



Social Stratification in Digital Learning: A Bibliometric Analysis of Self-Regulated Learning and Pedagogy via Biblioshiny (2016–June 2026)

Ridha Aulia^{1*}, Ervin Endro Sasongko², Alamsyah Siregar³, Maya Nur Anisa⁴,
A. Nururrochman Hidayatulloh⁵

¹Universitas Islam Negeri Sunan Kalijaga Yogyakarta, Indonesia

²Badan Pendidikan Pelatihan Keuangan, Indonesia

³Universitas Muhammadiyah Brebes, Jawa Tengah, Indonesia

⁴Universitas Islam Negeri Syekh Wasil Kediri, Indonesia

⁵Badan Riset dan Inovasi Nasional, Indonesia

Corresponding e-mail : ridhaaulia2000@gmail.com

ARTICLE INFO	ABSTRACT
Keywords: Bibliometric analysis; Bourdieu; Digital divide; Self-regulated learning; Social stratification. Article History Received: April 13, 2026 Revised : June 20, 2026 Accepted : August 01, 2026	The digital transformation of global education has accelerated pedagogical shifts that prioritize students' self-regulated learning (SRL) as a prerequisite for academic achievement. However, contemporary digital curricula frequently overlook social stratification and material disparities present in students' home learning environments. This descriptive-quantitative bibliometric study maps thematic trends, critiques epistemic biases, and synthesizes global literature on the relationship between socioeconomic class, digital inequality, and students' digital self-regulated learning agency from 2016 to June 2026. Utilizing the PRISMA protocol, 45 Scopus-indexed documents were analyzed with the Bibliometrix R-package via the Biblioshiny interface. Pierre Bourdieu's framework of capital, habitus, and symbolic violence guided the examination of publication trends, geographical distribution, citation structures, collaboration patterns, co-keyword networks, and thematic evolution. The results indicate a 19.62% annual growth rate, with a marked increase in publication activity during the first half of 2026. China led in publication output (19 appearances) and citation visibility (182 citations), followed by the United States (10 publications; 178 citations) and Australia (5 publications; 104 citations). Indonesia ranked among the top five contributors in publication output but was absent from major citation distributions, highlighting citation invisibility despite publication visibility. Co-keyword and thematic evolution analyses identified two major shifts: the reduction of SRL's theoretical depth to psychological, demographic, and administrative performance indicators, and the instrumentalization of SRL through artificial intelligence, adaptive learning technologies, and platform-based education. This study advances Critical SRL by demonstrating that digital learning agency constitutes a stratified form of digital cultural capital rather than solely an individual psychological capacity. The findings are pertinent to policymakers, curriculum designers, and educational technology developers in developing countries aiming to create class-sensitive and socially just digital learning systems.

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INTRODUCTION

The digital transformation of global education has progressed from serving as a supplementary instructional tool to establishing a dynamic learning environment that actively shapes contemporary pedagogy. By mid-2026, the widespread adoption of advanced technologies, such as generative artificial intelligence (AI), adaptive learning systems, and cloud-based educational ecosystems, intensified efforts to align education systems with future-oriented curricula (Strielkowski et al., 2025). International organizations, particularly UNESCO, have consistently advocated for the digitalization of education as a critical developmental opportunity for national education systems worldwide (UNESCO, 2020; McKay & Makhanya, 2008; Middlehurst & Woodfield, 2006). At the instructional level, this transformation necessitates the careful selection of learning methods that correspond to learners' characteristics, learning objectives, and contextual conditions. Pedagogical effectiveness depends not only on technological availability but also on the suitability of the learning approach (Aulia et al., 2025). Systematic and meta-analytic studies demonstrate that online, blended, distance, and technology-mediated learning environments increasingly require learners to exercise autonomy, metacognitive monitoring, planning, motivation regulation, and self-regulated engagement when interacting with digital instructional resources (Araka et al., 2020; Edisherashvili et al., 2022; Faza & Lestari, 2025; Guntur & Purnomo, 2024; Prasse et al., 2024; Wong et al., 2019; Xu et al., 2023). These findings suggest that digital pedagogy involves not only technological integration but also a reconfiguration of learner agency, responsibility, and regulation within increasingly flexible instructional environments. Within this learning ecology, students' academic achievement depends on their autonomous capacity to engage with digital content beyond formal classroom settings.

Despite optimistic narratives surrounding educational digitalization, a significant systemic challenge persists: digital self-regulated learning processes may function as mechanisms of social stratification and, consequently, intensify academic achievement disparities (Raimondi et al., 2025). Empirical research has highlighted the emergence of second- and third-level digital divides, in which the quality, purpose, and intensity of technology use vary markedly along socioeconomic lines. Students from privileged backgrounds often possess greater cultural capital, enabling them to navigate digital platforms, algorithmic content, and online learning resources for cognitive development. In contrast, marginalized students may experience digital alienation, using devices and the internet primarily for passive entertainment rather than for structured academic learning (Mzidabi et al., 2024). This condition is not only shaped by access to devices but also by the broader learning ecology surrounding students, since community-based and hidden-curriculum learning experiences have been shown to influence children's motivation and engagement in learning (Aulia, et al., 2024). Consequently, these students tend to demonstrate lower academic outcomes than their socioeconomically advantaged peers (Berger & Archer, 2016; Broer et al., 2019; Raimondi et al., 2025; Vadivel et al., 2023). Sociological analyses further indicate that underprivileged students' home environments often lack adequate space, tranquility, and social regulation, thereby depriving them of the structural conditions necessary for effective self-regulated learning.

Given these circumstances, a critical investigation of the intersection between social stratification and digital pedagogical design has become an urgent scholarly, policy, and equity-oriented priority (Putra et al., 2024). If educational application designers and policymakers continue to adopt a "sociologically color-blind" perspective, assuming that all learners possess equal psychological capacity, domestic support, and cultural resources, educational technology may reproduce rather than reduce social inequality. Educational practice is never purely technical; it is also shaped by moral, social, and environmental conditions that influence how

learners internalize values, discipline, and responsibility within learning processes (Aulia, Prastowo, et al., 2024). The most significant consequence of such neglect is the reinforcement of inequality through digital meritocracy, in which marginalized children are misrecognized as individually unmotivated or incompetent, despite being constrained by pedagogical systems that insufficiently account for their structural conditions (Masripah et al., 2025).

Classical SRL scholarship has traditionally conceptualized self-regulation as a set of social-cognitive, motivational, metacognitive, and goal-oriented processes that enable learners to plan, monitor, control, and evaluate their learning activities (Bandura, 1986; Pintrich, 2000; Schunk & Zimmerman, 2008; Zimmerman, 2000). This study does not reject this established theoretical tradition; rather, it extends it by examining how students' capacity for digital self-regulation is socially stratified through unequal access to economic resources, cultural capital, digital infrastructure, and home-based learning support.

