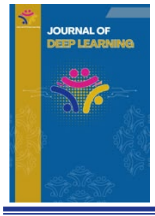

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Contextual Media-Based Deep Learning in Elementary Education: A Qualitative Study of Meaningful and Joyful Learning through an Ecoenzyme Project

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Abstract

The implementation of Deep Learning in elementary education requires learning experiences that are meaningful, engaging, and relevant to students' daily lives. However, research on contextual media-based Deep Learning in elementary schools remains limited. This study aimed to explore the implementation of Deep Learning through contextual media using an ecoenzyme project in elementary education. A qualitative descriptive approach was employed at Elementary School Muhammadiyah Program Khusus Pracimantoro. Data were collected through observations, semi-structured interviews, and documentation, and analyzed using the interactive model of Miles et al. with methodological triangulation to ensure data credibility. The findings reveal that contextual media promote meaningful learning by connecting instructional content with authentic experiences, thereby enhancing students' conceptual understanding, critical thinking, and reflective learning. In addition, the ecoenzyme project fostered joyful learning by improving students' motivation, collaboration, communication, and environmental awareness. The study also demonstrates that effective Deep Learning can be implemented through simple contextual media without relying on sophisticated digital technologies. These findings contribute to the development of student-centered learning strategies and provide practical implications for implementing Deep Learning in elementary education.

Keywords: deep learning framework, contextual media, meaningful learning, joyful learning, project-based learning, ecoenzyme project, inquiry-based learning.

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1. Introduction

Educational reform has increasingly emphasized learning that develops not only students' academic achievement but also their critical thinking, conceptual understanding, and meaningful learning experiences. In this context, the Deep Learning approach has emerged as an instructional paradigm that encourages learners to actively construct knowledge, connect new concepts with prior experiences, and engage cognitively and emotionally throughout the learning process. In this study, Deep Learning refers to a pedagogical approach that emphasizes meaningful, mindful, and joyful learning, enabling students to construct knowledge, engage actively

with learning experiences, and reflect on their understanding. Consequently, learning success is no longer measured solely by academic outcomes but also by students' ability to develop conceptual understanding, reflection, and positive learning experiences. However, implementing Deep Learning in elementary schools remains challenging because young learners require concrete, contextual, and engaging learning experiences that align with their developmental characteristics (Nafi'ah & Faruq, 2025).

Learning media play a crucial role in supporting the successful implementation of Deep Learning. Among various instructional media, contextual media have received considerable attention because they connect learning materials with students' real-life experiences, enabling learners to construct knowledge more meaningfully. Previous studies have shown that contextual learning enhances conceptual understanding, increases learning motivation, and promotes active participation in classroom activities (Yolanda et al., 2024; Suhermi et al., 2025). Likewise, contextual media have been found to facilitate meaningful learning by making abstract concepts more concrete and relevant to students' daily lives (Dewanti & Shofwan, 2025). In elementary education, contextual-based learning media have also been reported to improve students' enthusiasm, engagement, classroom participation, and understanding of learning materials, thereby creating more learner-centered instructional environments (Salsabil 'Aqiilah & Maula, 2024). These findings indicate that contextual media have considerable potential to support the implementation of Deep Learning in elementary classrooms.

One contextual learning opportunity that is particularly relevant to elementary education is the use of an ecoenzyme project. Organic waste is closely connected to students' everyday environments, providing an authentic context in which environmental and scientific concepts can be explored through direct learning experiences. Through an ecoenzyme project, students can engage in activities that involve observation, inquiry, collaboration, and reflection while connecting classroom learning with real-life environmental issues. Such characteristics make the ecoenzyme project relevant to the implementation of meaningful, mindful, and joyful learning within the Deep Learning framework.

Despite these promising findings, several gaps remain in the existing literature. First, previous research on Deep Learning has largely focused on technology-supported learning, online learning environments, or contexts outside elementary education, leaving its implementation through contextual media in elementary classrooms less explored. Furthermore, prior research has predominantly employed quantitative approaches emphasizing learning outcomes, providing limited understanding of how Deep Learning is implemented in classroom practice and how students experience meaningful and joyful learning throughout the instructional process (Napitupulu, 2025). Second, this outcome-oriented emphasis provides limited insight into the instructional processes through which Deep Learning develops during authentic classroom activities. Research specifically investigating contextual media-based Deep Learning in elementary education is also still limited, particularly studies that comprehensively examine classroom implementation, teacher practices, and student learning experiences (Adestipa et al., 2025; Feri et al., 2025). Third, limited attention has been given to how meaningful, mindful, and joyful learning emerge through students' experiences, classroom interactions, collaboration, and reflection during contextual learning activities. This limitation highlights the need

for qualitative investigations that provide a richer understanding of instructional processes within authentic classroom settings.

