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Adaptive Deep Learning eXperience (ADLX) and Adaptive Curriculum: The Foundation of Modern Learning for Inclusive and Effective Education in the Digital Age

Hani Arie Rachmanie[1]*, Bunyamin[1], Ishaq Nuriadin[1]

[1] The University of Muhammadiyah Prof. Dr. Hamka, Indonesia.

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Corresponding Author*:
Hani Arie Rachmanie
haniarierachmanie@uhamka.ac.id

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Abstract: This study aims to explore the implementation of ADLX and adaptive curriculum as a foundation for the development of modern learning at the secondary education level. Using a descriptive qualitative approach, this study involved interviews with teachers at a foundation with junior high school, senior high school, and vocational high school levels. The researcher also directly observed the learning process in the classroom and analysed learning documentation such as lesson plans, syllabi, and evaluation records. The findings indicate that the implementation of ADLX within the framework of an adaptive curriculum is capable of creating a more active, personalised, and participatory learning environment, leading to student engagement in thinking, exploratory, and reflective processes. Additionally, the adaptive curriculum allows teachers to tailor teaching strategies to students' needs, resulting in more optimal learning outcomes. These findings contribute to the development of future learning models that not only rely on technology but also place students at the centre of the educational process. With the right approach, ADLX and the adaptive curriculum have great potential to drive educational transformation toward greater equity, relevance, and meaning in the digital age.

Keywords: Adaptive curriculum; Adaptive Deep Learning Experience (ADLX); Inclusive education; Modern Learning

Introduction

The development of information and communication technology has brought major changes in the global education system. In this digital era, the demand for education that is inclusive, meaningful, and responsive to the needs of learners is increasingly prominent. Learning can no longer be homogenized, but needs to be adapted to the characteristics, potential, and diverse backgrounds of students. The development of digital technology has driven disruption in the global education system, demanding learning strategies that are more responsive to the needs and characteristics of learners. Social changes and technological developments in the digital era have driven new needs in the education system, especially to create more modern, inclusive and effective learning. In the midst of these changes, the Adaptive Deep Learning Experience (ADLX) approach becomes a strategic alternative to deliver deep, personalized, and contextualized learning experiences (Nkomo et al., 2021). ADLX combines the principles of constructivism, digital technology, and data-driven real-time monitoring to improve student engagement and understanding (Jansen et al., 2022).

The Adaptive Deep Learning eXperience (ADLX) concept is a learning approach that combines artificial intelligence, personalization, and a deep understanding of individual needs and learning styles to create a more inclusive, adaptive, and meaningful learning experience in the digital era (El-Sabagh, 2021). The concept is rooted in the principle of learner-centered learning, where the learning system is dynamically adjusted based on real-

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time feedback of learners' learning performance. Through the application of machine learning algorithms and learner modeling, ADLX enables the creation of unique learning trajectories for each individual, encouraging active participation and reflective learning (Hartini & Suherman, 2024; Munadirin et al., 2023). In addition, ADLX also emphasizes the importance of social interaction, utilization of data learning analytics, and integration of contextualized content to improve retention and motivation to learn sustainably (Bahgat et al., 2024). Thus, ADLX becomes one of the main foundations in developing a digital learning ecosystem that is responsive to current and future educational challenges.

The implementation of ADLX is inseparable from the support of an adaptive curriculum, which is a curriculum framework that is flexible, contextualized, and can be adapted to the interests and individual needs of learners (Mark & Bernadeth, 2024). Adaptive curriculum allows teachers to implement effective differentiation strategies to support students' diverse learning characteristics (Johar et al., 2023). Research shows that technology-based adaptive learning can reduce academic gaps and increase ownership of the learning process (Plooy et al., 2024). The concepts of Adaptive Deep Learning Experience (ADLX) and adaptive curriculum emerge as complementary approaches in building a learning ecosystem that is responsive to students' individual needs and potential. The application of *Adaptive Deep Learning Experience* (ADLX) in the educational context is practically realized through the integration of adaptive curriculum in the learning process (Tan et al., 2025). This flexible curriculum that is responsive to learners' needs provides space for teachers to design personalized and relevant learning experiences.