Research on self-regulated learning in education has produced a wide range of empirical studies. Cleary (2017) for instance, examined how socioeconomic status and prior academic achievement influence students' motivation and self-regulated learning behaviors in secondary mathematics. In primary education, Daniel (2016) demonstrated that children's self-regulated learning behaviors can fully mediate the relationship between parental involvement at school and students' reading achievement, after controlling for family socioeconomic position. The integration of digital technology has also gained prominence, as shown by Wang (2016), who implemented cross-device mobile technology in a flipped classroom to enhance students' self-regulated learning. However, Wang (2016) cautioned that device availability remains essential to prevent digital innovation from worsening the digital divide.

Although these studies have considered external factors such as socioeconomic status, parental involvement, and digital device availability, their analyses remain largely localized, relying on specific experiments, surveys, or classroom-based interventions. More importantly, social stratification is often treated as a control variable, a contextual factor, or a practical implication rather than as the central analytical category in explaining students' digital self-regulated learning capacity. To date, no research has systematically mapped the dynamics, bibliographic landscape, and global thematic evolution of the direct interaction between socioeconomic class, the digital divide, and students' capacity for digital self-regulated learning. This bibliometric analysis of 45 core Scopus-indexed documents directly addresses this gap by examining the intersection between macro-sociological structures and micro-psychological learning processes. The selected corpus represents a niche, highly selective literature set rather than a broad bibliometric generalization that may be distorted by extraneous data.

The novelty of this study lies in its methodological and conceptual positioning. Methodologically, it moves beyond a traditional narrative literature review by employing bibliometric analysis through Biblioshiny (R-package) to map the global scientific landscape of publications from January 2016 to June 2026. Recent bibliometric work in education has demonstrated that the integration of keyword mapping, thematic visualization, and literature-based interpretation can be used to identify research trends, conceptual gaps, and future research directions in a systematic manner (Aulia et al., 2026). Building on this methodological rationale, the present study uses spatial data visualizations, including thematic maps and co-occurrence networks, to examine how educational sociology discourse has responded to the evolving agency of self-regulated learning in the context of digital transformation and the rapid adoption of generative AI tools by mid-2026. Conceptually, this study extends existing self-regulated learning scholarship by locating students' digital learning agency within the unequal distribution of cultural capital, home-based learning resources, and class-mediated technological practices.

To analyze this phenomenon, the study integrates Pierre Bourdieu's Critical Sociological Theory, particularly the concepts of habitus and cultural capital, with modern pedagogical theory on self-regulated learning. Pierre Bourdieu's critical sociological framework, particularly the concepts of habitus, cultural capital, and symbolic violence, provides a useful lens for examining how digital learning reproduces unequal educational conditions (Bourdieu, 1986; Bourdieu et al., 2000). Within this framework, students' capacity to focus, evaluate, and regulate digital learning is not treated merely as an innate psychological ability, but as a form of digital habitus that is socially constructed and internalized through family class position, educational exposure, and everyday technological practice. This theoretical synthesis is essential for demonstrating how schools, by assigning digital learning tasks, may unintentionally enact symbolic violence when they require structurally disadvantaged students to adopt upper-middle-class digital habitus without providing equivalent social, cultural, and material support.

Building on this theoretical foundation, the present descriptive quantitative study, based on secondary bibliographic data, aims to map publication trends, intellectual structures, collaboration patterns, dominant keywords, thematic evolution, and emerging research agendas concerning the relationship between social stratification and digital self-regulated learning from 2016 to June 2026. Its primary contribution is to provide a critical bibliometric foundation for rethinking digital curricula, learning analytics, and educational technology design through a class-sensitive perspective.

METHOD

This study employed a descriptive quantitative approach using bibliometric analysis to map and examine the development of scholarly publications concerning the relationship between socioeconomic inequality, the digital divide, and students' self-regulated learning. Bibliometric analysis serves as a systematic measurement tool for identifying publication patterns, intellectual structures, thematic development, and knowledge gaps within a specific research domain (Donthu et al., 2021; Karim & Soebagyo, 2021). The research data were retrieved from the Scopus database, widely recognized as a reliable source of large-scale bibliometric data for research assessment, university ranking, and research policy evaluation (Baas et al., 2020). Data extraction was conducted on June 16, 2026.

The Scopus search was performed using the following query: (TITLE-ABS-KEY ("digital divide" OR "digital inequality" OR "socioeconomic") AND TITLE-ABS-KEY ("self-regulated learning" OR "learning autonomy") AND TITLE-ABS-KEY (student OR school OR "higher education")). The search string was restricted to operational socio-material indicators, including "digital divide," "digital inequality," and "socioeconomic," to retrieve an empirical and pedagogically relevant corpus documenting the tangible effects of digital and socioeconomic disparities on students' learning autonomy. Although the title and theoretical framework of this study are grounded in Pierre Bourdieu's critical sociology, terms such as "social stratification," "habitus," and "cultural capital" were not included in the search string to avoid broadening the dataset toward abstract sociological publications that do not directly address self-regulated learning, students, or digital pedagogy. Therefore, the final corpus represents a focused body of literature situated at the intersection of digital inequality and self-regulated learning.

Boolean operators, particularly AND and OR, were used to structure the Scopus search and ensure conceptual precision across the three main dimensions of the study: digital inequality, self-regulated learning, and student learning contexts. The publication period was limited to January 2016 to June 2026 to capture recent developments in digital learning research, including the expansion of generative AI-supported educational environments by mid-2026. The inclusion criteria consisted of: (1) documents indexed in Scopus; (2) publications written in English; (3) journal articles and review articles; (4) publications within the period of January

2016 to June 2026; and (5) documents that explicitly addressed at least two of the following dimensions: digital divide or digital inequality, socioeconomic context, self-regulated learning or learning autonomy, and student learning. Documents were excluded if they were outside the specified publication period, written in languages other than English, categorized as conference papers, book chapters, editorials, notes, or other non-article formats, or did not directly relate to the conceptual intersection examined in this study.

The document identification and screening process followed the PRISMA 2020 protocol to ensure transparent reporting of identification, screening, eligibility, and inclusion procedures (Page et al., 2021). The initial Scopus search identified 62 potential documents. Six records were excluded because they fell outside the publication period of January 2016 to June 2026, leaving 56 records for screening. A further nine records were excluded because they were categorized as non-eligible document types, such as conference papers, book chapters, notes, books, retracted articles, short surveys, or letters. This process left 47 documents for eligibility assessment. At the eligibility stage, two documents were excluded because they did not meet the final eligibility requirements, particularly language and relevance requirements. As a result, 45 documents were included in the final bibliometric corpus. The complete screening process is presented in Figure 1.