Building upon these gaps, the present study examines how contextual media can support the implementation of Deep Learning in an elementary classroom. While earlier studies have demonstrated the effectiveness of Deep Learning and contextual learning approaches, this research provides a more comprehensive understanding of how contextual media support Deep Learning practices in elementary school classrooms. Using a qualitative approach, the study explores teacher instructional practices, students' learning experiences, and classroom interactions that facilitate meaningful and joyful learning (Nurul et al., 2025; Lim, 2025). This process-oriented perspective contributes empirical evidence that complements previous outcome-based research.

The novelty of this study lies in examining how an authentic ecoenzyme project, as a contextual learning medium, operationalizes the principles of Deep Learning in an elementary classroom. Rather than focusing primarily on learning outcomes, this study examines how meaningful, mindful, and joyful learning emerge through students' authentic learning experiences, classroom interactions, collaboration, and reflection. In this way, the study provides a process-oriented understanding of how contextual learning media can facilitate Deep Learning in an elementary education setting.

Based on these considerations, this study aims to explore and describe the implementation of Deep Learning practices through the use of contextual media in elementary school learning. Specifically, it investigates (1) how contextual media are implemented in classroom instruction, (2) how they support meaningful and joyful learning experiences, and (3) how students respond to these learning practices. The findings are expected to contribute both theoretically and practically by providing insights into how contextual media can facilitate Deep Learning in elementary education.

2. Method

This study employed a qualitative descriptive design to explore the implementation of contextual media-based Deep Learning in an elementary school setting. A qualitative descriptive approach was selected because it enables researchers to obtain a comprehensive understanding of learning processes, participant experiences, and classroom dynamics without manipulating research variables (Sandelowski, 2000). Rather than examining causal relationships or quantitatively measuring learning outcomes, this study focused on describing how contextual media were implemented to facilitate meaningful and joyful learning within the Deep Learning framework.

The research was conducted at Elementary School Muhammadiyah Program Khusus Pracimantoro, involving teachers and students who actively participated in the implementation of contextual media-based Deep Learning. Participants were selected using purposive sampling, with the primary criterion being their direct involvement in the learning activities. The research procedure consisted of five stages: planning, implementation, data collection, data analysis, and conclusion drawing (Miles et al., 2014). During the planning stage, researchers identified instructional needs and collaboratively designed contextual learning activities. The implementation stage involved integrating contextual media into classroom instruction through project-based ecoenzyme production, where students utilized locally available organic waste materials. This

activity enabled students to connect scientific concepts with authentic experiences from their surrounding environment, thereby supporting meaningful learning in accordance with the principles of Deep Learning (Suhermi et al., 2025).

Data were collected using classroom observations, semi-structured interviews, and documentation, which are widely recognized as complementary techniques for capturing learning processes, participant perspectives, and contextual evidence in qualitative educational research (Greg et al., 2013). Classroom observations were conducted to examine instructional activities, teacher–student interactions, student engagement, and the use of contextual media during learning. Semi-structured interviews with teachers and selected students were carried out to explore their experiences, perceptions, and responses toward the implementation of contextual media-based Deep Learning. Documentation, including lesson plans, instructional media, students' project outputs, field notes, and photographs of classroom activities, served as supporting evidence to strengthen the research findings. The combination of these data collection methods enabled methodological triangulation, thereby enhancing the credibility and trustworthiness of the data (Denzin, 2012).

Data were analyzed using the interactive analysis model proposed by Miles et al. (2014), consisting of data reduction, data display, and conclusion drawing and verification. During the data reduction stage, information relevant to the research objectives was selected, organized, and coded systematically. The reduced data were subsequently presented in descriptive narratives to facilitate the identification of patterns, themes, and relationships among the findings. Finally, conclusions were developed and continuously verified throughout the analysis process to ensure the consistency and credibility of the interpretations. The analytical process emphasized understanding instructional practices, students' learning experiences, and classroom interactions rather than measuring learning achievement quantitatively. This analytical orientation is consistent with the principles of Deep Learning, which prioritize meaningful knowledge construction, critical reflection, and enjoyable learning experiences.

