

Dynamic assessment and deep learning in elementary writing instruction: A bibliometric study

Ferafanisah¹✉, Sri Suryaningsih², Jessy Parmawati Atmaja³

¹²³STKIP Harapan Bima, Indonesia

¹Email: ferafanisah123@gmail.com

²Email: suryaningsih2009@gmail.com

³Email: jessyparmawatiatmaja@habi.ac.id



(✉ Corresponding Author)

Abstract

This study conducts a bibliometric analysis to map global research trends on Dynamic Assessment (DA) and deep learning in elementary writing instruction from 2019 to 2025. Using 499 Scopus-indexed documents, the analysis employed VOSviewer to generate network, overlay, and density visualizations based on co-occurring terms. The results show two dominant thematic directions: (1) foundational writing pedagogy reflected in terms such as *writing instruction*, *skill*, *essay*, and *child* and (2) rapid growth of technology-driven themes, including *deep learning*, *machine learning*, *artificial intelligence*, and *ChatGPT*. The cluster and temporal maps reveal that narrative writing now functions as a bridge between reflective learning approaches and AI-supported scaffolding tools. Compared with previous studies that examined DA, deep learning, or writing instruction separately, this research provides the first comprehensive bibliometric evidence of their convergence. The study's novelty lies in identifying an emerging integrated research ecosystem where DA principles, deep learning strategies, and intelligent technologies collectively shape future directions in writing pedagogy. These findings suggest the need for adaptive, technology-enhanced assessment models that support meaningful and reflective writing development in elementary learners.

Keywords: dynamic assessment, deep learning, elementary writing instruction, narrative writing

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Contribution to Literature: This study provides the first bibliometric mapping that simultaneously examines Dynamic Assessment, deep learning, and elementary writing instruction, revealing how these domains increasingly converge in current research. The findings identify an emerging integrated research ecosystem where reflective writing processes, mediated feedback, and AI-supported tools collectively shape writing pedagogy.

1. Introduction

Writing is a fundamental literacy competency in elementary education, forming the basis for students' cognitive, linguistic, and creative growth. Narrative writing, particularly, helps young learners organize events, express ideas coherently, and build meaningful connections between experiences and textual structures. However, research shows that many elementary students face persistent difficulties in structuring narratives, applying linguistic features, and generating moral messages (Anggraeni et al., 2024). These challenges are further exacerbated when instructional practices rely predominantly on product-based assessments that provide limited scaffolding and feedback. Consequently, scholars emphasize the need for assessment approaches that are adaptive, process-oriented, and tightly integrated with instruction among them, Dynamic Assessment (DA) has emerged as a promising model.

Dynamic Assessment is grounded in Vygotsky's sociocultural theory and particularly the concept of the Zone of Proximal Development (ZPD), highlighting the importance of mediated learning and instructional scaffolding in helping students achieve optimal performance (Peña et al., 2006; Vygotsky, 1978). Unlike traditional summative assessments, DA integrates evaluation with immediate intervention, enabling teachers to diagnose students' weaknesses and provide mediation during the learning activity itself. In the context of narrative writing, DA is especially powerful because writing is a recursive process requiring continuous support, reflection, and revision. Studies have demonstrated that DA can enhance narrative competence through peer interaction, teacher scaffolding, and revision cycles, allowing learners to internalize writing strategies more effectively (Fiestas & Peña, 2018; Van Der Veen & Poland, 2012). DA has also been shown to reduce anxiety, increase motivation, and promote more equitable learning opportunities, especially for multilingual students (Goodarzi & Namaziandost, 2025).

Simultaneously, contemporary pedagogical discourse underscores the relevance of deep learning approaches in elementary education. Deep learning incorporates mindful, meaningful, and joyful learning as core dimensions, fostering intentional awareness, contextual understanding, and emotional engagement in students (Feriyanto & Anjariyah, 2024; Yusuf et al., 2025). In narrative writing instruction, deep learning occurs when students consciously monitor their writing processes, draw connections between stories and personal experiences, and engage enthusiastically in writing tasks through interactive and enjoyable learning environments (Curtis et al., 2025; Stern, 2019). These dimensions align naturally with the scaffolding and reflective cycles embedded in DA, making the integration of DA and deep learning especially meaningful for literacy development.