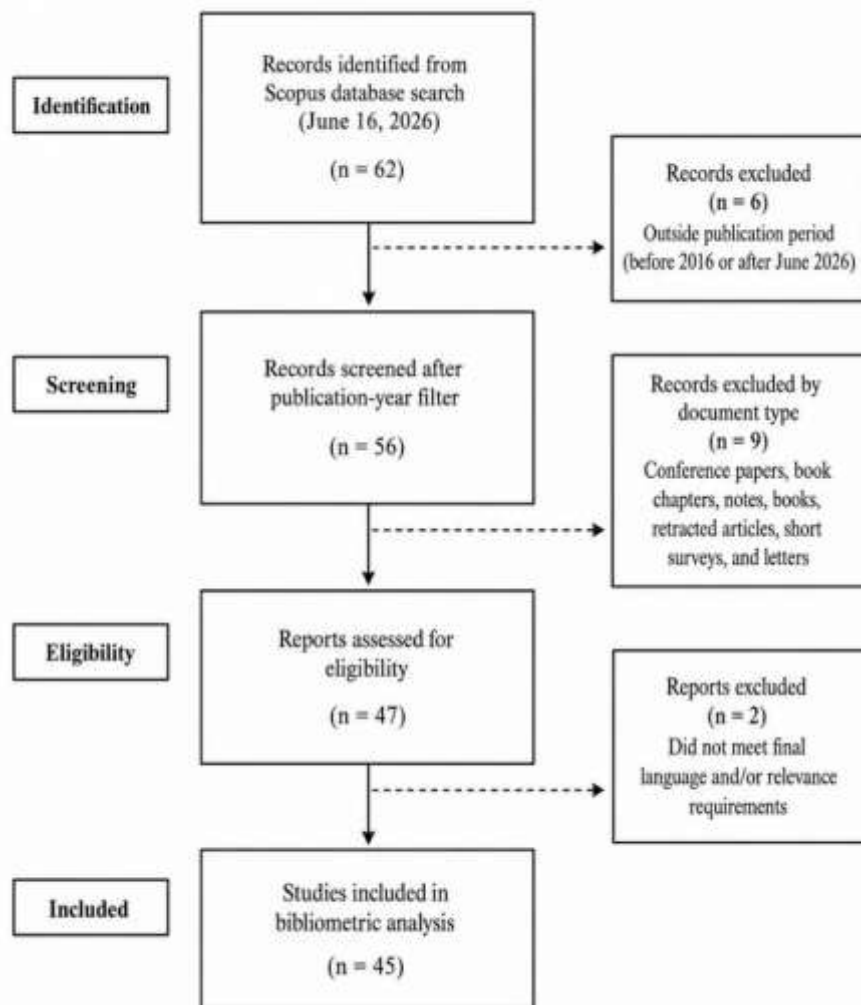


Figure 1. PRISMA flow diagram of document identification and screening

The selected documents were downloaded from Scopus in CSV format and analyzed using the Bibliometrix R package via the Biblioshiny interface (version 4.3.2). Bibliometrix, developed by Aria & Cuccurullo (2017), provides an integrated environment for quantitative bibliometric

analysis, science mapping, and visual exploration of bibliographic data. The analytical procedure followed four stages: data retrieval, data screening and cleaning, examination of bibliometric attributes, and bibliometric network analysis. This staged procedure is consistent with general methodological guidance for bibliometric analysis (Donthu et al., 2021), the analytical structure enabled by Bibliometrix/Biblioshiny (Aria & Cuccurullo, 2017), and prior bibliometric applications in educational research (Julia et al., 2020). The descriptive analysis examined annual publication trends, source distribution, authorship patterns, and citation structures. The science mapping analysis examined co-occurrence networks, thematic maps, and collaboration patterns to identify dominant topics, conceptual relationships, and the field's intellectual structure.

Pierre Bourdieu's critical sociological framework was operationalized as an interpretive analytical lens for reading bibliometric indicators, particularly symbolic capital, social capital, habitus, and symbolic violence (Bourdieu, 1986; Bourdieu et al., 2000). Symbolic capital was examined through citation-related indicators, including highly cited documents, influential sources, and the visibility of particular journals or authors within the corpus. Social capital was examined through collaboration structures, including co-authorship patterns, country collaboration networks, and institutional linkages, which indicate the relational distribution of scholarly production. Habitus was interpreted through dominant keyword clusters, thematic orientations, and recurring conceptual patterns that reveal how the field constructs students' learning agency, autonomy, and digital competence. Symbolic violence was examined through the dominance of individualized or psychologizing frameworks in keyword networks and thematic structures, particularly when students' self-regulated learning was discussed without sufficient attention to socioeconomic constraints, home learning environments, or unequal access to digital resources. This operationalization enabled the study to connect bibliometric indicators with a critical sociological interpretation of digital self-regulated learning.

A formal quality appraisal based on journal quartile, CiteScore, impact factor, h-index, or minimum citation threshold was not used as an exclusion criterion. This decision was made because the study's objective was not to synthesize only high-impact publications, but to map the complete structure of a narrowly defined Scopus-indexed literature corpus that met the inclusion criteria. Nevertheless, quality control was maintained through database selection, document-type restriction, language restriction, relevance screening, and metadata completeness checks. Citation counts, influential sources, and source visibility were analyzed descriptively as part of the bibliometric results, rather than used to exclude documents from the corpus. The absence of a formal quality appraisal threshold is acknowledged as a methodological limitation, since all included documents were treated equally in the network analysis regardless of their citation impact or journal-level reputation.

RESULTS AND DISCUSSION

Key Metrics Landscape and Annual Publication Trends (2016–June 2026): Measuring the Escalation of Discourse in the Age of AI Acceleration

To map how macro-sociological dynamics, particularly social stratification and the digital divide, intersect with micro-pedagogical agency in self-regulated learning (SRL), this section first outlines the field's epistemic landscape. The bibliometric indicators show how scholarly attention to digital inequality and SRL developed from 2016 to June 2026.

A. Macro Analysis of the Key Metric Landscape (Main Information)

The metadata show that scholarship linking SRL with structural inequality remains dispersed across scientific outlets. Table 1 summarizes the corpus.

Table 1. Bibliometric Data Key Metrics Landscape (2016–June 2026)

Description	Results
MAIN INFORMATION ABOUT DATA	
Timespan	2016:2026
Sources (Journals, Books, etc)	40
Documents	45
Annual Growth Rate %	19.62
Document Average Age	2.8
Average citations per doc	15.44
References	3000
DOCUMENT CONTENTS	
Keywords Plus (ID)	134
Author's Keywords (DE)	175
AUTHORS	
Authors	129
Authors of single-authored docs	8
AUTHORS COLLABORATION	
Single-authored docs	8
Co-Authors per Doc	3.04
International co-authorships %	17.78
DOCUMENT TYPES	
article	45

Source: Biblioshiny Data Processing (2026)

The corpus comprises 45 documents across 40 sources, yielding an almost 1:1 article-to-source ratio and indicating a decentralized field spread across educational technology, sociology of education, public policy, and educational psychology rather than concentrated in one outlet. With an average age of 2.8 years, the literature is recent and still developing. The documents cite 3,000 references, or about 66.67 per article, reflecting strong theoretical reliance on broader debates about technological neutrality, digital access, and unequal capacities for autonomous learning.

B. Collaboration Structure: Accumulation of Academic Social Capital

The corpus was produced by 129 authors, with only eight single-authored documents and an average of 3.04 co-authors per article, confirming a predominantly collaborative field. However, international co-authorship was only 17.78 percent, indicating that most collaboration remained domestic. In Bourdieusian terms, academic social capital exists but is unevenly internationalized: collaboration provides access to methods, theories, and publication networks, while limited cross-border ties constrain knowledge circulation. This pattern anticipates the later comparison between Single Country Publications and Multiple Country Publications.