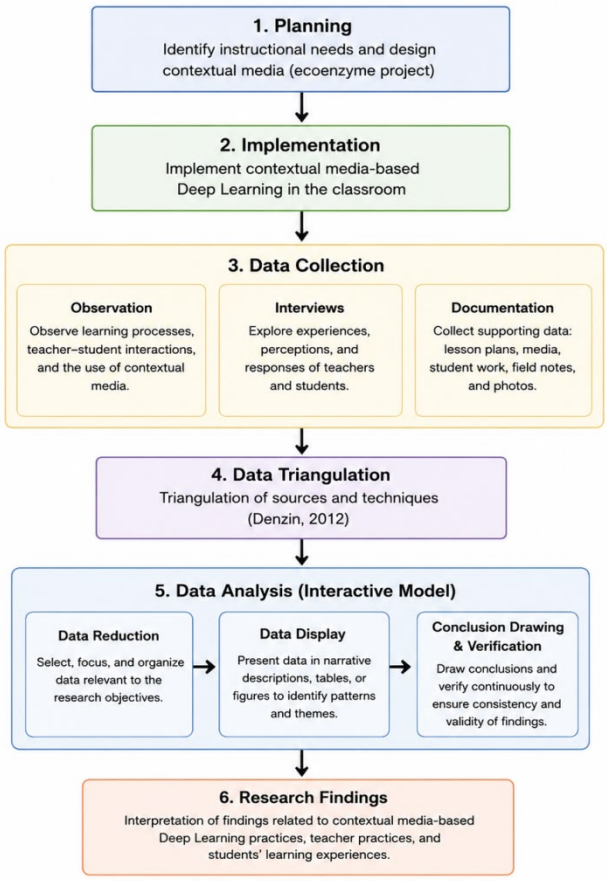

Figure 1. Research Framework for Contextual Media-Based Deep Learning Implementation

The overall research procedure is illustrated in Figure 1. The study was conducted through five sequential stages, namely planning, implementation, data collection, data analysis, and conclusion drawing. During the planning stage, contextual learning media were designed based on instructional needs. The implementation stage involved applying

contextual media-based Deep Learning through ecoenzyme project activities in the classroom. Data were subsequently collected through classroom observations, semi-structured interviews, and documentation, followed by triangulation to enhance data credibility. Finally, the collected data were analyzed using the interactive model proposed by Miles et al. (2014), consisting of data reduction, data display, and conclusion drawing and verification, to generate comprehensive findings regarding the implementation of contextual media-based Deep Learning in elementary education.

3. Result and Discussion

The findings of this study are organized into three major themes that reflect the implementation and experiences and processes of contextual media-based Deep Learning in elementary education. These themes were developed through an interactive analysis of observation, interview, and documentation data, representing the recurring patterns that emerged during the research process. The discussion is presented by linking the empirical findings with relevant learning theories and previous studies to provide a comprehensive understanding of how contextual media support meaningful, joyful, reflective, and student-centered learning. The three main themes are presented as follows.

a. Contextual Media as a Catalyst for Meaningful Deep Learning in Elementary Education

The findings of this study indicate that the implementation of contextual media through an ecoenzyme project provided a contextual setting for experiencing Deep Learning in elementary education. Classroom observations revealed that students participated in learning process, beginning with identifying environmental problems, collecting organic materials, producing ecoenzymes, documenting the fermentation process, and reflecting on the outcomes of their projects. Rather than functioning as passive recipients of information, students actively constructed knowledge by connecting scientific concepts with authentic experiences from their surrounding environment. This learning process aligns with Ausubel's theory of meaningful learning, which argues that new knowledge is retained more effectively when it is connected to learners' prior knowledge and real-life experiences (Indah & Abimanyu, 2025). Consequently, the ecoenzyme project provided concrete experiences through which students could relate environmental concepts to situations encountered in their daily lives.

The implementation of contextual media also was associated with a shift in the pattern of classroom interaction. During the project, where students explored ideas, discussed findings, asked questions, and collaboratively addressed authentic problems. Teachers primarily acted as facilitators who guided inquiry and encouraged students to reflect on their learning experiences. This instructional transformation reflects the essential principles of Deep Learning, which emphasize active knowledge construction, critical inquiry, and reflective thinking rather than rote memorization. Throughout the learning activities, students demonstrated willingness in expressing opinions and proposing alternative solutions related to environmental issues, indicating evidence of active cognitive engagement.

To better illustrate the implementation of contextual media during classroom instruction, the main learning activities

observed throughout the study are summarized in Table 1.

Table 1. Classroom Learning Activities Using Contextual Media-Based Deep Learning

Learning Stage	Teacher Activities	Student Activities	Deep Learning Dimension	Expected Learning Outcome
Problem Identification	Introduced issues related to household organic waste	Identified environmental problems in their surroundings	Meaningful Learning	Students connect learning with real-life situations
Project Planning	Guided project planning and discussion	Designed ecoenzyme production procedures collaboratively	Mindful Learning	Students develop planning and critical thinking skills
Project Implementation	Facilitated experiments and monitoring	Produced ecoenzymes using organic materials	Experiential Learning	Students construct knowledge through authentic experiences
Reflection	Facilitated reflective discussions	Evaluated project outcomes and learning experiences	Reflective Learning	Students consolidate conceptual understanding

Table 1 illustrates that every stage of the instructional process was intentionally designed to promote active engagement rather than passive knowledge acquisition. The learning sequence demonstrates that contextual media functioned as a bridge between theoretical concepts and authentic experiences. Students first encountered environmental issues that were directly relevant to their daily lives before progressing toward collaborative planning and practical experimentation. Such instructional sequencing enabled students to construct understanding progressively through observation, discussion, experimentation, and reflection. The reflection stage was particularly important because students were encouraged to evaluate both the learning process and the environmental significance of their projects. Taken together, these activities show that meaningful, mindful, and reflective elements of Deep Learning were embedded within the project rather than treated as separate learning activities.

