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Transforming Literacy Learning in Elementary Schools through Deep Learning

Ryan Dwi Puspita[a], Duhita Savira Wardani[b*], Deden Herdiana Althaftazani[c]
[a]Primary Education, IKIP Silwangi, Jawa Barat, Cimahi, Indonesia, ryan.dwi@ikipsiliwangi.ac.id
[b*]Primary School Teacher Education, IKIP Silwangi, Jawa Barat, Cimahi, Indonesia, duhita@ikipsiliwangi.ac.id
[c]Primary Education, IKIP Silwangi, Jawa Barat, Cimahi, Indonesia, deden@ikipsiliwangi.ac.id

*Correspondence: duhita@ikipsiliwangi.ac.id

Abstract
Reading and writing literacy is a fundamental skill that forms the foundation of both cognitive and social development for elementary school students. However, literacy instruction in many schools remains largely conventional, emphasizing rote memorization and technical drills, with limited opportunities to cultivate critical thinking, creativity, and collaboration. This study aims to examine the transformation of literacy instruction through the implementation of a deep learning approach in elementary schools. The research employed a descriptive design combining simple quantitative methods with qualitative observation. The participants were Grade 2 students in an elementary school, with a control group receiving conventional instruction and an experimental group engaged in deep learning–based instruction. Data were collected through literacy tests (fluency, comprehension, spelling, and writing structure), classroom observations, and teacher interviews. The results indicate significant improvements in the experimental group compared to the control, with an average literacy gain of 15%, particularly in reading comprehension (18%) and reading fluency (15%). Observations further revealed increased student participation in discussions, greater confidence in expressing ideas, and enhanced creativity in story writing. These findings suggest that deep learning not only strengthens technical literacy skills but also fosters adaptive, meaningful, and 21st-century–aligned learning experiences. The study concludes that the application of deep learning holds transformative potential for literacy instruction in elementary schools. Nevertheless, its scope remains limited to a small-scale, short-term implementation, highlighting the need for broader and more longitudinal studies to examine the sustainability of its impact.

Keywords:
Deep learning;
Literacy instruction;
Elementary school

1. Introduction

The advancement of 21st-century education necessitates a transformation in literacy instruction that goes beyond technical reading and writing skills to encompass critical thinking, collaboration, creativity, communication, character, and citizenship. This aligns with Fullan and Langworthy's (2014) view that deep learning constitutes a new paradigm that positions literacy as an integral component of developing deeper competencies. The challenges of 21st-century literacy, as articulated by Murnane, Sawhill, and Snow (2012), also underscore the persistent literacy gaps between students from different backgrounds, thereby necessitating literacy instruction that is both equitable in quality and relevant to global demands. Yet, literacy instruction in elementary schools often remains conventional, limited to practices such as oral reading, vocabulary memorization, and copying texts. Such approaches offer little opportunity for students to think critically or connect reading materials with real-life experiences. Kucirkova (2020) notes that although children are increasingly familiar with digital technology, literacy

approaches remain largely "surface-level," failing to nurture meaningful digital literacy skills. This is consistent with UNESCO's (2021) findings, which highlight that many elementary schools in developing countries have yet to effectively integrate literacy with 21st-century competencies.

Moreover, integrating technology into foundational literacy instruction remains a pressing challenge. A bibliometric study by Akbaba and Senkal (2024) affirms that while publications on educational technology have surged, its practical application in elementary classrooms is often restricted to basic tools such as e-books or simple applications, lacking deeper pedagogical strategies. At the same time, children's digital literacy develops rapidly outside the school environment, putting schools at risk of lagging behind in preparing students for the digital age (Ng et al., 2023). The gap between access to technology and its effective pedagogical use thus constitutes a real barrier to transforming literacy in elementary education.

Within the framework of deep learning, literacy is not merely a communication tool but a medium for developing global competencies. Fullan, Quinn, and McEachen (2018) argue that deep learning must connect the curriculum to students' real-life contexts, foster collaboration, and promote active engagement. Voogt and Roblin (2012) similarly emphasize that integrating 21st-century competencies into the elementary curriculum will only succeed if accompanied by pedagogical innovations that prioritize meaningful learning experiences. Consequently, literacy instruction at the elementary level must be designed not only to build foundational reading and writing skills but also to shape students' character and civic awareness.

Although the concept of deep learning has been widely discussed, empirical studies directly linking it to elementary reading and writing literacy remain scarce. Much of the existing research on literacy at this level continues to emphasize reading and writing scores without addressing dimensions of collaboration, creativity, and citizenship (Anderson & Spiro, 2021). Conversely, deep learning research tends to focus more heavily on secondary or higher education (Fullan, 2021). This highlights a significant research gap: the need to investigate how deep learning principles can be effectively adapted to elementary literacy contexts in ways that are relevant, adaptive, and meaningful. The research questions are as follows.

1) What are the current conditions and challenges of literacy instruction in elementary schools in the digital era?
2) What is the potential of applying deep learning to support the transformation of literacy instruction in elementary schools?
3) Does the use of deep learning influence students' reading and writing literacy skills?