C. Analysis of Annual Publication Trends and Citation Chronology

To assess how this discourse has evolved in response to digital transformation, the annual publication trend and citation chronology are presented in Table 2.

Table 2. Annual Scientific Production and Average Citations (2016–June 2026)

Year of Publication	Number of Publication Articles	Average Citations per Article (Mean TC per Art)	Average Citations per Year (Mean TC per Year)
2016	2	86.50	7.86
2017	3	54.67	5.47
2018	0	0.00	0.00

2019	2	21.50	2.69
2020	2	25.00	3.57
2021	1	3.00	0.50
2022	3	25.67	5.13
2023	4	17.00	4.25
2024	8	7.38	2.46
2025	8	7.12	3.56
January to June 2026	12	0.08	0.08

Source: *Biblioshiny Data Processing (2026)*

Table 2 shows a reactive-critical trajectory shaped by technological and educational disruptions. In 2016–2019, output remained at zero to three articles annually, but the 2016 and 2017 publications recorded high mean citations of 86.50 and 54.67, indicating foundational works that accumulated symbolic capital and legitimized links among digital access, socioeconomic conditions, and SRL. During 2020–2023, output rose gradually to 2, 1, 3, and 4 articles, while mean citations in 2020 (25.00) and 2022 (25.67) reinforced the view of the home as a non-neutral learning environment shaped by economic capital, spatial resources, digital infrastructure, parental support, and cultural capital. Growth accelerated in 2024–June 2026, with 8, 8, and 12 articles, respectively, producing an annual growth rate of 19.62 percent. The 2026 mean citation of 0.08 reflects citation latency rather than low scholarly significance because recent publications have had limited time to accumulate citations.

D. A Critical Analysis through Pierre Bourdieu's Sociological Framework: Academic Panic and Symbolic Violence in the Era of Artificial Intelligence

The sharp rise in publications by mid-2026 signals heightened scholarly concern and an epistemological shift in global education. Since late 2023, generative AI, Large Language Models (LLMs), and adaptive learning systems have intensified debate over learner autonomy, digital competence, and unequal capacities for self-regulation. In Bourdieu's terms, education is a field of struggle in which actors define legitimate knowledge, behavior, and competence; consequently, bibliometric growth indicates concern that digital environments reward students already possessing economic, cultural, and technological capital. This growth also reflects dissatisfaction with psychologically reductionist accounts of SRL as internal ability, motivation, or choice. Digital SRL is increasingly understood as digital habitus: class-shaped dispositions, cognitive routines, technological practices, and evaluative capacities. Privileged students can access high-quality devices, stable internet, premium platforms, and AI tools, while inherited cultural capital helps them formulate prompts, assess algorithmic outputs, and convert digital resources into academic advantage.

Less advantaged students may share low-quality devices, face restricted data access, study in crowded homes, and lack technical or critical guidance. These conditions foster a different digital habitus in which technology is used more for passive consumption than independent knowledge production. Whereas digital-divide research in 2016–2019 emphasized physical access and basic literacy, AI-mediated inequality increasingly appears as an agency divide: unequal capacity to convert economic and cultural resources into effective learning strategies. This shift exposes symbolic violence in educational digitalization. By requiring autonomy, digital competence, and SRL, institutions may present upper-middle-class dispositions as universal norms. Framed as neutral, future-oriented competencies, these expectations conceal unequal material and cultural resources and can label structurally constrained students as unmotivated, passive, or deficient. Thus, publication growth represents both expanded research and a critical effort to reveal how digitalization reproduces class inequality through the language of autonomy, innovation, and meritocracy.

Geographical Distribution and Global Influence of Scholarship: Mapping Centers of Academic Authority in the Digital Divide

This section maps the geographical distribution of knowledge production on digital inequality and SRL. Publication frequency, citation distribution, and international collaboration are interpreted not only as bibliometric indicators but also as evidence of unequal academic positioning. Publication frequency represents participation in knowledge production, citations reflect symbolic capital, and international collaboration indicates academic social capital. Consistent with the Method section, these indicators reveal both scientific output and the structure of scholarly visibility and recognition.

A. Competition in Scientific Output Among Nations

Figure 2 maps country contributions, while Table 3 reports publication frequency by authors' affiliations.

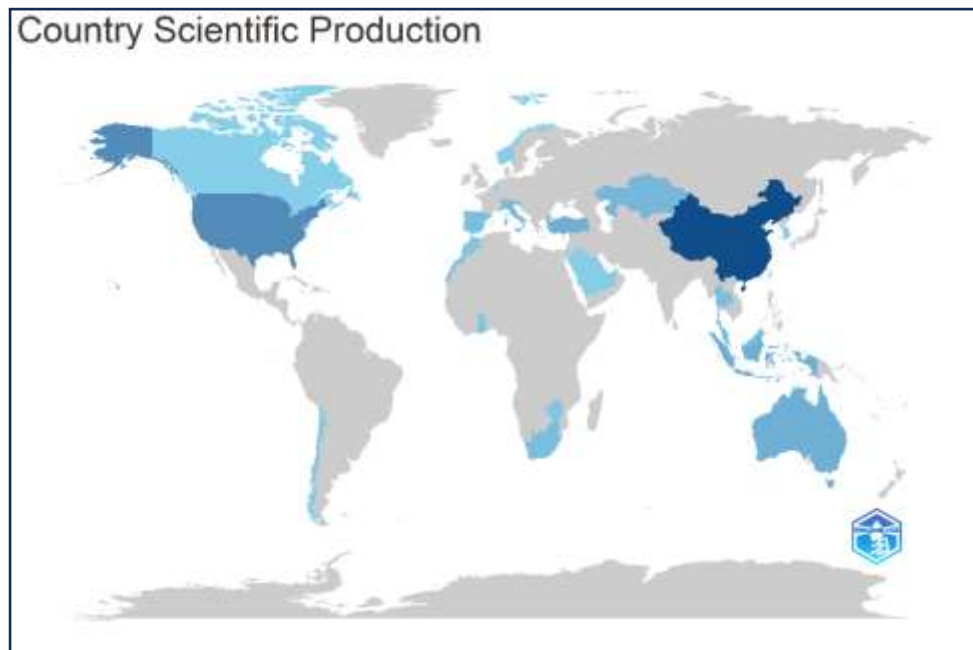


Figure 2. Geographical Distribution Map of Global Publications (Country Scientific Production)

Source: Biblioshiny Data Processing (2026)

Figure 2 shows uneven national participation: darker areas indicate stronger contributions, whereas lighter or gray areas indicate limited involvement. Thus, scholarship on digital inequality and SRL is concentrated in a small number of national academic systems within the selected Scopus corpus rather than evenly distributed across the global research community.