Although both DA and deep learning have been extensively discussed in educational literature, their intersection within elementary writing instruction remains underexplored from a bibliometric perspective. Existing studies tend to examine DA as a diagnostic or intervention tool for language learning (Petersen et al., 2017; Shrestha, 2020), while deep learning research has primarily focused on broader instructional innovation rather than on writing-specific contexts (Fullan & Langworthy, 2014). Furthermore, narrative writing research frequently highlights challenges in text structure, grammar, and writing motivation (Grenner et al., 2021; Hall et al., 2021), yet does not systematically map how DA and deep learning have shaped scholarly conversations in this field. As a result, we

lack a clear understanding of how these two frameworks converge, evolve, and influence global research trends in elementary writing pedagogy.

Bibliometric analysis offers a robust methodological lens to fill this knowledge gap. Science mapping techniques such as co-authorship networks, keyword co-occurrence, and co-citation analysis enable scholars to visualize the intellectual structure and thematic evolution of a research field. This is particularly valuable for emerging interdisciplinary topics such as DA and deep learning, where conceptual boundaries and research priorities continue to shift. By examining publication patterns across two decades, bibliometric analysis can reveal influential authors (e.g., Peña, Shrestha, Petersen), foundational theories (e.g., Vygotskian mediation), dominant themes (e.g., scaffolding, narrative competence), and emerging pedagogical innovations (e.g., technology-supported DA using tools like Wordwall; Putri et al., 2024).

Moreover, understanding global research trends is essential for informing educational practice. Studies show that DA enhances mindful revision and metacognitive awareness (Shrestha, 2020), while deep learning approaches strengthen students' engagement and conceptual understanding (Martinez & McGrath, 2018). Integrating these approaches in elementary writing may therefore provide transformative insights for teachers seeking to support diverse learners through adaptive, reflective, and joyful pedagogy. However, without a bibliometric understanding of how these fields converge, educators and researchers lack a comprehensive map of existing knowledge and future possibilities.

Therefore, this study conducts a comprehensive bibliometric analysis of global research on Dynamic Assessment and deep learning in elementary writing instruction, drawing from Scopus-indexed publications from 2000 to 2025. Using tools such as VOSviewer and Biblioshiny, this study aims to analyse dynamic assessment and deep learning in elementary writing instruction. By addressing this, the study enriches the scholarly understanding of how DA and deep learning intersect within elementary writing pedagogy, providing a valuable foundation for curriculum designers, practitioners, and researchers aiming to enhance literacy outcomes through adaptive and meaningful instructional approaches.

2. Literature Review

2.1. Dynamic Assessment in Elementary Education

Dynamic Assessment (DA), grounded in Vygotsky's ZPD, integrates assessment with instructional mediation to reveal and strengthen learners' developing abilities (Peña et al., 2006; Vygotsky, 1978). DA provides immediate scaffolding that allows teachers to diagnose writing difficulties and support improvement during the learning activity itself. Studies show that DA enhances narrative structure understanding, metacognitive awareness, and writing confidence through mediated interaction and revision cycles, making it particularly effective for young learners who benefit from guided, responsive feedback (Fiestas & Peña, 2018; Goodarzi & Namaziandost, 2025; Van Der Veen & Poland, 2012).

2.2. Deep Learning as a Pedagogical Foundation

Deep learning emphasizes mindful, meaningful, and joyful engagement, encouraging students to connect learning with experience, reflect during tasks, and participate with intrinsic motivation (Feriyanto & Anjariyah, 2024; Yusuf et al., 2025). In elementary writing contexts, deep learning supports reflective revision, contextual story construction, and enjoyment through creative activities and collaborative discussions. Research shows that emotionally engaging and conceptually rich environments such as arts-integrated

writing lessons or storytelling activities promote stronger writing performance and confidence among elementary learners (Curtis et al., 2025; Stern, 2019).

2.3. Intersections Between Dynamic Assessment and Deep Learning

DA and deep learning share complementary characteristics: DA fosters mindful learning through reflection and feedback, meaningful learning through scaffolded understanding of narrative elements, and joyful learning through collaborative and interactive activities, including digital tools like Wordwall (Bal & Öztürk, 2025; Putri et al., 2024). Previous studies indicate that formative mediation enhances narrative structure, linguistic features, and writing motivation in young learners (Grenner et al., 2021; Hall et al., 2021). Despite these conceptual links, no bibliometric study has systematically mapped how DA and deep learning converge in elementary writing research, creating a significant gap addressed by this present study.