The interview findings further support the observation data by revealing changes in how students explained and understood the learning content. Most students explained that they previously perceived organic waste merely as household garbage without recognizing its environmental value. Following participation in the ecoenzyme project, however, students demonstrated the ability to explain the scientific principles underlying organic decomposition, fermentation processes, and the practical applications of ecoenzymes using their own words. Rather than simply recalling definitions from textbooks, students interpreted concepts through direct experience, illustrating that a process of connecting new concepts with their experiences and observations. These findings indicate that contextual media facilitate conceptual change by allowing learners to integrate new knowledge into existing cognitive structures (Indah & Abimanyu, 2025). The finding is particularly relevant to meaningful learning because the learning

content was presented through an environmental problem that students could recognize in their own surroundings.

In addition to conceptual understanding, classroom observations revealed evidence of inquiry-oriented thinking. Students continuously questioned why different organic materials produced different fermentation outcomes, discussed possible explanations, and proposed improvements for subsequent project activities. Such behaviors demonstrate that contextual learning activities stimulated inquiry-based learning and encouraged students to evaluate evidence before drawing conclusions. These findings support previous research indicating that contextual learning influences both mindful learning and joyful learning, where students actively engage in cognitive processes while maintaining positive emotional involvement throughout instructional activities (Nafi'ah & Faruq, 2025). The enhancement of students' conceptual understanding is summarized in Table 2.

Table 2. Indicators of Students' Meaningful Learning Development

Indicator	Initial Understanding	Evidence Observed during Learning	Evidence from Observation and Interview
Understanding of organic waste	Limited to identifying waste types	Explained environmental impacts and utilization	Students related waste management to everyday practices
Scientific concept comprehension	Memorized definitions	Explained fermentation and ecoenzyme production independently	Students used their own explanations during interviews
Critical thinking	Responded to teacher questions only	Asked questions, analyzed problems, and proposed solutions	Active discussions observed during project implementation
Reflection ability	Limited reflection	Evaluated project outcomes and environmental benefits	Students reflected on both process and product

The findings presented in Table 2 indicate qualitative changes in the ways students understood, discussed, and reflected on the learning content. Rather than merely demonstrating increased factual knowledge, students exhibited more elaborated explanations and reasoning. Interview data showed that students were capable of connecting classroom learning with environmental issues encountered in their daily lives, suggesting that students perceived the relevance of the learning content beyond the immediate classroom activity. Moreover, students became increasingly reflective, evaluating not only the success of their ecoenzyme products but also the broader environmental implications of waste management. Such findings reinforce the argument that meaningful learning occurs when instructional experiences enable learners to integrate cognitive understanding with authentic real-world contexts

Another important finding concerns the role of contextual media in maintaining students' cognitive engagement throughout the learning process. Observational data demonstrated sustained participation during classroom discussions, practical activities, and reflective sessions. Students were observed participating in activities that required direct interaction and collaboration. Teachers also reported that students who were

previously passive during conventional instruction became more willing to contribute ideas when learning activities involved authentic projects. This teacher-reported observation suggests that the contextual nature of the activities created additional opportunities for participation, although it should be interpreted as qualitative evidence rather than a measured change in engagement.

Teacher perspectives regarding the implementation of contextual media are summarized in Table 3.

Table 3. Teachers' Perceptions of Contextual Media-Based Deep Learning

Theme	Teacher Observation	Educational Implication	Supporting Evidence
Student engagement	Students participated more actively during learning	Promotes learner-centered instruction	Observation and interview data
Conceptual understanding	Students understood concepts more easily through direct experience	Strengthens meaningful learning	Classroom discussions and reflections
Critical thinking	Students asked more analytical questions	Encourages inquiry-based learning	Teacher field notes
Classroom participation	Passive students became more involved	Supports inclusive classroom participation	Interview with classroom teachers

Table 3 demonstrates that teachers consistently perceived contextual media as a useful instructional approach for facilitating Deep Learning. Teachers emphasized that authentic learning experiences reduced students' dependence on direct teacher explanations because learners were able to construct understanding independently through observation and experimentation. Furthermore, contextual media appeared to create a more inclusive learning environment by encouraging participation from students with varying academic abilities. Students who previously hesitated to participate during conventional lessons became more willing to participate when engaging in practical project activities. These findings suggest that contextual media can support conceptual understanding but also strengthen learner autonomy and classroom participation, both of which are fundamental characteristics of student-centered learning.

