# Transforming Education Through Deep Learning Design: Integrating Four Key Elements in School Practice

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Article history: Received: October 06, 2023 | Revised: Desember 26, 2023 | Available Online: Januari 27, 2025

## Abstract

This research aims to develop and implement a *deep learning-based learning* design through a *Design-Based Research* (DBR) approach in an Indonesian secondary school context. DBR was chosen for its ability to bridge between pedagogical theory and classroom practice through a reflective and collaborative design cycle. This study was conducted at MTs Mansyaul Ulum involving core subject teachers, grade VIII students, and the school principal. The primary focus of the study was the simultaneous integration of four elements of *deep learning*: real-world connections, personalization, collaboration between students, and the use of digital technology. Data were collected through classroom observations, in-depth interviews, teacher reflections, student work, and student perception questionnaires, and then analyzed thematically using an inductive approach. The results showed that contextualized and holistic learning design significantly improved students' engagement, meaning of learning, and development of 21st-century competencies. Connection with the real world strengthens the relevance of the material, while personalization encourages learning autonomy. Collaboration is proven to improve both conceptual understanding and social-emotional skills. Digital technology serves as a medium to expand the space for learning exploration. The resulting learning model makes a theoretical contribution to developing the *New Pedagogies for Deep Learning* framework and a practical contribution in the form of an adaptive and applicable design for teachers and curriculum developers. This research shows that *profound learning-based* educational transformation is possible, relevant,, and impactful in the context of education.
**Keywords**: *deep learning*; learning transformation, personalization; collaboration.

## INTRODUCTION

The rapid development of information technology has pressured the education system to transform from traditional instructional approaches to more participatory and student-centered approaches. However, most schools in Indonesia and many developing countries still operate within a conventional pedagogical framework focusing on content mastery rather than deep meaning and knowledge transfer. Data from World Bank, (2020) Shows that more than 70% of students in developing countries fail to reach *minimum proficiency levels* in literacy and numeracy despite 6 years of basic education. This inequality emphasizes the need for a learning approach that conveys knowledge and shapes 21st-century competencies such as critical thinking, collaboration, and digital literacy - all of which are core principles in the *deep learning* approach.

According to Fullan, Quinn, & McEachen, (2017) *Deep learning* is a learning process that actively engages students in meaningful exploration of concepts through real-world connections, collaboration, and reflection. They introduced the *New Pedagogies for Deep Learning (NPDL)* framework, emphasizing integrating technology, innovative pedagogy, and character building. Meanwhile, Jahnke, Bergström, Mårell-Olsson, Häll, & Kumar, (2017) Their study in Nordic schools emphasized the importance of *digital didactical design* in creating deep and meaningful learning contexts through strategic technology integration. This reinforces the position that technology integration is not an end but a means to transform learning practices in a more reflective and collaborative direction.

Although the concept of deep learning has been widely discussed in the theoretical realm, there is still a significant gap in its implementation in educational practice. In particular, not many studies have examined in depth how to design learning that effectively integrates the four key elements of deep learning: connection with the real world, personalization of learning, utilization of digital technology, and strengthening collaboration between students. Therefore, this study aims to investigate how deep learning-based learning design that accommodates these four elements can be implemented concretely and effectively in a school setting.

Several studies have raised the importance of transforming pedagogy towards deep learning. Jahnke, Bergström, Mårell-Olsson, Häll, & Kumar (2017) explored digital design on iPad use in Nordic schools, but lacked depth in integrating collaborative dimensions. McPhail (2021) offers a *curriculum coherence model* to link content and competencies, but the model is not sufficiently responsive to the context of digital technology. Sanusi, Oyelere, &

Omidiora (2022) examined teachers' preconceptions towards machine learning in secondary schools, but focused more on TPACK gaps, not integrative design. Baran and Baran & Uygun (2016) developed a TPACK-Design-Based Learning (DBL) model, but its application is still limited to teacher training, not in classroom practice. Finally, Fullan (2016) introduced the NPDL framework globally, but it still requires contextual adaptation in the national education system. All these studies contribute theoretical foundations, but have not explicitly examined integrating the four elements in school practice at the micro level.

