focused on the effectiveness of programs, pedagogical approaches, or narrative reviews, but few have systematically and quantitatively examined the structure of knowledge, collaborative networks, and thematic evolution [24], [25], [26]. This limitation creates a significant gap in the literature regarding a comprehensive understanding of the dynamics and direction of development of Digital-SEL as an interdisciplinary research domain involving education, psychology, and digital technology.

Based on the gaps in the literature, this study aims to map the dynamics of Digital-SEL development from 2015 to 2025. The main focus of this study includes keyword co-occurrence analysis to identify dominant terms and themes in relevant scientific publications, followed by keyword co-occurrence analysis of keywords and abstracts to understand the broader conceptual relationships of each term used by researchers. This study also presents a visual map of keyword density to illustrate the density and intensity of topics in the Digital-SEL landscape visually. Through these three approaches, this study aims to provide a comprehensive and data-driven overview of thematic directions, term networks, and potential research areas that remain open for further development in the future.

This study aims to enrich the conceptual understanding of the position and development of Digital-SEL in the global research ecosystem and offer a robust methodological approach through long-term bibliometric mapping. The novelty of this study lies in its specific focus on Digital-SEL as a domain of study that has not been systematically and quantitatively analyzed in scientific literature. This study uses a broad time span, from 2015 to 2025, to capture the dynamics of trends longitudinally. The uniqueness of this study compared to previous studies lies in the application of bibliometric techniques that combine keyword correlation analysis, visual mapping of topic density, and the formation of conceptual term networks to identify emerging knowledge structures. Unlike previous studies, which tended to be narrative or program evaluation-focused, this study offers a data-driven approach that provides an objective picture of the Digital-SEL scientific landscape. The integration of data from two major databases, Google Scholar and Scopus, also strengthens the validity of the analysis and broadens the scope of global literature representation in this field.

2. Methods

This study applies a quantitative bibliometric approach to map and analyze global research trends related to Digital Social Emotional Learning (Digital-SEL) during the period 2015–2025. This method was chosen to evaluate publication dynamics, citation distribution, patterns of scientific collaboration, and thematic structure within the relevant literature. Bibliometric analysis is considered effective in providing a systematic and data-driven representation of the

scientific landscape of a field in a longitudinal and objective manner [22], [27]. Compared to traditional literature reviews, bibliometric analysis offers a more rigorous and replicable approach to identify the intellectual structure and evolution of a research domain. It allows researchers to uncover hidden patterns, emerging themes, and collaboration networks across time and disciplines, which is essential for relatively new and interdisciplinary topics such as Digital-SEL [22], [28].

The research data was taken from two main databases, Scopus and Google Scholar, given their broad coverage and diversity of indexed documents. Scopus was selected due to its curated and high-quality indexing of peer-reviewed journals and conference proceedings, which ensures strong citation integrity and metadata reliability [29]. Meanwhile, Google Scholar was included to complement Scopus by capturing gray literature, preprints, book chapters, and educational reports that are often excluded from conventional databases but highly relevant for an applied and emerging field like Digital-SEL [30]. The combination of these two sources provides a more inclusive and representative dataset across disciplines, document types, and geographic regions. Other databases such as Web of Science or ERIC were not selected due to their narrower indexing scope and more restrictive inclusion criteria, which may omit valuable interdisciplinary or non-traditional publications commonly found in the Digital-SEL domain.

The search was conducted using the keyword "Digital Social Emotional Learning (Digital SEL)" for the period 2015–2025. Data were extracted using the Publish or Perish (PoP) software with search configurations on title and keyword elements. Subsequently, the data files in RIS format were curated using Mendeley Reference Manager to remove duplicates, align metadata, and verify the relevance of documents to the study focus.

The search yielded 290 documents, comprising 114 documents from Scopus and 176 from Google Scholar. The types of documents included journal articles, conference proceedings, books, book chapters, literature reviews, and other online documents. Journal articles were the most numerous category, with 190 documents (65.5%), followed by conference proceedings with 42 documents (14.5%), while the rest were spread across other document types as shown in the following table.