2.4. Previous Research on DA, Deep Learning, and Elementary Writing

To provide a foundational understanding of how Dynamic Assessment and deep learning have influenced writing instruction in elementary education, this subsection highlights five representative studies drawn from the uploaded references. These studies were selected because they directly inform core concepts of assessment, mediation, motivation, and writing development. The table below summarizes their focus and relevance, offering a concise overview of prior scholarly contributions that shape the background of the current bibliometric investigation.

Table 1. Previous studies related to DA, deep learning, and elementary writing.

No.	Title	Reference
1	Dynamic Assessment of school-age children’s narrative ability and classification accuracy	Peña et al. (2006)
2	Mindful, meaningful, and joyful learning as the core dimensions of deep learning	Feriyanto & Anjariyah (2024)
3	Narrative instruction and its influence on writing performance in elementary classrooms	Hall et al. (2021)
4	DA as a tool for enhancing bilingual learners’ motivation and reducing writing anxiety	Goodarzi & Namaziandost (2025)
5	Joy, confidence, and creative expression in children’s writing through arts-based practices	Curtis et al. (2025)

3. Research Method

3.1. Research Design

This study employed a bibliometric research design to systematically map global scholarly publications on *Dynamic Assessment* (DA) and *deep learning* within the context of *elementary writing instruction*. Bibliometric analysis was selected because it enables quantitative evaluation of publication trends, authorship patterns, citation structures, and thematic developments across a large scientific dataset. The Scopus database was chosen as the primary data source due to its comprehensive coverage of peer-reviewed and high-impact journals in education and applied linguistics.

The initial search produced a broad dataset of publications from 2000 to 2025, reflecting the rapid development of DA and deep learning in elementary literacy research during this period. Using predefined Boolean keywords, a total of 1,240 documents were retrieved. A systematic screening process was then conducted to ensure dataset relevance.

Articles were excluded if: (1) they did not explicitly address DA, deep learning, or writing instruction; (2) they were unrelated to elementary/primary education; (3) they were duplicates; or (4) they lacked sufficient bibliographic completeness for analysis.

Following this filtering procedure, 1,118 articles were retained as the final dataset. All selected publications were exported in CSV and RIS formats to allow dual-mode processing: CSV files were used for descriptive and statistical analysis in Microsoft Excel, while RIS files supported advanced visualization and network mapping in VOSviewer.

3.2.Data Sources

All bibliographic data were obtained from Scopus, selected for its reliability, indexing accuracy, and international visibility. The search strategy employed combinations of keywords such as “*dynamic assessment*,” “*deep learning*,” “*elementary education*,” “*primary school*,” “*writing instruction*,” and “*narrative writing*.” Only journal articles, conference papers, and reviews written in English and indexed in Scopus were included.

After the initial retrieval of 1,240 documents, titles, abstracts, and keywords were screened to ensure alignment with the study’s focus on DA, deep learning pedagogy, and literacy development in early schooling. A total of 122 articles were excluded due to thematic irrelevance or insufficient metadata. The refined dataset of 1,118 articles was subsequently organized in Microsoft Excel for preliminary frequency and trend analysis, then imported into VOSviewer for network mapping of co-authorships, keyword co-occurrence, and citation relationships.

3.3.Procedure of Data Collection

Data collection proceeded through four systematic stages: (1) Retrieval of Bibliographic Records: A structured search was conducted in Scopus using Boolean operators and controlled vocabulary. All retrieved publications were exported in both CSV and RIS formats for flexible processing. (2) Screening and Filtering: All documents underwent a screening process involving title, abstract, and keyword review. Duplicates, non-elementary studies, and articles not addressing DA or deep learning were removed. (3) Data Preparation and Organization: The cleaned dataset was tabulated in Microsoft Excel to facilitate initial descriptive analysis. Fields such as authors, publication year, journal source, keywords, and citation counts were standardized and prepared for computational mapping. (4) Computational Mapping and Visualization: Using VOSviewer, several bibliometric maps were generated, including co-authorship networks, keyword co-occurrence clusters, co-citation networks, and bibliographic coupling maps. These maps enabled the identification of research structures, dominant themes, and emerging trends in DA and deep learning research at the elementary level.