Overall, the findings indicate that contextual media function as a contextual support for meaningful Deep Learning in elementary education. The ecoenzyme project enabled students to integrate prior knowledge with authentic environmental experiences, thereby promoting meaningful knowledge construction, critical inquiry, and reflective thinking. Unlike conventional instruction that often emphasizes content delivery, contextual media facilitated active participation throughout every stage of learning, allowing students to construct concepts through direct experience and collaborative problem solving. These findings are consistent with previous studies emphasizing that Deep Learning is achieved when learning activities are relevant to students' lives and encourage active meaning-making (Nafi'ah & Faruq, 2025). Therefore, the present study adds qualitative evidence that meaningful Deep Learning can be implemented through simple contextual media utilizing locally available environmental resources, without requiring sophisticated digital technologies.

b. Fostering Joyful Learning and Collaborative Skills through Ecoenzyme Project-Based Learning

The findings of this study indicate that the implementation of contextual media through an ecoenzyme project provided opportunities for a joyful learning environment that promoted collaboration and social interaction. Throughout the learning process, students demonstrated high enthusiasm, active participation, and sustained engagement in every stage of the project. Unlike conventional classroom instruction, where students often rely on teacher explanations and individual assignments, the ecoenzyme project encouraged learners to explore authentic environmental problems collectively and construct solutions through shared experiences. Classroom observations showed that students participated voluntarily in discussions, exchanged ideas with peers, and actively contributed during project implementation. Such conditions reflect one of the fundamental characteristics of Deep Learning, in which cognitive development is inseparable from emotional engagement and collaborative knowledge construction (Nafi'ah & Faruq, 2025).

The joyful atmosphere observed during the project was associated with the fact thatlearning activities were directly connected to students' daily lives. Students collected organic waste from their homes, discussed the environmental impacts of improper waste management, and transformed discarded materials into useful ecoenzymes. This authentic experience made learning relevant and engaging as students perceived the activities as relevant to their personal experiences rather than as isolated classroom exercises. The opportunity to manipulate real objects, conduct simple experiments, and observe the fermentation process over time stimulated curiosity and supported students' continued participation in the project activities. Rather than perceiving learning as an obligation, students appeared to experience the project as an enjoyable exploration that allowed them to discover new knowledge independently.

The observational findings further revealed that students expressed positive emotions throughout classroom activities. Many students smiled, laughed, and enthusiastically interacted with their peers while completing project tasks. Such emotional responses provide qualitative evidence of positive emotional engagement during the activities. According to the Broaden-and-Build Theory, positive emotions broaden individuals' thought–action repertoires and can support social engagement (Fredrickson, 2001). In the present study, the positive emotional atmosphere was accompanied by students' willingness to participate, ask questions, and interact with peers. This pattern suggests that joyful learning and cognitive engagement occurred alongside one another during the project.

The indicators of joyful learning observed during the implementation of the ecoenzyme project are presented in Table 4.

Table 4. Indicators of Joyful Learning during Ecoenzyme Project-Based Learning

Learning Aspect	Observation Findings	Student Responses	Contribution to Deep Learning	Evidence Source
Learning motivation	Students participated voluntarily throughout activities	Students expressed excitement about project tasks	Increases learning engagement	Classroom observation
Curiosity	Students frequently asked questions regarding fermentation and environmental issues	Students explored additional information independently	Encourages inquiry and reflection	Observation and interview
Classroom atmosphere	Relaxed, interactive, and supportive	Students expressed enjoyment during activities	Supports joyful learning	Field notes
Active participation	Nearly all students contributed during discussions and project implementation	Students confidently shared opinions	Promotes meaningful engagement	Observation

Table 4 demonstrates that joyful learning emerged consistently across various dimensions of classroom activities. Students displayed willingness to participate that was reflected in their participation without continuous teacher prompting. Their curiosity became evident as they formulated questions, sought explanations from peers and teachers, and connected project activities with environmental issues encountered outside the classroom. Furthermore, the supportive classroom atmosphere encouraged students to participate and express opinions. These observations suggest that the contextual project created conditions conducive to joyful learning, while the qualitative data do not establish a causal increase in motivation.

Beyond fostering positive emotional engagement, the ecoenzyme project also provided opportunities for students to develop students' collaborative skills. Throughout the implementation process, students worked in small heterogeneous groups consisting of members with different academic abilities and social characteristics. Each group collaboratively planned project activities, collected organic materials, prepared fermentation containers, documented observations, and presented project outcomes to the class. Rather than assigning identical tasks to every member, students negotiated responsibilities according to individual strengths and interests, creating opportunities for authentic teamwork and shared decision-making. Classroom observations indicated that students consistently encouraged one another, exchanged ideas respectfully, and jointly solved practical challenges encountered during project implementation.

The collaborative nature of the ecoenzyme project also promoted the development of important social competencies. Students learned to communicate effectively, negotiate differing opinions, resolve disagreements constructively, and assume responsibility for completing assigned tasks. Such competencies represent essential twenty-first-century learning skills that extend beyond academic achievement. According to Fullan and Langworthy (2014), Deep

Learning encompasses not only cognitive development but also interpersonal competencies that enable learners to collaborate, communicate, and contribute positively within their communities. The present findings support this perspective by demonstrating that collaborative project-based learning provides authentic opportunities for students to develop these competencies naturally through meaningful social interaction.

The development of collaborative skills observed throughout the study is summarized in Table 5.