Table 1. Type of Document

Type of Document	Frequency	Percentage (%)
Article	190	65,5%
Book	32	11 %
Book Chapter	12	4,1%
Review	6	2,1%
Conference Papers	42	14,5%
HTML	5	1,7%
PDF	3	1%

Table 1 shows the distribution of document types used in the bibliometric analysis on the topic of Digital Social Emotional Learning during the period 2015 to 2025. All documents were exported in RIS format and managed using Mendeley to ensure metadata consistency. Bibliometric visualization was performed using VOSviewer software, which was used to map author collaboration networks, co-occurrence of keywords, and citation structures interactively [31], [32]. To complement the visual analysis, the Datawrapper platform was used to present temporal trends in the form of bar and line charts, thereby supporting more communicative quantitative interpretation.

3. Results and Discussions

Research related to Digital-SEL shows an upward trend over the past decade in line with the integration of digital technology in educational practices. Compared to other digital themes, publications related to Digital-SEL are still relatively limited and show fluctuating patterns in terms of both quantity and thematic coverage. These limitations are influenced by the complexity of SEL as a contextual concept, as well as the suboptimal adoption of digital technology in supporting the development of social-emotional competencies across cultural and educational contexts [5], [24], [33].

Most publications in the data corpus focus on the design and evaluation of digital interventions aimed at improving specific aspects of SEL, such as self-awareness, empathy, and emotional regulation. However, there are still few studies that holistically integrate digital pedagogy approaches with the overall SEL competency framework. This situation highlights research opportunities to develop digital learning models that systematically combine SEL dimensions with educational technology innovations [34], [35], [36].

Table 2. Research Trend in Digital Social-Emotional Learning

Year	Google Scholar	Scopus	Number of Studies
2015	10	4	14
2016	13	6	19
2017	18	7	25
2018	20	9	29
2019	24	10	34
2020	27	13	40
2021	23	12	35
2022	18	12	40
2023	15	14	29
2024	5	10	15
2025	3	7	10

Table 2 shows the distribution of Digital-SEL research based on the year of publication from 2015 to mid-

2025. The number of publications began to increase in 2017 and peaked in 2020 with a total of 40 documents, consisting of 27 documents from Google Scholar and 13 documents from Scopus (13.79% of the total). The years 2019 and 2021 also recorded fairly high numbers, with 34 and 38 documents, respectively. This significant increase during the 2017–2021 period reflects the high level of academic attention to strengthening social-emotional competencies through digital approaches, particularly in response to the challenges of online learning during the COVID-19 pandemic.

Figure 3 below illustrates the temporal trend in the number of Digital-SEL publications indexed in Google Scholar and Scopus during the period 2015–2025. Overall, the publication trend shows a gradual upward trend, peaking in 2020 before declining in recent years. This pattern reflects a surge in interest in Digital-SEL as a response to the pandemic conditions that accelerated the adoption of technology in learning [37], [38]. However, the downward trend after 2021–2022 in both indexes indicates a shift in research focus from the digitalization of SEL to new issues in the field of digital education.

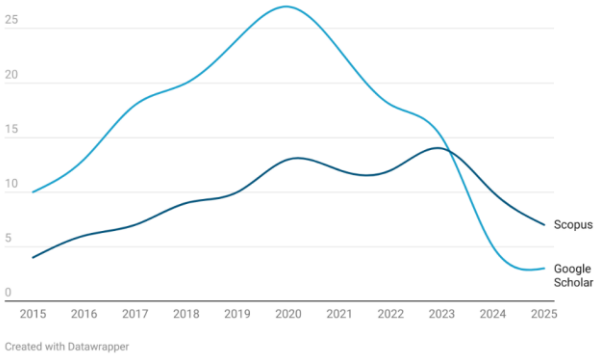

Figure 2. Research Trend in Digital Social-Emotional Learning

In addition to looking at publication volume, annual citation analysis provides an important picture of the influence and academic reach of a piece of research within the scientific community. A high number of citations indicates that a scientific work is not only read but also used as an important reference in the development of further studies. The annual citation trend related to the Digital-SEL context can reflect the relevance of this topic in addressing the challenges of digital education and social-emotional well-being, particularly in the post-pandemic era [39], [40].