3.4.Data Analysis

Data analysis was carried out using a combination of quantitative bibliometric indicators and visual science mapping techniques. In Microsoft Excel, descriptive statistics such as annual publication trends, document types, authorship frequency, and country distribution were computed to provide an overview of research development over time.

Advanced bibliometric techniques were then implemented through VOSviewer, which generated: (1) Co-occurrence analysis to identify central concepts and thematic clusters; (2) Co-authorship analysis to reveal collaboration patterns across authors and institutions; (3) Co-citation analysis to determine influential scholars and foundational literature; (4) Bibliographic coupling to map connections among recent publications.

Link strength, occurrence frequency, and clustering algorithms were used to determine the prominence and relationships of nodes (authors, keywords, sources) within each network. These visual and statistical outputs formed the basis for interpreting intellectual structures and thematic evolution in global research on DA and deep learning in elementary writing instruction.

4. Results and Discussion

4.1. Dynamic Assessment and Deep Learning in Elementary Writing Instruction (2019-2025)

The bibliometric analysis revealed a clear and progressively strengthening publication pattern on the topic of *Dynamic Assessment (DA)* and *Deep Learning* within *Elementary Writing Instruction* between 2019 and 2025. From an initial retrieval of 500 indexed documents, 499 articles met the inclusion criteria, with only one publication excluded due to incomplete metadata. Rather than representing a limitation, this relatively contained dataset reflects the emerging nature of this interdisciplinary field, suggesting that scholarly interest in integrating DA and deep learning principles into early writing pedagogy is still developing its theoretical foundation and research identity. Such a pattern commonly occurs in fields undergoing conceptual consolidation, where early studies lay the groundwork for more extensive research expansion in subsequent years.

The annual distribution of publications (Figure 1; Table 2) demonstrates a consistent upward trajectory with slight fluctuations that correspond to broader educational research trends. Beginning in 2019, the field showed a modest research presence with 53 documents, but publication activity increased substantially in 2020 (76 documents), likely reflecting the heightened academic attention to adaptive learning and assessment innovations during the global shift toward online and hybrid education. Although the year 2021 saw a slight decline to 52 publications, this dip appears temporary, as the following years showed accelerated growth.

Research output rebounded in 2022 with 70 publications, followed by a significant increase in 2023 (84 publications). The upward momentum continued through 2024, which recorded the highest annual output (106 articles), suggesting that scholars increasingly recognize the relevance of DA and deep learning for improving writing competence, reflective thinking, and student engagement in elementary classrooms. In 2025, the year-to-date publications total 59 documents, reflecting an ongoing but not yet complete accumulation for the current year. If projected linearly, 2025 is expected to maintain the upward trajectory observed since 2022.

Overall, the annual publication pattern indicates three key trends: **(1) Growing scholarly interest** in DA and deep learning as complementary frameworks for writing instruction. **(2) Emergence of new research themes**, such as mediated feedback, narrative competence, scaffolded writing, and technology-enhanced assessment. **(3) Stabilization of the field**, with publication rates increasing steadily, reflecting a movement from conceptual exploration toward empirical and applied research.

These findings confirm that DA and deep learning are becoming increasingly recognized as effective pedagogical approaches for enhancing elementary students' narrative writing skills. As schools transition toward more formative, reflective, and student-centered learning paradigms, the integration of DA and deep learning principles is likely to attract even broader academic attention in the coming years.