Table 5. Development of Students' Collaborative Skills

Collaboration Indicator	Student Behavior	Teacher Observation	Educational Outcome	Data Source
Communication	Shared ideas openly during discussions	Students communicated respectfully	Improved interpersonal skills	Observation
Responsibility	Completed assigned project tasks	Students showed accountability	Strengthened self-management	Observation and interview
Teamwork	Assisted peers during project activities	Students collaborated effectively	Enhanced collaborative competence	Classroom observation
Problem-solving	Resolved project-related challenges collectively	Students proposed alternative solutions	Improved collective reasoning	Observation and documentation

Table 5 indicates that collaborative competencies developed alongside students' cognitive understanding. Rather than functioning as isolated social activities, communication, teamwork, and shared problem-solving became integral components of the learning process. Teachers reported that students were able to distributing responsibilities fairly, respecting diverse opinions, and reaching collective decisions through discussion. These experiences provided opportunities for the development of responsibility and mutual respect among group members. Furthermore, collaborative problem-solving encouraged students to evaluate multiple perspectives before making decisions, thereby strengthening critical thinking alongside interpersonal competence. Such findings confirm that project-based contextual learning provides an authentic environment for integrating cognitive, affective, and social dimensions of Deep Learning.

Interview data with teachers further revealed that the joyful and collaborative learning environment was perceived to support students' confidence and classroom participation. Teachers observed that students who were previously passive during conventional lessons became increasingly willing to ask questions, present project findings, and engage in classroom discussions. This behavioral change was associated by teachers with the supportive and cooperative nature of the project activities. Teachers also emphasized that authentic project activities created equal opportunities for every learner to contribute according to individual abilities, thereby supporting inclusive classroom participation.

Teacher perceptions regarding the influence of ecoenzyme project-based learning are summarized in Table 6.

Table 6. Teachers' Perceptions of Joyful and Collaborative Learning

Theme	Teacher Perspective	Impact on Students	Educational Implication	Supporting Evidence
Joyful learning	Students appeared more enthusiastic and motivated	Increased classroom engagement	Creates positive learning experiences	Interview
Student confidence	Passive students became more active	Improved classroom participation	Encourages learner autonomy	Observation and interview
Collaborative learning	Students effectively worked together	Better communication and teamwork	Supports student-centered learning	Observation
Character development	Students became more responsible and environmentally aware	Strengthened cooperation and environmental stewardship	Supports holistic education	Interview and documentation

Table 6 highlights teachers' consistent perceptions that contextual media-based project learning supported students' emotional, social, and behavioral engagement. Teachers emphasized that authentic learning activities transformed the classroom into a more interactive and supportive environment, enabling students to participate according to their abilities and roles within the project. Furthermore, teachers reported positive observations in students' responsibility toward project completion and environmental sustainability. These findings indicate that joyful learning extends beyond emotional satisfaction and can be connected with broader educational goals, including character education, environmental awareness, and collaborative competence.

Another important finding concerns the relationship between joyful learning and students' willingness to extend learning beyond the classroom. Students expressed a desire to continue ecoenzyme production outside the classroom by involving family members in household organic waste management. This finding suggests that contextual learning experiences may encourage students to consider applying the learning experience in their everyday contexts. Such transfer of learning demonstrates that joyful and meaningful educational experiences can encourage learners to connect acquired knowledge with authentic social contexts.

Overall, the findings indicate that ecoenzyme project-based learning provided opportunities for joyful learning while simultaneously supporting the development of students' collaborative competencies. The integration of authentic environmental projects with contextual media enabled students to experience learning as an enjoyable, meaningful, and socially interactive process. Positive emotional engagement was observed alongside participation, curiosity, and confidence, whereas collaborative activities involved communication, teamwork, responsibility, and collective problem-solving. These findings support the argument of Fredrickson (2001) that positive emotions can broaden engagement and reinforce the perspective of Fullan and Langworthy (2014) that Deep Learning encompasses interconnected cognitive, affective, and social dimensions.

Therefore, this study provides qualitative evidence that simple contextual projects utilizing local environmental resources can

create opportunities for joyful learning, collaboration, and character-related development in elementary classrooms.

c. Pedagogical Implications of Contextual Media for Deep Learning Implementation

The findings of this study provide important pedagogical implications regarding the implementation of Deep Learning through contextual media in elementary education. Beyond describing patterns of engagement and participation in students' cognitive, affective, and social engagement, the findings reveal that contextual media also were associated with instructional practices that encouraged more student-centered, inquiry-oriented, and experience-based learning. Throughout the implementation of the ecoenzyme project, teachers primarily functioned as facilitators who guided students through authentic learning experiences, while continuing to provide instructional direction and support. This pattern reflects one of the core principles of Deep Learning, which emphasizes meaningful knowledge construction, reflective thinking, collaboration, and learner autonomy rather than teacher-centered information delivery (Nafi'ah & Faruq, 2025).

Observation data showed that teachers were not limited to direct information delivery during classroom instruction. Instead, they designed learning situations that encouraged students to investigate environmental problems, formulate questions, conduct experiments, discuss findings, and evaluate project outcomes collaboratively. Such instructional practices created opportunities for students to actively participate throughout the learning process while simultaneously developing inquiry-oriented thinking. Teachers reported that contextual media enabled them to facilitate classroom discussions more naturally because students could directly relate scientific concepts to authentic situations encountered in their daily lives. Consequently, classroom interaction became more dynamic, reflective, and learner-centered during the project activities.