The citation data presented in Table 3 shows the accumulation of citations per year collected from two main sources in Scopus and Google Scholar. The differences in citation counts between databases also reflect the indexing characteristics and coverage of each. In general, citation counts have seen a significant increase starting in 2020, coinciding with the early stages of the pandemic, which forced the accelerated adoption of digital technology in education. Some recent studies even suggest that the pandemic has accelerated the integration of technology in the development of students' social-emotional aspects and expanded research interest in Digital-SEL approaches [41], [42].

Table 3. Annual Citations of Research on Digital-SEL

Year	Scopus citations per year	Google Scholar citations per year	Number of Citations per Year
2015	11,8	17,6	29,4
2016	17,5	26,9	44,4
2017	26,7	40,3	67
2018	35,2	53,1	88,3
2019	53,9	79,7	133,6
2020	71,6	102,5	174,1
2021	91,8	125,9	217,7
2022	94,5	129,3	223,8
2023	89,3	118,6	207,9
2024	80,7	108,8	189,5
2025	84	108,3	192,3

Table 3 shows that the peak number of citations for Digital-SEL publications occurred in 2020 with a total of 331 citations (Scopus: 146, Google Scholar: 185). This trend reflects the surge in academic interest in digital-based social-emotional issues amid the urgent need for online learning during the COVID-19 pandemic disruption [43]. The graph in Figure 3 clearly illustrates this dynamic, showing a consistent upward trend until 2020, before declining in subsequent years. This decline is likely related to the stabilization of the digital learning ecosystem and a shift in research focus toward post-pandemic themes. The urgency of Digital-SEL has increased sharply during the pandemic, showing that social-emotional aspects have become a crucial issue in digital education, especially when learning is conducted remotely. Not only cognitive performance has become a challenge, but the psychosocial well-being of students has also experienced significant pressure. Several studies have shown that online SEL programs integrated into virtual learning contribute positively to the development of students' social-emotional skills during the pandemic [13], [38].

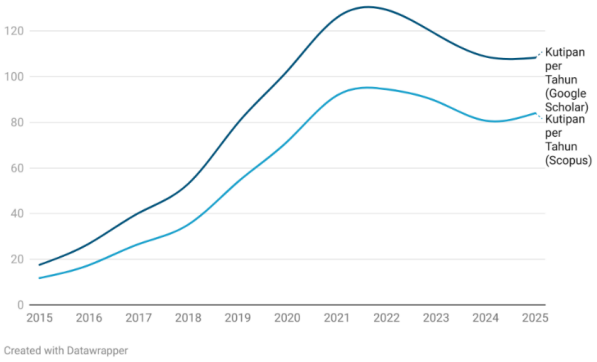

Figure 3. Annual citations from Digital-SEL Research

The increase in citations in 2020 and 2021 indicates that Digital-SEL has developed as a strategic multidisciplinary field of study, encompassing the domains of educational technology, developmental psychology, and digital pedagogy. The decline in the number of citations during the period from 2023 to 2025 may indicate saturation with conventional theoretical and evaluative approaches, as well as a shift in research focus toward the integration of artificial intelligence [44], [45], [46].

Bibliometric mapping based on Keyword Co-occurrence Networks from Digital-SEL research in Figure 4 shows that the term "social emotional learning" dominates the frequency of occurrence and occupies a central position in the visualization network. This finding confirms the role of this term as a thematic center in Digital-SEL literature. Surrounding it are five main clusters consisting of supporting keywords, each with different colors that illustrate variations in research focus, ranging from pedagogical approaches, technology integration, to the psychosocial aspects of students.