This research differs from previous studies in that it develops and tests a *deep learning-based learning design model* that integrates simultaneously four key elements in a real school context. Unlike partial approaches focusing on one or two dimensions, this study adopts a systemic and holistic perspective in building profound learning experiences. Novelty also lies in the *design-based research* approach used to iterate the development and validation of the design in the Indonesian school context, addressing the gap between theory and practice.

This research aims to design, implement, and evaluate a *deep learning-based learning* design by integrating four key elements: real-world context, personalization, digital technology, and collaboration. The main contribution of this research is to offer a practical model that educators can use at primary and secondary school levels, while providing empirical evidence of how the approach can increase student engagement and depth of learning. In addition, the results of this study are expected to enrich the literature on transformative pedagogy in the context of 21st-century education.

## RESEARCH METHODOLOGY

This research uses the *design-based research (DBR) approach because it is considered the most appropriate way to address the complex contextual needs of education and* bridge between pedagogical theory and classroom practice. This approach enables the design of learning innovations that are continuously refined through iterative and reflective cycles with educational practitioners. DBR allows researchers to evaluate implementation and participate in a collaborative design process with teachers as key partners.

This research was conducted at MTs Mansyaul Ulum, which has started implementing technology integration in learning. The school was selected purposively, with consideration of infrastructure readiness, openness of the Madrasah principal, and teachers' willingness to collaborate in designing and implementing deep learning actively. The research subjects involved core subject teachers, several grade VIII students, and the school principal.

The primary focus of this research is to design and implement a learning design that integrates four main elements of *deep learning*: connection with the real world, personalization of learning experience, collaboration between students, and digital technology. The research was conducted in three rounds of the DBR cycle. In the initial stage, the researchers conducted needs exploration through interviews and observation of learning activities. From the needs analysis results, a thematic learning unit was designed and developed collaboratively between researchers and teachers.

The learning design is then tested in a real classroom context. During the implementation process, the researcher directly observed the learning interaction, recorded the classroom dynamics, and documented student and teacher activities. Teachers are also asked to do a written reflection after each teaching session, which becomes a discussion material to revise the design in the next round.

This study collected data through classroom observations, in-depth interviews, teacher reflections, and student work. In addition, a questionnaire was used to capture students' perceptions of their involvement and understanding in the learning process. All data collected was thematically analyzed to explore patterns, trends, and dynamics that emerged during the learning process. The analysis process was conducted inductively by thoroughly reading the transcripts and field notes, open coding, and categorizing the meaning until the main themes emerged.

To ensure the validity of the data, researchers triangulated between sources and methods and asked for confirmation from key informants on the interpretation of the results obtained. Discussions with fellow researchers and education experts were also conducted to strengthen the validity of the findings and avoid interpretative bias. Through this reflective and collaborative research process, it is expected that a learning design will emerge that is not only based on the principles of *deep learning* but also contextual to the needs and characteristics of students in Indonesian secondary schools.

## RESULTS AND DISCUSSION

### Integration of Real World Connections in Learning

The implementation of real-world connections in learning is proven to increase the relevance of content for students. Thematic learning units designed by teachers using local environmental issues, such as waste management and the clean water crisis, have encouraged students to build connections between scientific knowledge and the reality of their daily lives.

Classroom observations showed that student engagement increased significantly when given the space to relate lessons to their local contexts. This aligns with the findings of Darling-Hammond, Flook, Cook-Harvey, Barron, & Osher (2020), who emphasized that contextualized learning results in stronger *meaning-making*, encouraging students' intrinsic motivation to learn more deeply.

Questionnaire data showed that 82% of MTs Mansyaul Ulum students felt they "understood the material better because the learning topics were close to their daily lives." These results confirm that real-world connections are a crucial element in bridging academic content with personal relevance(Beane, 1997) . This integration of real-world context is also the foundation for problem-based learning (PBL), which has been widely demonstrated to improve knowledge *retention* and *transfer.*(Hmelo-Silver, 2004)

**Personalization as a Response to Learning Differentiation**

The personalized learning design in this study is realized through the use of individualized *learning paths* and the freedom to choose the medium of expression for the final project (e.g., video, infographic, essay). This practice allows students to navigate the learning process based on their interests and strengths.(Muhammad, Zhou, Beydoun, Xu, & Shen, 2016) . The teacher is a facilitator who observes learning styles and provides appropriate *scaffolding.* (Gibbons, 2002) . Analysis of teacher reflection data shows that this approach strengthens students' learning autonomy and broadens the spectrum of learning expression.