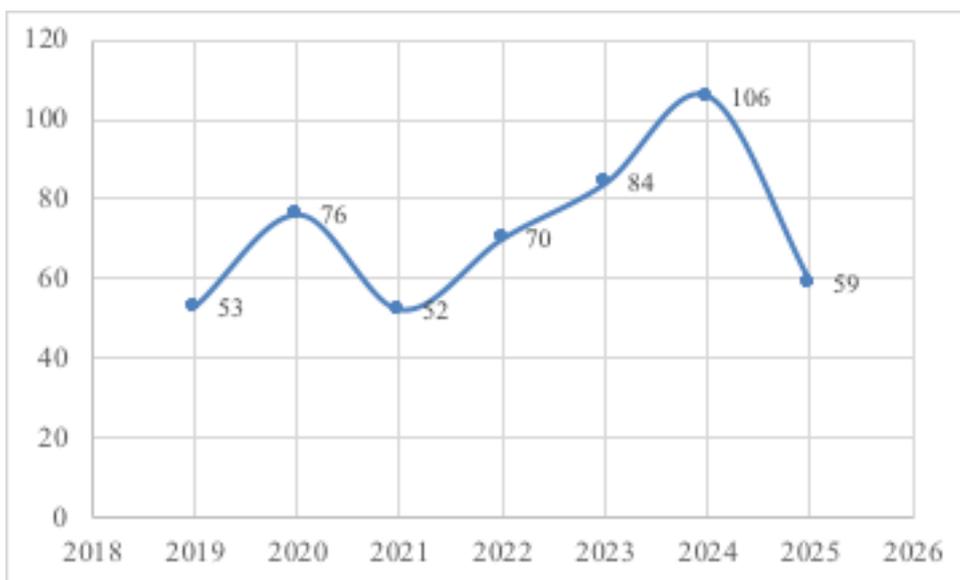


Figure 1. Annual report of publications

Table 2. Annual publication distribution on “dynamic assessment and deep learning in elementary writing instruction”.

Year	Documents	Percentages (%)
2019	53	10.6%
2020	76	15.2%
2021	52	10.4% (Lowest)
2022	70	14.0%
2023	84	16.8%
2024	106	21.2% (Highest)
2025	59	11.8%
Total	500	100%

4.2. Most Influential and Highly Cited Publications

The analysis of the 500 retrieved documents also identified the most influential and highly cited publications related to themes connected to Dynamic Assessment, deep learning, literacy development, and technology-enhanced instruction. Table 3 presents the top 20 most cited articles within the dataset, showing a clear concentration of highly influential works published between 2019 and 2025. The most cited publications show a strong orientation toward the broader integration of Artificial Intelligence (AI), digital learning tools, and pedagogical innovation, reflecting a global shift in research attention toward emerging technologies and their impact on learning processes.

Interestingly, the highest-cited article of [BaiDoo-Anu & Ansah \(2023\)](#), with 4,038 citations focuses on AI’s potential for transforming teaching and learning, particularly through generative AI tools such as ChatGPT. Although not directly investigating Dynamic Assessment or elementary writing, its influence demonstrates the increasing relevance of AI-mediated feedback, automated writing support, and adaptive learning systems, all of which align conceptually with the mediated scaffolding mechanisms of DA.

Similar patterns appear in other highly cited works. For example, [Chan \(2023\)](#) and [Holmes & Tuomi \(2022\)](#) examine the broader educational implications of AI literacy and AI innovation, highlighting themes such as adaptive assessment, automated feedback, and intelligent tutoring systems. These technologies indirectly support the principles of

Dynamic Assessment, which rely on responsive and individualized mediation. Likewise, publications such as [Walter \(2024\)](#) and [Crawford et al. \(2023\)](#) reveal how ethical considerations and pedagogical strategies for AI integration are increasingly essential for understanding modern learning environments.

Another cluster of influential works relates to online learning, literacy development, and student engagement. [Atmojo & Nugroho \(2020\)](#) provide insights into remote language learning challenges during the COVID-19 pandemic, underscoring the need for effective digital scaffolding, paralleling DA’s emphasis on mediated support. [Kim et al. \(2021\)](#) and [Tunmer & Hoover \(2019\)](#) provide foundations for understanding reading and literacy acquisition, which indirectly inform writing instruction at the elementary level.

A smaller portion of the highly cited studies, such as [Ranalli \(2021\)](#) and [Vázquez-Cano et al. \(2021\)](#), directly analyze automated writing feedback, further reinforcing the link between DA’s goals and modern AI-supported writing interventions. Meanwhile, [Gholam \(2019\)](#) and [King & Pringle \(2019\)](#) highlight inquiry learning and underrepresented students’ STEM experiences, contributing to the broader landscape of student-centered and reflective pedagogies.