Table 3. Distribution of Publication Frequency Based on Author's Geographical Affiliation

REGION	FREQUENCY
CHINA	19
USA	10
AUSTRALIA	5
INDONESIA	5
TURKEY	5
ITALY	4
KAZAKHSTAN	4
MALAYSIA	3
SOUTH AFRICA	3
SPAIN	3

THAILAND	3
CHILE	2
GHANA	2
ISRAEL	2
MOROCCO	2
PORTUGAL	2
SLOVENIA	2
SWITZERLAND	2
UNITED ARAB EMIRATES	2
ZIMBABWE	2
BELGIUM	1
CANADA	1
NORWAY	1
SAUDI ARABIA	1
SOUTH KOREA	1

Source: Biblioshiny Data Processing (2026)

Table 3 places China first with 19 appearances, followed by the United States with 10; Australia, Indonesia, and Turkey each record five. The field is therefore not exclusively Western, as East Asian and selected Global South countries contribute visibly. Indonesia's top-five position shows active engagement with digital inequality, socioeconomic disparity, and SRL, supporting the argument that digital learning is shaped by infrastructure, home conditions, and social stratification as well as technology and pedagogy. However, publication volume indicates participation rather than influence; in Bourdieusian terms, symbolic capital depends on citation, recognition, and wider scholarly circulation.

B. Symbolic Capital Inequality and the Hegemony of Global Citations

Although publication frequency provides an overview of national participation, the symbolic influence of a country in the scientific field is more clearly reflected through citation accumulation. Citations are not interpreted here merely as numerical indicators, but as signs of recognition and academic legitimacy within the global knowledge system. Citation-based indicators are widely used in bibliometric analysis to assess scientific influence, visibility, and intellectual impact within a research field (Aria & Cuccurullo, 2017; Donthu et al., 2021). The global distribution of citation visibility is presented in Figure 3.

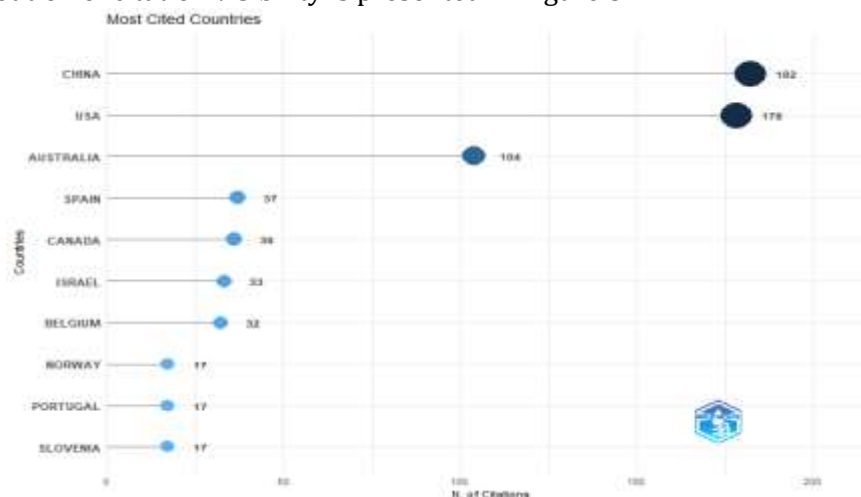


Figure 3. The Influence of Global Citations by Country (*Most Cited Countries*)

Source: Biblioshiny Data Processing (2026)

Figure 3 shows concentrated symbolic capital: China leads with 182 citations, followed by the United States (178) and Australia (104), while Spain, Canada, and Slovenia receive 37, 36, and 17 citations, respectively. Despite the broader geographical participation shown in Figure 2, citation recognition remains concentrated. Indonesia exemplifies this disparity: although it ranks among the five most productive countries in Table 3, it is absent from the major citation distribution. This gap represents citation invisibility; whereby developing or semi-peripheral academic systems contribute knowledge but remain weakly positioned in global citation circulation.

This finding should not be reduced to an assumption about the lower quality of Indonesian scholarship. The bibliometric pattern points instead to a structural problem of academic recognition. Research from developing countries often addresses urgent empirical realities, including unequal digital infrastructure, limited device ownership, unstable connectivity, and uneven home learning support. However, such research may receive limited international uptake if it is weakly connected to dominant citation networks, leading journals, and cross-border scholarly communities (Shen et al., 2021).

Indonesia's citation invisibility shows that stratification in digital learning is mirrored in academic knowledge production. Just as unequal capital shapes students' learning opportunities, it also affects countries' capacity to convert local evidence into globally recognized theory. Lower citation visibility therefore does not imply unimportant findings; it indicates that recognition is mediated by symbolic and social capital.

C. Social Capital Isolation and Constraints on International Collaboration

Academic symbolic capital is closely related to social capital, examined here through co-authorship and international collaboration. Figure 4 distinguishes Single Country Publications (SCP) from Multiple Country Publications (MCP). China combines strong domestic production with international collaboration, whereas Indonesia and several developing countries rely mainly on SCP, indicating weaker integration into cross-border academic networks.

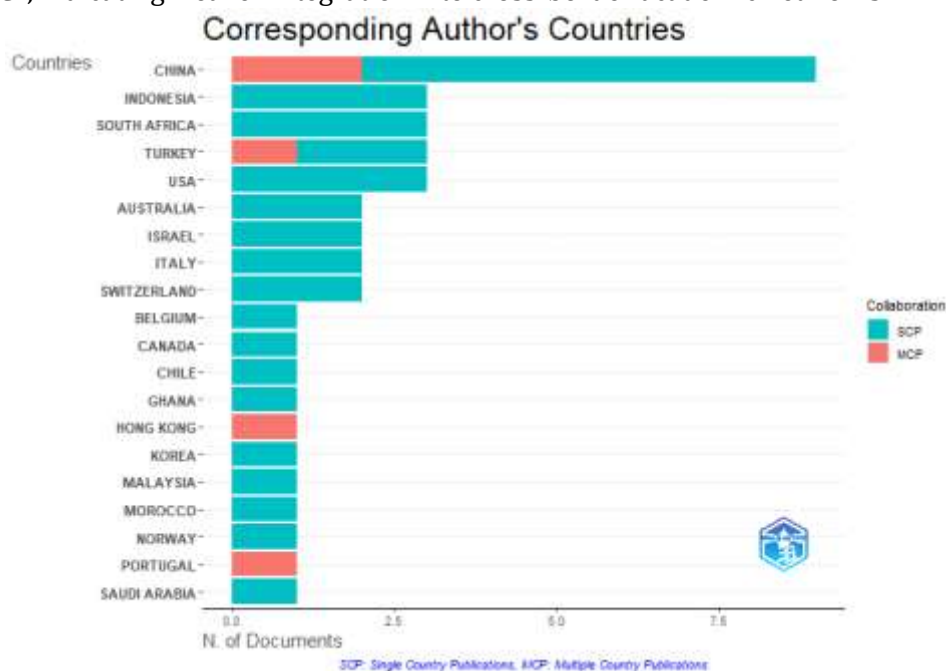


Figure 4. Analysis of Corresponding Authors and Collaboration Structures

Source: Biblioshiny Data Processing (2026)

In Bourdieusian terms, international collaboration provides access to expertise, methodological exchange, publication opportunities, and wider circulation, enabling social capital to be converted into symbolic capital through visibility and citations. Limited

collaboration may leave relevant Global South evidence on device scarcity, unstable internet access, and unequal home learning support peripheral to global theory formation. Consequently, SRL models from highly resourced systems may dominate, while the experiences of students in digitally constrained environments remain underrepresented.