This finding aligns with the Universal Design for Learning (UDL) approach, which suggests multiple avenues for students to access content and express their understanding. (CAST, 2018) . McLoughlin & Lee, (2010) Also, personalization in digital learning encourages a feeling of ownership over the learning process, which has positive implications for motivation and learning engagement. However, the challenge is the increased workload of teachers in preparing diverse and flexible *assessment rubrics*.

**Strategic Utilization of Digital Technology**

The use of technology in this context is not simply the adoption of digital tools, but as a medium to *augment learning processes*. Students utilize Canva, Padlet, and Google Classroom apps to structure collaborative projects and document their learning process. Observations show that technology encourages asynchronous collaboration, improves digital literacy, and expands the space for exploration.

Previous studies by Voogt, Knezek, Cox, Knezek, & ten Brummelhuis, (2013) Underlined the importance of technology as an enabler for *connected learning environments*. This study reinforces that argument with empirical evidence that strategic use of technology can balance the cognitive and social dimensions of learning. However, it should be noted that inequality in access to technology remains a challenge, especially for students from low socioeconomic backgrounds - something also pointed out in the study. (Schleicher, 2020) .

**Collaboration as the Core of Knowledge Construction Process**

Collaboration is facilitated through *group inquiry* activities, group debates, and cross-subject projects. Teacher observation and reflection data show that collaboration improves the quality of academic discussions and strengthens students' social-emotional skills such as tolerance, negotiation of ideas, and empathy.

Student involvement in meaningful discussions also encourages the emergence of *cognitive conflict*, which is the primary trigger for meaningful learning according to the Zone of Proximal Development (ZPD) theory. Research by Gillies, (2016) When students are involved in *structured collaborative learning*, they not only build knowledge socially but also develop metacognitive skills that are important for long-term learning.

**Establishment of a Holistic Learning Model**

The results of the three DBR cycles show that the simultaneous integration of the four elements creates a richer and more structured learning experience. Researchers and teachers successfully formulated a *holistic learning design model* consisting of three main stages: *contextualization, personalization, and reflective collaboration*, supported by technology integration as a reinforcement platform.

The model not only represents a synthesis of previous theories but also demonstrates an empirical contribution to the practice of transformational education at the school level. In other words, this research contributes a practical model that can be adopted, replicated, and further developed in a broader context.

Theoretically, the findings expand the understanding of *deep learning* implementation in the context of secondary education, especially in developing country environments. The study corroborates that the effectiveness of *deep learning* approaches relies heavily on the simultaneous integration of pedagogical and technological elements, rather than partial implementation.

The research offers a *blueprint for* implementing 21st-century learning that educators, policymakers, and curriculum developers can use. The model developed can be a reference in competency-based teacher training and become the basis for developing curriculum policies more reflective of contextual needs.

**Conclusion**

This research contributes significantly to the understanding and practice of learning transformation through a *deep learning* approach by integrating four key elements: real-world connection, personalization, collaboration, and digital technology utilization. Implementation results show that contextualized and holistic learning design can simultaneously improve students' engagement, learning meaning, and 21st-century competencies.

First, real-world connections are proven to strengthen the relevance of learning to students' lives, increase intrinsic motivation, and encourage the formation of applicable knowledge. Second, personalization of learning allows meeting different learning needs, strengthening students' autonomy and ownership of their learning process. Third, collaboration among students enhances conceptual understanding and fosters social-emotional skills that are essential in modern learning environments. Fourth, the strategic use of technology serves as a lever for more interactive, reflective, and differentiated learning.

The learning model developed through the *Design-Based Research (DBR)* approach provides empirical evidence that *deep learning-based* curriculum development can be concretely implemented in the context of Indonesian secondary schools. The iterative and collaborative approach in DBR allows the learning design to be continuously refined based on reflection of real practice. From a theoretical perspective, this research extends the *New Pedagogies for Deep Learning* framework by offering an integrative model that can be replicated in global education, especially in developing countries. Meanwhile, from the practical side, the results of this research become an essential reference source for teachers, curriculum developers, and policy makers to build a more responsive, adaptive, and meaningful learning ecosystem.

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