Taken together, these findings suggest that the intellectual influence surrounding DA and deep learning in elementary writing instruction is dominated by broader technological and literacy research, rather than by DA-specific studies alone. This indicates that the field is still expanding and drawing conceptual strength from adjacent domains such as AI in education, automated feedback, and literacy development frameworks. Such patterns highlight an important research gap: while DA and deep learning are supported conceptually by these influential works, few highly cited studies directly address the integrated application of both frameworks to elementary writing instruction, reinforcing the novelty and necessity of the present study’s focus.

Table 3. Most cited articles on dynamic assessment and deep learning in elementary writing instruction.

No	Cites	Title	Year	Cites Per Year	Ref.
1	4038	Education in the era of generative artificial intelligence (AI): Understanding the potential benefits of ChatGPT in promoting teaching and learning	2023	2019.00.00	BaiDoo-Anu & Ansah (2023)
2	1707	A comprehensive AI policy education framework for university teaching and learning	2023	853.50.00	Chan (2023)
3	1122	State of the art and practice in AI in education	2022	374.00.00	Holmes & Tuomi (2022)
4	979	Embracing the future of Artificial Intelligence in the classroom: the relevance of AI literacy, prompt engineering, and critical thinking in modern education	2024	979.00.00	Walter (2024)
5	941	EFL classes must go online! Teaching activities and challenges during COVID-19 pandemic in Indonesia	2020	188.20.00	Atmojo & Nugroho (2020)
6	800	Leadership is needed for ethical ChatGPT: Character, assessment, and learning using artificial intelligence (AI)	2023	400.00.00	Crawford et al. (2023)
7	437	Not quite eye to AI: Student and teacher	2023	218.50.00	Barrett &

No	Cites	Title	Year	Cites Per Year	Ref.
8	346	perspectives on the use of generative artificial intelligence in the writing process Black girls speak STEM: Counterstories of informal and formal learning experiences	2019	57.67	Pack (2023) King & Pringle (2019)
9	282	Artificial intelligence in foreign language learning and teaching: a CALL for intelligent practice	2022	94.00.00	Schmidt & Strasser (2022)
10	275	Artificial intelligence (AI) learning tools in K-12 education: A scoping review	2025	275.00.00	Yim & Su (2024)
11	254	Chatbot to improve learning punctuation in Spanish and to enhance open and flexible learning environments	2021	63.50.00	Vázquez-Cano et al. (2021)
12	251	Inquiry-based learning: Student teachers' challenges and perceptions	2019	41.83	Gholam (2019)
13	234	Potential of Artificial Intelligence for transformation of the education system in India.	2021	58.50.00	Jaiswal & Arun (2021)
14	234	Investigating the comprehension iceberg: Developing empirical benchmarks for early-grade reading in agglutinating African languages	2020	46.80	Spaull et al. (2020)
15	218	The cognitive foundations of learning to read: A framework for preventing and remediating reading difficulties	2019	36.33.00	Tunmer & Hoover (2019)
16	215	Generative Artificial Intelligence in Education: From Deceptive to Disruptive.	2024	215.00.00	Alier et al. (2024)
17	213	AI in teacher education: Unlocking new dimensions in teaching support, inclusive learning, and digital literacy	2024	213.00.00	Zhang & Zhang (2024)
18	207	L2 student engagement with automated feedback on writing: Potential for learning and issues of trust	2021	51.75	Ranalli (2021)
19	203	Media Literacy Education in the Age of Machine Learning.	2019	33.83	Valtonen et al. (2019)
20	201	Improving reading comprehension, science domain knowledge, and reading engagement through a first-grade content literacy intervention.	2021	50.25.00	Kim et al. (2021)