Three Fields Plot visualizations clarify patterns of social capital and marginality. Figure 5 links productive authors, national affiliations, and dominant keywords.

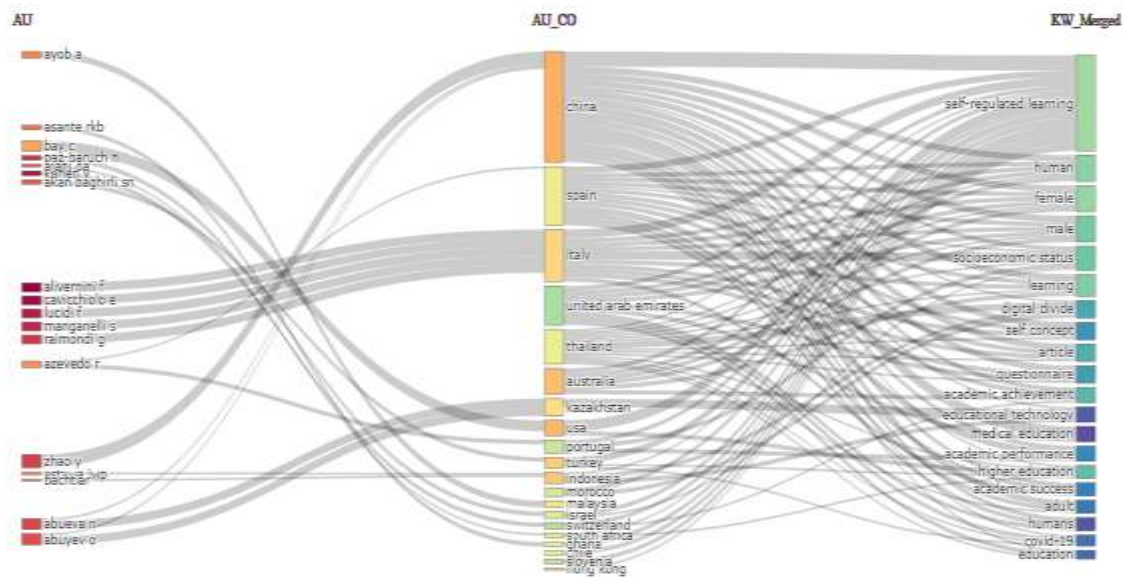


Figure 5. Interweaving Authors, Countries, and Key Keywords through Three Fields Plot 1

Source: Biblioshiny Data Processing (2026)

Figure 5 clusters authors within national and conceptual formations: Zhao Y is strongly linked to China, while Alivernini F, Cavicchiolo E, Lucidi F, Manganelli S, and Raimondi G form an Italian bloc. These nationally embedded communities shape not only publication output but also the concepts, methods, and student populations visible in the literature. Figure 6 further maps the density and direction of flows among countries, authors, and keywords.

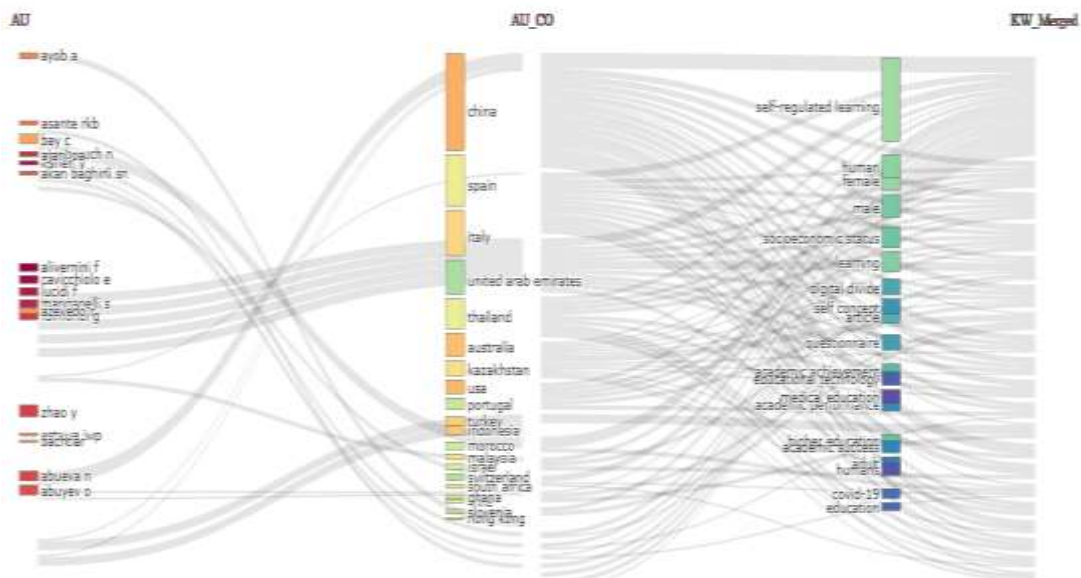


Figure 6. Affirmation of Theoretical Content Flow Density through Three Fields Plot 2

Source: Biblioshiny Data Processing (2026)

Together, Figures 4–6 show that the digital divide concerns not only student access but also unequal authority to define digital pedagogy. Countries with stronger collaboration and citation visibility shape dominant SRL categories, creating the risk that theories developed in well-resourced systems are generalized to materially different learners. Such theories may reproduce an upper-middle-class digital habitus and overlook structural constraints in less-resourced contexts. Academic social capital and citation visibility thus shape how autonomy and competence are understood. The next section uses co-keyword analysis to examine the literature’s internal conceptual structure.

After mapping the geographical distribution of knowledge production and the unequal circulation of symbolic capital, this section examines the internal conceptual structure of the literature through co-keyword network analysis. In bibliometric science mapping, author keywords and indexed keywords are not merely descriptive labels; they indicate how a research field organizes its dominant concepts, methodological preferences, and theoretical priorities (Aria & Cuccurullo, 2017; Donthu et al., 2021). In this study, co-keyword analysis is used to identify how the discourse on digital inequality and self-regulated learning connects macro-sociological variables, such as socioeconomic status and digital divide, with micro-pedagogical variables, such as learning autonomy, motivation, achievement, and self-regulation.

Source: Biblioshiny Data Processing (2026)

ITEJ : Indonesian Education and Technology Journal | 159

motivation, and student agency. Socioeconomic status, digital divide, COVID-19, education, higher education, motivation, and structural equation modeling appear in the same cluster, but socioeconomic status has a betweenness of only 3.04 and digital divide a PageRank of 0.008. Structural inequality is therefore recognized, yet remains secondary to the dominant psychological vocabulary of self-regulation.

The blue cluster connects female, male, and human, each with a betweenness of 43.37, and learning, with 25.65, to academic achievement, performance, and success. This structure reflects an emphasis on measurable individual characteristics and outcomes. Although useful, such an orientation risks reducing SRL to an individual attribute and obscuring how digital resources, family support, cultural capital, and domestic learning environments shape learning capacity. In Bourdieusian terms, treating motivation, regulation, and achievement as individualized variables may enact symbolic violence by concealing unequal material and social conditions.