The findings further indicate that contextual media functioned as an effective pedagogical bridge between curriculum objectives and authentic learning experiences. Rather than presenting environmental concepts solely through textbooks or lectures, teachers integrated locally available organic waste into project-based activities that enabled students to observe, analyze, and solve real-world problems. This instructional approach reduced the gap between theoretical knowledge and practical application, allowing students to understand scientific concepts through direct experience. Such findings reinforce the perspective that contextual learning environments facilitate meaningful knowledge construction by connecting learning materials with learners' prior experiences and surrounding environments (Indah & Abimanyu, 2025).

The major pedagogical changes observed during the implementation of contextual media-based Deep Learning are summarized in Table 7.

Table 7. Pedagogical Changes Following the Implementation of Contextual Media-Based Deep Learning

Pedagogical Aspect	Contextual Media-Based Deep Learning	Educational Implication	Evidence Source
Teacher Role	Learning facilitator	Promotes student autonomy	Observation and interview
Student Role	Active knowledge constructor	Enhances meaningful engagement	Observation
Learning Resources	Local environmental resources and ecoenzyme project	Strengthens contextual understanding	Documentation
Learning Process	Inquiry, project-based, and reflective	Supports higher-order thinking	Observation

Table 7 illustrates a shift in instructional patterns following the implementation of contextual media. The most notable pedagogical pattern concerned the complementary roles of teachers and students. Teachers facilitated learning through questioning, scaffolding, and reflection, while students assumed greater responsibility for constructing understanding through project activities. The utilization of local environmental resources also diversified instructional materials and reduced dependence on textbook-centered learning. These pedagogical patterns indicate that contextual media can provide practical opportunities for implementing learner-centered learning in elementary classrooms. Consequently, learning becomes a collaborative process in which teachers and students interact through authentic learning experiences.

Another important implication emerging from this study concerns the accessibility and sustainability of contextual media as instructional resources. Unlike technology-oriented approaches discussed in parts of the existing literature, the present findings provide qualitative evidence that meaningful learning activities can also be designed using simple, locally available materials. The ecoenzyme project required organic household waste, reusable containers, and collaborative classroom activities, making it feasible for schools with limited technological infrastructure. This finding suggests that the implementation of Deep Learning can depend substantially on instructional design and pedagogical creativity rather than solely on the sophistication of educational technology.

Furthermore, teacher interviews indicated that contextual media helped address instructional challenges commonly experienced during elementary science instruction. Teachers explained that abstract scientific concepts, which were previously difficult for students to understand, became more comprehensible when presented through authentic project activities. Students were able to directly observe fermentation processes, discuss environmental issues, and connect theoretical knowledge with practical experiences. Consequently, teachers reported more active classroom interaction, greater student curiosity, and more meaningful classroom discussions during the project activities.

The pedagogical benefits identified by participating teachers are summarized in Table 8.

Table 8. Teachers' Perceptions of the Pedagogical Benefits of Contextual Media

Pedagogical Benefit	Teacher Observation	Qualitative Implication	Supporting Evidence	Educational Significance
Student centered instruction	Students became more independent	Increased learner autonomy	Interview	Supports Deep Learning principles
Easier concept delivery	Students understood concepts through authentic experiences	Improved conceptual understanding	Observation	Facilitates meaningful learning
Increased participation	More students contributed during classroom discussions	Better classroom interaction	Observation and interview	Encourages inclusive learning
Flexible instructional resources	Teachers utilized local environmental materials	Sustainable classroom innovation	Documentation	Applicable in diverse school contexts

Table 8 demonstrates that teachers perceived contextual media as a useful pedagogical resource that supported several aspects of classroom instruction. Rather than functioning solely as learning aids, contextual media became instructional resources that facilitated active discussion, inquiry, collaboration, and reflective thinking. Teachers emphasized that authentic projects simplified the explanation of abstract scientific concepts because students could directly observe and experience the phenomena being studied. Moreover, the flexibility of using locally available resources enabled teachers to design meaningful learning activities without depending on sophisticated technological facilities.

The present findings also contribute to the ongoing discussion regarding educational innovation in the era of digital transformation. Existing literature frequently associates Deep Learning with digital learning environments, virtual laboratories, learning management systems, and technology-enhanced instruction. The present study adds a qualitative perspective by showing how meaningful learning activities can also be organized around contextual projects grounded in local environmental resources. Therefore, technological sophistication should not be regarded as the sole determinant of instructional innovation. Instead, pedagogical design remains important in creating authentic learning experiences that encourage students to actively construct knowledge and connect classroom concepts with real-life situations.