Along with the increasing use of educational technology, adaptive learning systems are now widely supported by artificial intelligence and data-driven learning. These technologies provide opportunities for teachers to personalize learning, provide instant feedback, and map students' learning progress with precision (Strielkowski et al., 2025). Moreover, in the context of online learning, ADLX has been shown to increase students' intrinsic motivation and active participation (Hummel et al., 2021). In the context of ADLX, adaptive curriculum becomes a fundamental element as it enables digital learning systems to operate dynamically and contextually (Gligorea et al., 2023). Without a responsive curriculum foundation, personalized learning experiences will lose direction and be less relevant to learners' needs. Therefore, the integration between adaptive learning technology and flexible curriculum is an important prerequisite in creating a holistic, inclusive and future-oriented modern learning system.

Despite its great potential, the implementation of ADLX and adaptive curriculum still faces serious challenges. The main obstacles are educators' limited digital literacy, lack of professional training, and uneven technology infrastructure, especially in areas with limited access (Siemens, 2014; Stadin et al., 2021). In addition, most teachers still tend to maintain conventional learning models that emphasize lectures and memorization (Johnson et al., 2016). This can demotivate the application of ADLX so that it cannot run optimally without the support of an adaptive and flexible curriculum. An adaptive curriculum provides a pedagogical framework that allows customization of content, methods, and assessments based on the characteristics, interests, and abilities of diverse learners (El-Sabagh, 2021).

Studies also point to the need for policy approaches that support the integration of adaptive pedagogy into the formal education system (Ng et al., 2020). Bibliometric research conducted by Valeri et al. (2023) noted a rapid increase in publications on adaptive learning in the past decade, but limited local context and field-based implementation. Therefore, this study aims to explore how ADLX and adaptive curriculum are implemented in school settings as the foundation of inclusive and effective modern learning. This research is important to understand the dynamics of implementation in the field, the challenges faced and practical strategies that can be adopted in building an adaptive, relevant and sustainable education system in the digital era.

Objectives

This research aims to explore and describe the implementation of Adaptive Deep Learning Experience (ADLX) and adaptive curriculum as the foundation of inclusive and effective modern learning in the digital era. Specifically, the objectives of this research are to: Explore how the ADLX approach is applied in classroom learning practices, particularly in enhancing student engagement, deep understanding, and personalization of learning experiences; Analyze the extent to which the adaptive curriculum is able to adapt the learning process to the needs, abilities and characteristics of diverse students; Identify challenges and supporting factors faced by educators and institutions in integrating ADLX and adaptive curriculum into learning activities; and Formulate practical insights and strategic recommendations that can strengthen the implementation of ADLX and adaptive curriculum as part of the transformation of learning in the digital era.

Method

This research uses a descriptive qualitative approach that aims to explore in depth the real experiences of teachers and schools in implementing the *Adaptive Deep Learning Experience* (ADLX) and adaptive curriculum in the classroom. The main focus of this approach is to understand how these two concepts are implemented as part of a strategy to develop a more modern, inclusive and effective education in the digital era (Ajani, 2024). By tracing direct practices in the field, this research seeks to capture various forms of adaptation, challenges and innovations made by educational actors in responding to the demands of changing times and the increasingly diverse learning needs of students.

A descriptive qualitative approach was chosen because it is able to provide an in-depth and contextual understanding of the phenomenon studied. Through data sourced from interviews, observations and documentation, this approach allows researchers to record the dynamics of ADLX implementation and adaptive curriculum in detail in the context of secondary education (Taghap & Pabalan, 2025). In addition, this approach also provides space to explore the perceptions, attitudes, and strategies developed by schools in building a learning environment that is responsive to students' needs, as well as relevant to current technological and information developments.

Participant selection

Participants in this study were selected using purposive sampling technique, which focuses on teachers who have direct experience in planning, implementing and evaluating the implementation of ADLX and adaptive curriculum in the classroom. Participants were selected by considering criteria, using their pseudonym names– such as: Direct involvement in planning and implementing ADLX-based learning strategies; and Experience in the use of digital technology and adaptive curriculum in the context of secondary school education.