The green cluster contains questionnaire, humans, psychology, medical education, undergraduate, and medical student, showing the influence of survey-based, psychology-oriented research in medical and higher education. These studies clarify how SRL is operationalized, but reinforce the field's preference for cognitive and instrument-based approaches. Socioeconomic status and digital divide remain visible without attaining the authority of self-regulation, demographic categories, and achievement indicators.

Together, the clusters reveal conceptual stratification. Digital inequality is acknowledged, but the field remains organized around psychological, demographic, and performance categories, positioning SRL at the highest symbolic level while structural conditions remain peripheral. Figure 7 therefore supports the argument that SRL becomes sociologically incomplete when detached from economic capital, cultural capital, and digital resources. In AI-supported education, students with digital habitus can convert technology into academic advantage, whereas those lacking equivalent capital are assessed by identical standards of autonomy and performance despite unequal constraints.

Thematic Evolution and Future Research Agendas: Manifestations of the Deconstruction of a Class-Biased Digital Curriculum

The thematic evolution analysis compares the foundational period (2016–2024) with the acceleration period (2025–June 2026), tracing movement from socioeconomic status, motivation, and online learning toward artificial intelligence, adaptive technologies, higher education, and digital divide discourse. PageRank identifies changing conceptual influence, while Bourdieu's framework interprets shifts in symbolic capital, digital habitus, and class-biased technological expectations. Table 4 summarizes the clusters, keywords, centrality values, transitions, and intervention priorities.

Table 4. Conceptual Transformation Matrix and Inter-Period PageRank Centrality Value

Thematic Category Cluster	Period 1 Keywords	P1 PageRank	Transition	Period 2 Keywords	P2 PageRank	Academic Intervention Focus
Core Theoretical Anchor	Self-regulated learning	0.0457	→	Self-regulated learning; Adaptive learning technologies; Artificial intelligence; Educational technology	0.0318; 0.0072; 0.0068; 0.0078	Instrumentalization of student cognition through algorithm-driven corporate learning platforms
Social &	Socioeconomic	0.0060;	→	Higher	0.0123;	Shift of inequality

Demographic Context	c status; Motivation; Primary education	0.0055; 0.0050		education; Digital divide; Social status	0.0115; 0.0105	discourse from primary education to higher education contexts
Academic Impact & Outcomes	Academic achievement; Online learning	0.0104; 0.0089	→	Article; Academic success	0.0155; 0.0091	Standardization of learning outcomes into administrative success metrics
Global Crisis Context	COVID-19; Female	0.0094; 0.0155	→	Human; Adults	0.0155; 0.0123	Post-pandemic normalization toward general digital adulthood

Source: *Biblioshiny Data Processing (2026)*

Four shifts emerge. First, SRL remains the theoretical anchor but moves from a cognitive-motivational construct associated with socioeconomic status and primary education toward adaptive learning, AI, and educational technology. Its growing role as a prerequisite for AI-supported learning indicates instrumentalization through algorithmic platforms (Lan & Zhou, 2025). In Bourdieusian terms, SRL becomes digital cultural capital: a class-mediated capacity to manage platforms, evaluate information, and convert access into academic advantage.

Second, the social-demographic cluster shifts from socioeconomic status, motivation, and primary education to higher education, digital divide, and social status. Universities are increasingly visible because they depend on learning management systems, digital assessment, and AI tools. However, this concentration may obscure inequalities in primary and secondary education, even though digital agency develops earlier through family resources, schools, and accumulated digital habitus.

Third, academic achievement and online learning shift toward article and academic success, reflecting the standardization of outcomes into administrative and performance indicators. Uniform measures may constitute symbolic violence when they conceal unequal access to devices, connectivity, study space, parental support, and prior digital literacy (Vasz kun & Mihalkov Szakács, 2025). Students lacking economic and cultural capital may consequently appear less self-regulated despite structurally produced constraints.

Fourth, COVID-19 and female shift toward human and adults, indicating the post-pandemic normalization of digital learning as part of education and lifelong learning. Normalization may hide unequal infrastructure, domestic support, and cultural resources, presenting class-based advantage as individual readiness or competence (Qaribilla et al., 2024).

Overall, the field has moved from socioeconomic status, motivation, primary education, and online learning toward AI, adaptive technologies, higher education, digital divide, social status, and academic success. Earlier concerns persist but are reorganized within platform-based, AI-mediated, and performance-oriented education. Digital SRL should therefore be understood as socially produced and technologically mediated agency dependent on economic and cultural capital, infrastructure, and institutional support (Bouakaz & Khalid, 2025; Bulathwela et al., 2024;).

Future research should examine class-based digital habitus across educational levels; identify how AI platforms privilege prompt literacy, information evaluation, and autonomous task management; compare Scopus with other databases to assess Global South visibility; and develop class-sensitive curricula grounded in students' material conditions. The objective is not to reject SRL but to reconstruct it through a critical, socially grounded, and equity-oriented perspective that challenges class-biased digital curricula.

Limitations of the Bibliometric and Theoretical Interpretation

This study has four limitations. First, the focused corpus of 45 Scopus-indexed documents limits the stability and generalizability of betweenness, closeness, and PageRank; these values indicate relative positions within the corpus rather than the entire digital-learning literature. Second, exclusive reliance on Scopus improves metadata consistency but may underrepresent publications indexed in Web of Science, ERIC, Dimensions, Google Scholar, and regional databases, potentially reproducing the citation invisibility examined here (Rafols et al., 2020). Third, the narrow search terms improved precision but may have excluded related concepts, including digital capital, digital inclusion, learning agency, online-learning inequality, cultural capital, and educational stratification. The corpus therefore represents a focused core rather than an exhaustive literature.

Fourth, Bourdieu's symbolic capital, social capital, habitus, and symbolic violence were interpreted through citations, collaboration, keyword clusters, and thematic structures rather than full-text coding. This integration cannot replace qualitative content analysis. Future studies should combine bibliometric mapping with systematic review or critical discourse analysis and use broader, multi-database datasets. These limitations define the study's interpretive boundaries without invalidating its critical mapping of Scopus-indexed literature from 2016 to June 2026.

Conclusive Synthesis: Theoretical Gaps and the Politicization of Self-Regulated Learning

The empirical findings presented in this study demonstrate that the discourse on self-regulated learning in digital environments is shaped by uneven structures of publication visibility, citation recognition, conceptual dominance, and thematic transformation. Through key metrics, geographical distribution, citation patterns, collaboration structures, co-keyword networks, and thematic evolution, the analysis shows that self-regulated learning is not merely a neutral psychological construct. Rather, it is increasingly embedded within a digitally mediated educational field in which students' learning agency is interpreted, measured, and rewarded through unequal distributions of economic, cultural, social, and symbolic capital.