This perspective represents an important contribution to the literature because many schools, particularly in developing regions, continue to experience limitations in digital infrastructure. The findings indicate that contextual media provide an accessible alternative for implementing Deep Learning without requiring substantial financial investment or advanced technological equipment. Consequently, schools with limited access to digital technologies may still implement meaningful, student-centered instruction by utilizing locally available learning resources.

To clarify the contribution of the present study compared with previous research, Table 9 summarizes the distinctive pedagogical implications identified through the implementation of contextual media-based Deep Learning.

Table 9. Comparison of Previous Studies and the Present Research

Research Aspect	Previous Studies	Present Study	Pedagogical Contribution	Supporting Reference
Learning media	Predominantly digital technology and online platforms	Contextual media using ecoenzyme project	Demonstrates effectiveness of non-digital innovation	Ahmed et al. (2021)
Research focus	Learning outcomes and technology integration	Learning process, teacher practices, and student experiences	Provides process-oriented evidence	Napitupulu (2025)
Educational context	Mostly higher education	Elementary education	Expands empirical evidence for primary education	Adestipa et al. (2025)
Deep Learning implementation	Technology-supported learning	Local contextual project-based learning	Extends pedagogical application of Deep Learning	Nafi'ah & Faruq (2025)

Table 9 summarizes the positioning of the present study in relation to existing research. While previous investigations have examined technology-supported Deep Learning and learning outcomes, this study provides qualitative evidence of how contextual media can be used in an elementary classroom. Furthermore, unlike studies focusing primarily on measurable learning outcomes, the present research provides process-oriented evidence concerning instructional practices, teacher facilitation, classroom interactions, and students' learning experiences. This process-oriented perspective enriches current understanding by explaining how Deep Learning can be implemented through authentic contextual activities within an elementary educational setting. Consequently, the findings broaden the pedagogical discussion of Deep Learning by highlighting the importance of contextual instructional design alongside technological innovation.

Another significant implication concerns teacher professional development. The implementation of contextual media-based Deep Learning requires teachers to develop competencies in designing authentic learning experiences, facilitating inquiry-based discussions, conducting reflective activities, and utilizing local environmental resources creatively. Therefore, future teacher training programs may benefit from extending beyond technological literacy to include instructional design strategies that integrate meaningful, mindful, and joyful learning into everyday classroom practice. Strengthening these pedagogical competencies may enable teachers to implement Deep Learning across diverse educational settings regardless of technological availability.

Overall, this study provides qualitative evidence that contextual media can support the implementation of Deep Learning in elementary education. The ecoenzyme project created opportunities for student-centered learning, authentic inquiry, collaborative problem-solving, and reflective knowledge construction. Unlike approaches emphasizing digital technologies, the present findings show that meaningful educational experiences can also emerge from simple contextual resources that are closely connected to

students' daily lives. This study therefore contributes to the literature by highlighting that the implementation of Deep Learning involves pedagogically meaningful learning experiences, contextual relevance, teacher facilitation, and active student participation, rather than technological sophistication alone. These findings provide theoretical and practical insights for educators seeking to strengthen the implementation of Deep Learning through accessible, sustainable, and contextually relevant instructional practices in elementary schools.

4. Conclusion

This study provides qualitative evidence that the implementation of Deep Learning through contextual media in the form of an ecoenzyme project can support meaningful learning in elementary education. The findings indicate that contextual media provided opportunities for students to connect instructional content with their real-life experiences and actively construct knowledge through authentic learning activities. The ecoenzyme project also encouraged students to engage in questioning, discussion, inquiry, and reflection, reflecting important dimensions of Deep Learning. The study also found that contextual project-based learning created opportunities for joyful and collaborative learning. Students demonstrated enthusiasm, curiosity, active participation, and positive interaction during the learning activities, while collaborative project work involved communication, teamwork, responsibility, and environmental awareness. These findings indicate that Deep Learning involves interconnected cognitive, affective, and social dimensions rather than cognitive learning alone.

Furthermore, the findings provide important pedagogical implications regarding the implementation of Deep Learning through contextual media. The study indicates that meaningful and authentic learning activities can be designed using simple, locally available environmental resources without relying exclusively on sophisticated digital technologies. The ecoenzyme project provided teachers with opportunities to facilitate student-centered, inquiry-oriented, collaborative, and reflective learning. This finding highlights the importance of contextual instructional design and teacher facilitation in supporting the implementation of Deep Learning in elementary classrooms.

Overall, this study contributes to the growing body of knowledge on Deep Learning in elementary education by providing qualitative, process-oriented evidence concerning contextual media, teacher facilitation, classroom interaction, and students' learning experiences. Theoretically, the findings enrich the understanding of how meaningful, mindful, and joyful dimensions of Deep Learning can be integrated through authentic contextual activities. Practically, the findings provide insights for teachers seeking to design accessible, sustainable, and contextually relevant learning experiences by utilizing local environmental resources. Future studies may investigate the implementation of contextual media-based Deep Learning across different subjects, educational levels, and cultural contexts, as well as examine how contextual and digital learning media can be integrated to support diverse learning experiences.

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