2. Method

2.1 Research Method

This study employed a descriptive method with a qualitative approach, supported by simple quantitative data. This method was chosen because it is appropriate for providing an in-depth depiction of the process of transforming reading and writing literacy instruction through the application of deep learning in elementary schools.

2.2 Participants

The research subjects were Grade 2 students from two public elementary schools in Cimahi City, with a total of 30 students. The subjects were selected purposively, based on the consideration that students at this level are in a critical developmental stage for mastering foundational literacy skills. In addition to students, classroom teachers were also involved as informants to provide perspectives on the implementation of deep learning–based literacy instruction.

2.3 Instruments

Data were collected through (a) a simple literacy test administered before and after the learning intervention, to capture students' literacy progress. (b) Classroom observations conducted by the researchers to record student activities, engagement, and responses during the learning process. (c) Brief interviews with teachers to explore their experiences, challenges, and opportunities in implementing deep learning within the context of foundational literacy.

2.4 Data Analysis Techniques

Quantitative data from the literacy tests were analyzed descriptively, by comparing students' initial and final results. Meanwhile, qualitative data from observations and interviews were analyzed through data reduction, data display, and conclusion drawing, in order to identify relevant patterns and meanings.

3.Results and Discussion

3.1 Results

3.1.1 Potential of Deep Learning in Supporting the Transformation of Literacy Instruction in Elementary Schools

Findings from observations and interviews indicate that reading and writing literacy instruction in elementary schools continues to encounter various challenges. Teachers predominantly rely on conventional methods such as shared reading, text copying, or answering comprehension questions. While these methods are effective for some students, they fall short in accommodating individual differences in literacy abilities. Some students were observed struggling with new vocabulary, while others were already fluent readers who required greater challenges. Furthermore, limited access to digital facilities in elementary schools presents an additional barrier. Teachers also reported lacking adequate knowledge regarding the integration of artificial intelligence–based technologies in literacy instruction. This reflects a clear gap between the needs of students in the digital era and the instructional practices currently implemented in classrooms. Observations and interviews with teachers and students further reveal five key challenges in literacy instruction: (1) Inappropriate instructional methods: Existing models fail to sufficiently address the diverse needs of students with different literacy skills, creating uniformity in teaching. As a result, fluent readers are under-challenged, while struggling students lack targeted support; (2) Disparities in literacy ability: Data show significant variation in reading and writing proficiency. While some students read quickly with good comprehension, others continue to struggle with decoding words. This heterogeneity presents a major challenge in classroom management; (3) Low motivation for extended texts: Students often become disengaged when presented with lengthy texts without varied media, suggesting the need for more interactive, engaging, and student-centered approaches adapted to digital-era learning styles; (4) Limited use of technology: Although schools possess digital devices such as tablets or computers, their use in literacy instruction remains minimal. Technology is more frequently used for other subjects, such as mathematics, rather than reading and writing; (5) Infrastructure barriers: Not all classrooms have reliable internet connectivity or adequate devices, underscoring the need for infrastructural support to ensure that technology integration in literacy instruction is truly effective.

3.1.2 Potential of Deep Learning in Supporting the Transformation of Literacy Instruction in Elementary Schools

Observations conducted in Grade 3 classrooms show that when teachers began to apply deep learning principles in literacy activities, students demonstrated increased engagement and motivation. For example, in a folk tale reading activity, teachers not only asked students to read and answer literal questions but also encouraged them to discuss the moral values of the story, rewrite the ending, and present their work to the class. Such activities fostered creativity, communication, and collaboration. Observation data reveal that more than 70% of students actively expressed their opinions during discussions, while 65% successfully rewrote the story with new ideas differing from the original text. Moreover, the potential of deep learning was evident in strengthening connections between literacy and real-life contexts. When students were asked to relate the text to their daily experiences, for instance, teamwork at school, they appeared more enthusiastic and demonstrated deeper comprehension. Teachers further reported that typically passive students began to contribute more confidently. These findings suggest that deep learning supports the transformation of literacy instruction by making the process more adaptive, meaningful, and aligned with students' developmental needs.

Table 1
Results of Observations on the Potential Application of Deep Learning in Elementary Literacy Instruction

Learning Activity	Literacy & Deep Learning Indicators	Observation Results
Reading a folk tale and discussing its content	Communication & Critical Thinking: Students express opinions on story meaning	70% actively participated
Rewriting the story with a different ending	Creativity & Writing Literacy: Students produced new texts with varied ideas	65% produced new ideas
Small group discussion of moral messages	Collaboration & Character: Students worked together and respected peers' opinions	75% showed good collaboration
Relating text to real-life experiences	Citizenship & Critical Thinking: Students provided examples from daily life	60% made personal connections
Presenting reading/writing outcomes in class	Communication & Confidence: Students presented ideas orally	55% presented without teacher assistance

3.1.3 Effects of Deep Learning on Students' Reading and Writing Literacy Skills

To examine the impact of deep learning on students' literacy skills, learning outcomes were compared between two groups: Group 1, which did not receive deep learning–based instruction, and Group 2, which did. The outcomes were assessed across four dimensions: reading fluency, reading comprehension, spelling accuracy, and writing structure.