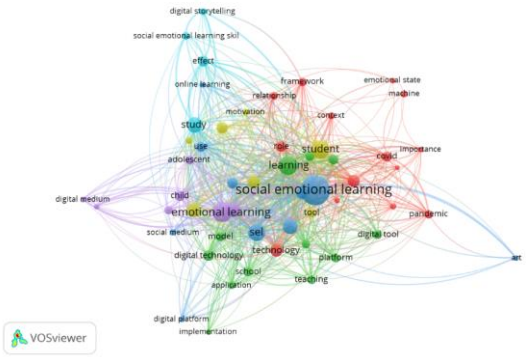

Figure 4. Co-occurrence network of keywords from research related to Digital-SEL

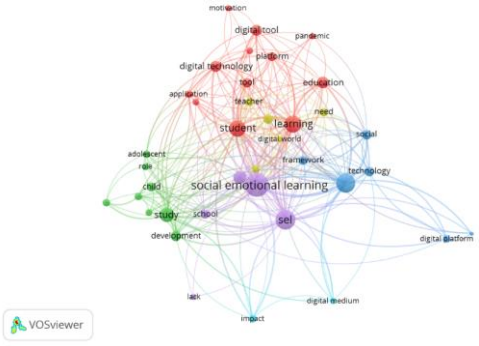

Figure 5. Co-occurrence network of keywords and abstracts

Bibliometric visualization shows that Social Emotional Learning (SEL) has a strong correlation with various terms that represent the digital context in 21st century education. Keywords such as "technology," "digital tool," "platform," and "digital medium" form a close connection with SEL, reflecting increased interest in integrating social-emotional aspects into the digital learning ecosystem [11], [47]. The connection between SEL and terms like "student," "school," and "teaching" indicates that formal educational institutions remain the primary arena for developing social-emotional competencies. The emergence of terms such as "digital storytelling," "online learning," and "digital platform" also reflects a response to the demand for more adaptive pedagogical approaches, particularly in the post-pandemic landscape of online and hybrid learning [48], [49].

The emergence of keywords such as "pandemic," "COVID," and "emotional state" in a cohesive cluster with SEL reinforces the finding that the issue of students' emotional well-being is a major focus in recent research. The Digital-SEL approach is not merely about technology but also encompasses pedagogical dimensions that integrate social, psychological, and emotional aspects [7], [44]. The relationship between SEL and terms such as "motivation," "relationship," and "framework" indicates that research in this field encompasses not only implementation aspects but also the development of conceptual frameworks and instructional designs that are multidisciplinary and continuously evolving [50].

The visualization also shows that the term "digital" and its variations, such as "digital tool," "digital platform," "digital storytelling," and "digital technology," are closely related to the keyword "social emotional learning." This finding indicates a shift in SEL from a direct interaction-based approach to integration in a technology-based learning context. This development necessitates new adaptations to social and emotional practices represented through digital media, where student-to-student relationships, teacher-student interactions, and emotional expressions undergo complex transformations due to non-verbal limitations and the nuances of digital communication [51], [52].

The digital position within the SEL framework represents two complementary roles. The first role lies in its function as a new social space that enables the formation and testing of students' social-emotional skills through virtual interactions, network-based collaboration, and participation in task-based online communities [34], [53]. The second role lies in its function as a pedagogical tool with interactive media features, reflective applications, and data-driven digital technologies that enable the development of skills such as self-awareness, emotional regulation, and interpersonal communication through digital learning platforms [54], [55].

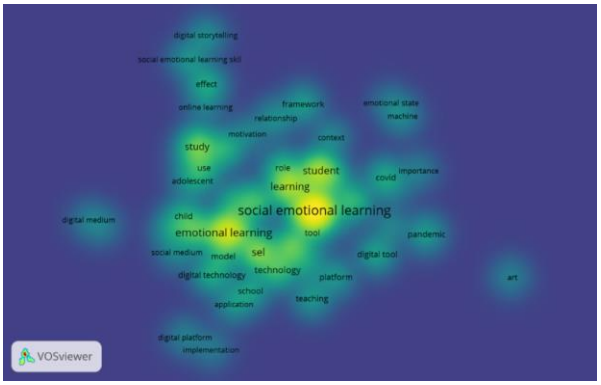

Figure 5. Visualization Map of Keyword Density from Research Related to Digital-SEL

The next analysis is a density analysis that aims to map the concentration of terms in the literature on Digital-SEL over the past ten years. Bright yellow represents areas with high density, indicating the frequency of occurrence of certain terms in publications. Purple blue reflects lower density. This visualization shows that terms such as "social emotional learning," "learning," "student," and "emotional learning" are nodes with the highest density levels. These findings confirm that the conceptual foundation of SEL, which focuses on students and the learning process in the affective domain, remains a central focus in the landscape of research trends over the past ten years [7], [56].