This finding directly contributes to theories of social stratification by showing that digital learning has become a new arena in which class-based inequalities are reproduced. Classical and contemporary perspectives on social stratification emphasize that social inequality is not limited to income differences, but also involves unequal access to resources, recognition, networks, institutional legitimacy, and opportunities for social mobility (Jalali et al., 2023). In the context of digital pedagogy, these dimensions are translated into unequal access to devices, internet stability, digital literacy, parental educational support, learning space, and familiarity with platform-based or AI-supported learning environments (Kafle et al., 2025). Therefore, the digital divide should not be treated merely as a technical gap in infrastructure, but as a stratified social condition that shapes students' capacity to perform self-regulated learning.

The first major finding concerns the stratification of knowledge production. The geographical and citation analyses show that countries may participate actively in publication production without necessarily acquiring equivalent symbolic capital. Indonesia, for example, appears among the visible contributors in publication frequency, yet remains absent from the major citation distribution. This citation invisibility indicates a disjunction between empirical contribution and international recognition. In Bourdieusian terms, the global academic field distributes symbolic authority unevenly: some countries possess the capacity to define dominant theoretical vocabularies, while others contribute empirical realities that remain less visible in citation circulation. This finding extends the logic of social stratification from the student level to the academic field itself, showing that the production of knowledge about digital inequality is also shaped by unequal recognition and symbolic hierarchy.

The second major finding concerns the role of academic social capital. Collaboration analysis shows that countries with stronger international co-authorship networks are better positioned to circulate their findings and accumulate scholarly recognition. By contrast, countries with limited Multiple Country Publications remain more dependent on domestic academic networks. This pattern reflects a stratified structure of academic social capital, where access to international collaboration functions as a relational advantage. In this sense, the same sociological mechanism that privileges students with stronger family, school, and digital support also privileges researchers and countries with stronger scholarly networks. Social capital therefore operates across levels: it shapes both students' access to learning opportunities and researchers' access to global academic legitimacy.

The third major finding appears in the co-keyword network. The conceptual structure of the field is dominated by self-regulated learning, psychological variables, demographic categories, achievement indicators, and instrument-based approaches. Although terms such as socioeconomic status and digital divide are present, they occupy less central positions than the psychological vocabulary of learner competence. This pattern reveals a conceptual imbalance. The literature increasingly recognizes the relevance of social inequality, yet it still tends to organize explanation around individual self-regulation, motivation, and performance. From the standpoint of social stratification theory, this is problematic because it risks converting structurally unequal learning conditions into individual performance differences. From Bourdieu's perspective, this tendency may operate as symbolic violence when students' unequal access to capital is misrecognized as unequal motivation, discipline, or academic ability.

The fourth major finding is the thematic transformation of the field between 2016–2024 and 2025–June 2026. The Conceptual Transformation Matrix shows four shifts: the instrumentalization of SRL through artificial intelligence and adaptive learning technologies; the movement of inequality discourse from primary education toward higher education; the standardization of learning outcomes into administrative success metrics; and the post-pandemic normalization of digital learning as a general condition of educational life. These shifts indicate that SRL is increasingly positioned as a prerequisite for participation in AI-supported and platform-mediated education. In this context, self-regulation becomes a form of digital cultural capital: a socially produced capacity to navigate, evaluate, and benefit from algorithmic learning environments.

Taken together, the findings address the theoretical gap identified in the Introduction. Existing studies have often treated socioeconomic status, device availability, and parental involvement as contextual or control variables. This bibliometric analysis demonstrates that these factors should instead be placed at the center of digital SRL theory. Students' ability to regulate learning in digital environments is not simply a matter of motivation or individual discipline. It is shaped by their location within a stratified social structure, including access to economic resources, cultural capital, home learning conditions, digital infrastructure, institutional support, and recognition within the educational system.

The central contribution of this study is the development of a critical bibliometric reading of digital SRL discourse through the lens of social stratification. By integrating Biblioshiny-based science mapping with Bourdieu's concepts of symbolic capital, social capital, habitus, and symbolic violence, the study shows that bibliometric indicators can be used not only to measure scientific production but also to expose the power relations embedded in knowledge circulation. The results suggest that the global digital curriculum often presents autonomy, adaptability, and self-regulation as universal educational ideals, while insufficiently accounting for the unequal capital required to perform these ideals in practice.

This synthesis does not reject self-regulated learning as a pedagogical goal. Rather, it argues that SRL must be reconstructed through a socially grounded and equity-oriented perspective. In

the age of artificial intelligence and adaptive learning platforms, the key educational question is not only whether students can regulate their own learning, but under what social, technological, institutional, and class-based conditions such regulation becomes possible. Future research should therefore move beyond individualistic models of learner autonomy and develop critical frameworks that connect digital pedagogy, social stratification, and the unequal formation of digital habitus.

CONCLUSIONS

This Biblioshiny-assisted analysis of 45 Scopus-indexed documents published from 2016 to June 2026 shows that digital self-regulated learning (SRL) is not merely an individual psychological skill. It is a socially situated capacity shaped by unequal access to devices, connectivity, digital literacy, home support, and AI-supported learning environments. The discourse itself is also structured by unequal publication visibility, citation recognition, international collaboration, keyword centrality, and thematic development. The study's main contribution is Critical SRL, which integrates bibliometric science mapping with Bourdieu's cultural, social, and symbolic capital, habitus, and symbolic violence. This perspective defines digital SRL as a class-mediated disposition formed through economic, cultural, technological, and institutional resources. It also shows that publication output does not guarantee influence in citation circulation or theoretical agenda-setting.

The findings are limited by the small Scopus-only corpus, the focused keyword strategy, and the interpretation of Bourdieu through bibliometric indicators rather than full-text coding. Future research should compare databases, combine bibliometrics with systematic review, qualitative fieldwork, or critical discourse analysis, and investigate how disadvantaged students develop digital habitus and learning agency in AI-supported settings. For policymakers, particularly in developing countries, digital transformation must extend beyond standardized platforms. Autonomous learning requires equitable devices, affordable and stable connectivity, teacher scaffolding, AI literacy, family support, and context-sensitive curricula. Without these conditions, digital pedagogy may reproduce inequality by applying identical expectations of independence to students with unequal resources.

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AUTHOR CONTRIBUTION STATEMENT

RA contributed to the conceptualization, methodology, data collection, data curation, formal analysis, visualization, and preparation of the original manuscript draft. EES contributed to the conceptualization, methodology, validation, formal analysis, and review and editing of the manuscript. AS contributed to the theoretical framework, critical interpretation, validation, and review and editing of the manuscript. MNA contributed to data screening, data curation, bibliometric analysis, visualization, and review and editing of the manuscript. ANH contributed to supervision, theoretical validation, interpretation of the findings, project administration, and review and editing of the manuscript. All authors contributed to the interpretation and discussion of the findings, reviewed and approved the final version of the manuscript, and agreed to be accountable for all aspects of the work.

AI DISCLOSURE STATEMENT

The authors used a generative artificial intelligence tool solely to assist with language editing, including improving grammar, sentence structure, readability, and clarity. Artificial intelligence was not used to formulate the research objectives, develop the theoretical framework, determine the search strategy, select or screen the documents, conduct the bibliometric analysis, interpret the findings, or formulate the conclusions. All AI-assisted text was carefully reviewed, revised, and verified by the authors. The authors take full responsibility for the accuracy, originality, integrity, and final content of the manuscript.

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