Table 2
Comparison of Students' Literacy Scores

Literacy Aspect	Group 1	Group 2	Improvement (%)
Reading Fluency	65%	80%	15%
Reading Comprehension	60%	78%	18%
Spelling Accuracy	62%	75%	13%
Writing Structure	58%	72%	14%
Average	61%	76%	15%

The table demonstrates that all aspects of literacy improved in the experimental group. The highest gain was in reading comprehension (18%), followed by reading fluency (15%), writing structure (14%), and spelling accuracy (13%). These findings highlight that literacy instruction based on deep learning effectively optimizes reading and writing through more meaningful, creative, and contextually relevant activities.

3.2 Discussion

The findings suggest that elementary literacy instruction faces five primary challenges: (a) reliance on conventional and uniform methods, (b) disparities in literacy skills across students, (c) student disengagement with extended texts, (d) limited use of digital technologies, and (e) constraints in teacher competence and infrastructure. These challenges highlight a gap between students' needs in the digital era and classroom practices that remain rooted in traditional approaches. Within Fullan's deep learning framework, learning is not limited to the acquisition of basic knowledge but also encourages the development of six core competencies: character, citizenship, collaboration, communication, creativity, and critical thinking (Fullan & Langworthy, 2014). This approach is particularly relevant in addressing literacy disparities, since literacy encompasses not only technical skills in reading and writing but also critical thinking, idea expression, and active societal participation.

The finding that students quickly lose interest in extended texts illustrates the need for more contextualized and meaningful pedagogical innovations. Deep learning emphasizes student-centered instruction that connects curricular content with real-life experiences. Thus, literacy instruction in

elementary schools can be transformed through project-based learning, collaborative discussions, and the meaningful integration of digital technologies, not merely as tools, but as instruments for enriching learning experiences (Fullan, Quinn, & McEachen, 2018). Furthermore, teacher barriers in leveraging technology and limited instructional variety may be overcome by implementing deep learning, which positions teachers as facilitators, co-learners, and designers of learning environments. Teachers no longer serve merely as transmitters of content but as partners guiding students in developing deeper skills. Observations in this study showed that applying deep learning principles increased student activity and creativity. For instance, about 70% of students actively expressed moral reflections on texts, and 65% generated new story ideas in their writing. These findings align with research showing that active, reflective pedagogies enhance student engagement in 21st-century literacy (Toquero & Capistrano, 2024).

The integration of deep learning principles under the New Pedagogies for Deep Learning (NPDL) initiative further emphasizes that deeper competencies; collaboration, communication, critical thinking, creativity, character, and citizenship, must be embedded in instruction to ensure that students do not merely "learn" content but also apply and extend it in real-world contexts (NPDL, 2023). Although 60% of students were able to relate texts to personal experiences, only 55% demonstrated confidence in presenting ideas independently, indicating that while deep learning fosters engagement, students' confidence and public communication skills still require strengthening. This is consistent with studies on 21st-century teaching competencies, which suggest that many teachers remain unprepared to implement such skills due to a lack of pedagogical models and practical support (Almazroa & Alotaibi, 2023). Thus, implementing deep learning in elementary literacy requires sustained teacher training and gradual scaffolding strategies to ensure that students feel safe to develop competencies such as public speaking and critical reflection. Overall, the application of deep learning positively influenced students' reading and writing literacy by extending instruction beyond technical skills to include reflection, creativity, collaboration, and real-life connections. This finding aligns with Almazroa and Alotaibi (2023), who emphasize that 21st-century competence–based learning enhances student engagement, motivation, and academic achievement. Similarly, Toquero and Capistrano (2024) highlight that active participation and critical reflection significantly contribute to literacy development. Thus, deep learning is demonstrated to be an effective approach for transforming literacy instruction into a more adaptive, meaningful, and 21st-century–responsive process.

4. Conclusion

This study affirms that the transformation of reading and writing literacy instruction in elementary schools through a deep learning approach yields positive effects both on students' technical literacy skills and on the development of 21st-century competencies. The application of deep learning principles—emphasizing collaboration, creativity, communication, character, citizenship, and critical thinking—renders the learning process more meaningful, adaptive, and relevant to students' real-life contexts. The findings demonstrate an increase in student engagement in reading, writing, and discussion activities, as well as greater confidence in expressing ideas. Accordingly, deep learning holds strong potential as a pedagogical framework for transforming foundational literacy from a set of technical skills into a vehicle for self-development and global competence. However, this study remains limited to two elementary schools with a relatively small number of participants, restricting the generalizability of the findings to broader contexts. The short duration of the study also precludes conclusions regarding the long-term effects of deep learning on literacy development. Furthermore, the instruments employed measured only fluency, comprehension, spelling, and writing structure, while teachers' readiness to implement deep learning approaches varied, potentially influencing learning outcomes. The implication of these findings is that, while deep learning shows promise as a transformative approach to literacy instruction in elementary schools, further research is needed with broader coverage, more comprehensive literacy instruments, and sustained teacher training to ensure consistent and sustainable implementation.

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