Although terms such as "digital technology," "digital tool," "digital platform," and "technology" are not in the highest intensity zone, their position in the green to yellow spectrum reflects a significant connection with SEL. This finding indicates that the digital dimension has been integrated into academic discourse on SEL research within the context of teaching and the application of learning technology [51], [57]. This finding aligns with the global trend of adopting a pedagogical approach based on the integration of social-emotional competency development and the use of digital technology as a response to 21st-century learning challenges, including post-pandemic online learning models.

The density visualization in Figure 6 shows that research on Digital-SEL is in a dynamic interdisciplinary position. Terms such as "art," "digital medium," and "machine" appear in the peripheral areas of visualization with low density. This finding indicates that these topics have not been the main focus of research in this decade. However, it is precisely at this point that new exploration opportunities arise, particularly the integration of art-based approaches and artificial intelligence technology within the Digital-SEL framework. This potential can enrich more holistic and adaptive learning approaches tailored to the needs of learners in the digital age [7], [12].

This study has several limitations that need to be considered. First, this bibliometric analysis only uses data from two main databases, namely Scopus and Google Scholar, so there may be relevant literature from other databases that is not accessible. Second, the use of specific keywords such as "social emotional learning" and "digital" in the search configuration may limit the scope of broader or cross-term literature. Third, the visualization results obtained from VOSviewer are descriptive and do not fully capture the conceptual depth of each publication, so the interpretation of findings should be combined with further qualitative analysis.

4. Conclusions

Digital-SEL is important because it represents the educational response to the demands of the 21st century, which emphasizes social-emotional skills in the digital learning ecosystem. Bibliometric findings show a consistent increase in the number of publications and citations during the period 2015–2025, reflecting strong growth in interest in this topic. Network visualization indicates a strong connection between SEL and digital terms such as technology, digital platforms, and online learning, signaling a paradigm shift from conventional approaches to digital approaches in the development of social-emotional skills.

Density analysis shows that the term "digital" has become an integral part of SEL discourse, although there are still relatively unexplored thematic areas, such as digital medium, art, or machine. Further research should be directed toward exploring technology-based pedagogical approaches that specifically support the development of social-emotional competencies in a digital context. Although terms such as "digital platform," "digital storytelling," and "online learning" have emerged as significant nodes, their intensity has not yet demonstrated sufficient theoretical depth or practical richness. Interdisciplinary collaboration between educational technology, computer science education, educational psychology, and computer science is a relevant strategy for expanding the scope of Digital-SEL research.

Further research is recommended to integrate a systematic literature review or meta-analysis approach to explore the depth of the concept and effectiveness of Digital-SEL implementation. In addition, exploration of Digital-SEL practices and innovations in developing countries is still very open, especially those related to technology access, teacher readiness, and socio-cultural diversity. Qualitative research based on case studies also has the potential to enrich understanding of students' experiences in using digital technology for the contextual development of social-emotional skills.

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Author Contributions Statement

Name of Author	C	M	So	Va	Fo	I	R	D	W
M. Zidni Ilman Nafi'a	✓	✓	✓	✓	✓	✓		✓	✓
Mila Yunita	✓	✓				✓			✓
M. Syifaul Muntafi	✓		✓	✓			✓	✓	
Krisna Raditya Pratama					✓				✓

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
W : Writing - Review

Conflict of Interest Statement *(mandatory)*

Authors state no conflict of interest.

Data Availability *(mandatory)*

- The data that support the findings of this study are available on request from the corresponding author, [initials, MZIN]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.
- Derived data supporting the findings of this study are available from the corresponding author [initials, MZIN] on request.
- The data that support the findings of this study are available from the corresponding author, [initials, MZIN], upon reasonable request.

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