Data Collection

The research data was collected using three main techniques (Taghap & Pabalan, 2025):

Interviews

Interviews were conducted with teachers to explore their perspectives on the challenges, perceptions and practices related to implementing ADLX and adaptive curriculum. The interviews also aimed to understand the extent to which the adaptive curriculum can improve the quality of more personalized and inclusive learning and how they overcome barriers in its implementation (Puspitasari, 2024).

Classroom Observation

Observations were conducted to record the dynamics of ADLX-based learning and adaptive curriculum implementation in the classroom. It involves direct observation of the interaction between students and teachers, the use of digital technology, and the learning strategies implemented (Almasri et al., 2024). The main focus of the observation is to assess how well the adaptive curriculum can be adapted to the needs and characteristics of diverse students.

Document Analysis

The documents analyzed included lesson plans (RPP), syllabi, and internal school policies related to the implementation of the adaptive curriculum. This document analysis aims to assess the extent to which ADLX and adaptive curriculum are reflected in lesson planning and implementation at the institutional level. It is also to find out how technology integration and teaching strategies are adjusted to meet the individual needs of students (Cruz & A, 2023).

Results and Discussion

Results

The results of this study show that the implementation of Adaptive Deep Learning Experience (ADLX) and adaptive curriculum have an important role in shaping modern, inclusive, and effective learning in the digital era. Through the process of interview, observation, and document analysis, three main findings were obtained, namely: (1) the real form of ADLX implementation in the classroom, (2) the flexibility of the adaptive curriculum in responding to student needs, and (3) the challenges and supporting factors in the integration of the two.

First, the ADLX approach is applied in a variety of active and student-centered learning strategies. Teachers report that they integrate project-based learning, group discussions, problem solving and the use of interactive digital media in the teaching-learning process. Classroom observations show that students are actively involved in material exploration, peer collaboration and reflection on their learning experiences. Technologies such as online learning platforms, interactive videos, and digital feedback systems are used to support the personalization of learning. Students are more enthusiastic, engaged and show increased levels of learning independence.

Interviewer: How is ADLX implemented in this class?

Ms. Nina (Teacher): We use project-based learning to explore social topics in English. Students work in groups, discuss and design a short video which will then be assessed by their classmates.

Mr. Reza (Teacher): We use platforms like Google Classroom and Padlet to share ideas, and Edpuzzle for interactive videos. Technology helps them learn at their own pace.
Interviewer: How have the students responded?
Ms. Nina: Students are more enthusiastic and independent. They actively ask questions and express themselves in English, because this task is more relevant to their lives.
Interviewer: Is there any reflection from the students?
Ms. Nina: After the project, they write a self-reflection, assessing their learning progress, which becomes part of ADLX to encourage self-awareness in learning.

Second, the adaptive curriculum allows teachers to make adjustments to materials, methods and evaluations based on students' needs and characteristics. The practice of differentiation is seen in the learning design, where teachers make variations in tasks and assessments based on the level of student readiness. Learning documents such as lesson plans and syllabi show flexibility in learning objectives and implementation strategies that accommodate students' diverse learning styles and interests. Some schools have even used technology-based formative assessments to monitor learning progress regularly so that teachers can provide timely interventions.
Interviewer: How are these material and evaluation adjustments made?
Ms. Maria: We design flexible lesson plans and syllabi, with customizable objectives. For example, fast learners are given additional challenges, while struggling students are given simpler materials and technology-based assessments to track their progress regularly.
Interviewer: What is the impact of this approach?
Ms. Maria: Students feel more cared for because they learn at a pace and in a way that works for them. We can also provide intervention faster if needed.