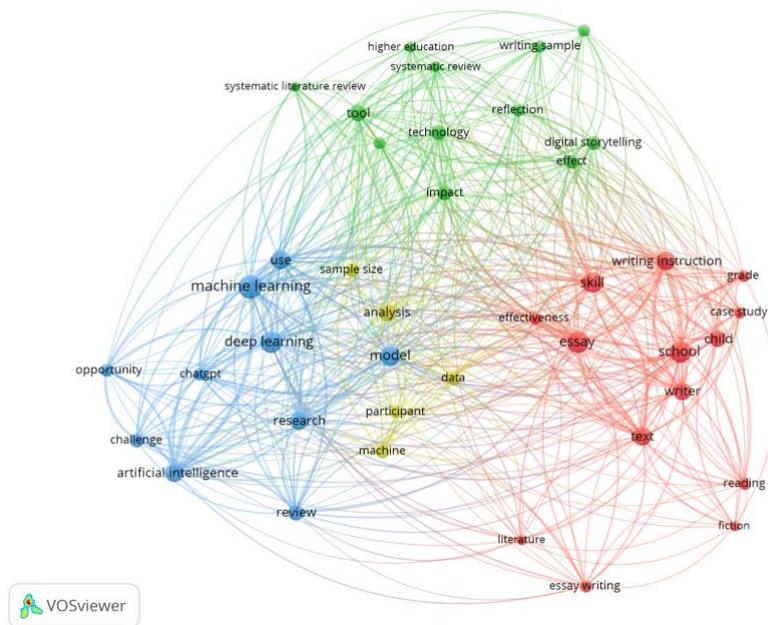


Figure 2. Network visualization based on co-occurrence of terms.

4.3. Visualization of Research Data Mapping of Dynamic Assessment and Deep Learning in Elementary Writing Instruction

The bibliometric visualization performed using VOSviewer provides a comprehensive picture of the conceptual landscape, thematic patterns, and intellectual structure underpinning research on Dynamic Assessment and Deep Learning within Elementary Writing Instruction. Three types of visual outputs were generated with network, overlay, and density visualizations, each contributing unique insights into how key terms interact, evolve, and cluster within the broader research domain.

A total of 3,090 raw terms were initially extracted from titles, abstracts, and author keywords. Because such a large term pool often contains conceptual noise, a minimum co-occurrence threshold of 10 was applied, narrowing the dataset to 68 frequently appearing terms. VOSviewer's relevance scoring further refined the dataset to the top 60% most contextually meaningful terms, resulting in a final set of 41 terms used in the network visualization (Figure 2). These terms were distributed into four distinct clusters, each representing a thematic concentration within the literature.

The first cluster (red) with 14 items concentrates on core literacy and writing instruction, including terms such as *writing instruction*, *essay*, *text*, *skill*, *child*, *school*, and *reading*. This cluster reflects the pedagogical foundation of elementary writing studies, focusing on writing development, instructional strategies, and learning outcomes. The second cluster (green) with 12 items captures deep learning-oriented and reflective writing themes, with terms like *deeper learning*, *narrative writing*, *reflection*, *digital storytelling*, and *technology*, showing how writing pedagogy increasingly integrates reflective practices and digital tools to support meaningful learning.

Meanwhile, the third cluster (blue) with 10 items represents the rapidly growing influence of technology and AI, revealed by terms such as *artificial intelligence*, *chatgpt*, *machine learning*, and *deep learning*. This cluster indicates a shift toward AI-supported feedback, automated evaluation, and technological mediation, concepts that intersect with Dynamic Assessment's emphasis on responsive and adaptive support. The fourth cluster (yellow) with 4 items highlights methodological keywords such as *analysis*, *data*,

connections to *effectiveness*, *case study*, and *writer* indicate that many studies focus on evaluating teaching strategies and writing outcomes through empirical, classroom-based research. This map confirms that writing instruction remains a stable and foundational theme in the broader research ecosystem.

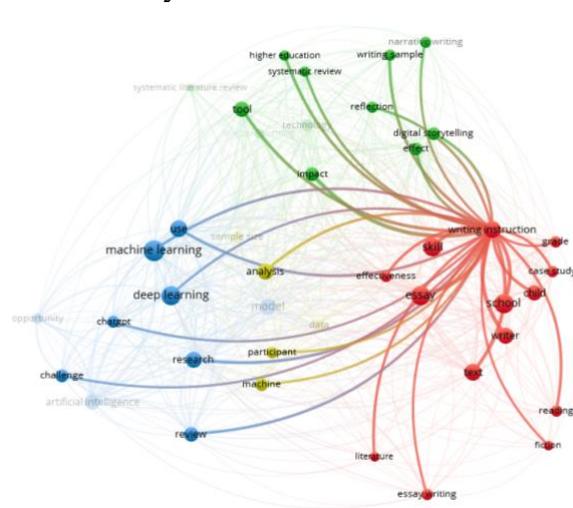


Figure 6. Network visualization of writing instruction

Finally, Figure 7 highlights *narrative writing* as a conceptual bridge between deep learning and writing pedagogy. Its network links with terms like *digital storytelling*, *reflection*, *writing sample*, and *technology*, signaling that narrative writing research increasingly incorporates reflective learning processes and digital tools that enhance creativity and meaning-making. The connectivity pattern shows that narrative writing serves as a key context where both Dynamic Assessment and deep learning principles naturally converge.

Taken together, the density and focused network visualizations strengthen the overall insight that research in this field evolves along two reinforcing directions: (1) Advancement of AI-supported and deep-learning frameworks, and (2) Pedagogical efforts to improve writing quality, narrative competence, and literacy outcomes among elementary learners.

These patterns confirm the interdisciplinary nature of the field and highlight the relevance of integrating Dynamic Assessment with deep learning-oriented writing instruction.

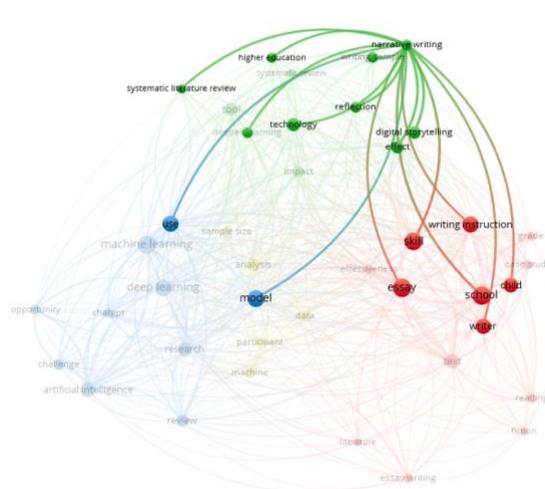


Figure 7. Network visualization of narrative writing

4.4. Synthesis and Implications

The bibliometric findings indicate that research on Dynamic Assessment (DA) and deep learning in elementary writing instruction is shaped by two dominant directions: (1) sustained attention to core writing pedagogy (*writing instruction, skill, essay, child*), and (2) rapid growth of technology-oriented terms (*deep learning, machine learning, artificial intelligence, ChatGPT*). This confirms earlier writing studies emphasizing DA's role in improving narrative structure and metacognitive awareness (Fiestas & Peña, 2018; Peña et al., 2006), while also aligning with deep learning literature highlighting reflection, meaningful engagement, and digital storytelling as drivers of writing performance (Curtis et al., 2025; Feriyanto & Anjariyah, 2024).

Compared with previous research, which largely examined DA, deep learning, or writing instruction in isolation, our results show that these domains increasingly converge. The cluster and overlay visualizations reveal that narrative writing now sits between reflective learning practices and AI-supported tools, indicating a shift toward more adaptive and technology-enhanced writing environments. This trend is consistent with global findings on AI-supported feedback and automated scaffolding (Holmes & Tuomi, 2022; Ranalli, 2021), yet prior studies have not connected these developments explicitly to DA principles.

This gap highlights the novelty of the present study: we provide the first bibliometric evidence that DA, deep learning, and writing instruction are evolving into an integrated research ecosystem, increasingly influenced by intelligent technologies. These insights imply that future pedagogy should combine DA's mediated feedback with deep learning's reflective processes and AI-driven support to strengthen writing competence in elementary learners.

5. Conclusion

This bibliometric study shows that research on Dynamic Assessment and deep learning in elementary writing instruction is shaped by two main themes: traditional writing pedagogy and the rapid rise of AI-supported learning environments. The cluster and overlay maps reveal that writing instruction remains foundational, while deep learning, machine learning, and ChatGPT represent growing areas of interest. Compared with earlier studies that examined these topics separately, our findings highlight a new convergence, indicating that DA, deep learning, and intelligent technologies are increasingly integrated in current research. This constitutes the novelty of our study. The results suggest that future writing pedagogy should combine DA's guided mediation with deep learning strategies and AI tools to create more adaptive and meaningful writing experiences for young learners.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this article.

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Author Contributions

Ferafanisah: conceptualization of the study, drafting of the initial manuscript, methodological design, data collection and analysis, as well as manuscript editing and revision. **Suryaningsih** and **Atmaja:** academic supervision, validation of the scholarly content, and providing critical feedback and guidance for manuscript improvement.

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