Third, there are a number of challenges in implementing ADLX and the adaptive curriculum, including limited professional training for teachers, low digital literacy, and limited supporting infrastructure such as devices and internet connections. Some teachers admitted that they still find it difficult to design truly adaptive learning experiences due to a lack of understanding of modern pedagogical principles. In addition, there is still resistance from some teachers to changes in learning methods that demand flexibility and technology. However, this study also found significant supporting factors, such as support from the principal, the formation of teacher learning communities, and school policies that encourage learning innovation. Schools that have successfully implemented ADLX and adaptive curriculum generally have a culture of collaboration, mentoring between teachers, and structured periodic training. In interviews with Mrs. Sarah and Mr. Dedi, two English teachers, they revealed some of the challenges in implementing ADLX and adaptive curriculum in their classrooms.
Ms. Sarah: "We face a big challenge in terms of professional training. Many of us do not fully understand how to integrate technology with modern pedagogical principles in learning." She also revealed that some fellow teachers find it difficult to adapt learning methods to students' individual needs.
Mrs. Dedi: "I also see that there are infrastructure limitations that hinder us. Limited devices and internet connections make it difficult for us to maximize the potential of technology in learning." He added that although there is a desire to use more digital media, the facilities in the classroom are sometimes not supportive.

However, both agreed that there were some enabling factors that were very helpful. Ms. Sarah says, "We have the full support of the principal, who always encourages us to innovate. The learning community among teachers is also very supportive for us to keep improving." Mr. Dedi adds, "Regular training and mentoring between teachers is also very important. We can share ideas and experiences with each other, which makes the implementation of ADLX smoother."

As a follow-up to these findings, this study also formulated some practical recommendations for strengthening the implementation of ADLX and adaptive curriculum. These include the importance of continuous professional training focusing on digital literacy and adaptive pedagogy, the formation of learning communities among teachers, improving access to ICT infrastructure, and strengthening school policies that encourage learning innovation. The findings suggest that ADLX and adaptive curriculum, when adequately supported, have great potential to transform learning to be more meaningful, relevant and respond to the real needs of learners in the digital era.

Discussion

The results of this study prove that the integration of Adaptive Deep Learning Experience (ADLX) and adaptive curriculum plays a transformative role in shaping inclusive and effective modern education in the digital age. The implementation of ADLX, as observed in project-based learning, collaborative inquiry, and technology-supported instruction, aligns with the principles of constructivist and student-centered learning theories. These findings are in line with Bradley & Kendall (2014) research, which emphasizes that adaptive learning environments significantly improve student engagement, motivation, and academic

outcomes. Similarly, the personalized and flexible learning approach observed in this study is consistent with Chukwu & Cletus (2025) research, which highlights the importance of differentiated instruction in supporting diverse learning needs.

This study also found that adaptive curriculum acts as a critical enabler in inclusive learning. By enabling customization of content, pace and assessment, teachers can create a more equitable learning environment where students from diverse backgrounds can access and utilize the curriculum. This supports the argument put forward (Zhou & Zhang, 2019), who assert that adaptive frameworks can reduce learning inequalities and promote social justice in education. The presence of formative assessment and personalized learning pathways in classroom practices also reflects an important shift towards more responsive and student-centered instructional design.

However, this study reveals significant implementation challenges that must be overcome for wider adoption of ADLX and adaptive curriculum. Teachers reported a lack of professional development opportunities related to adaptive pedagogy and digital literacy, which in turn limits their ability to fully leverage technology for personalized learning. This finding is in line with Siemens (2014) observation that the effectiveness of learning technologies is often limited by educator readiness and institutional support. Infrastructure limitations-especially in rural or underfunded schools-remain a pressing obstacle, further highlighting the digital divide in the education system.

Resistance to change has also emerged as a socio-cultural barrier, with some educators expressing discomfort or skepticism towards shifting away from traditional teaching models (Kerimbayeva et al., 2024). Overcoming this kind of resistance requires not only technical training but also a cultural transformation in schools that values experimentation, innovation and reflective practice. Leadership support, as observed in schools with successful implementation, plays a key role in facilitating this change. When school leaders advocate for adaptive learning, allocate resources strategically and foster a culture of continuous improvement, teachers are more likely to take responsibility for innovative practices.

The implications of the findings are both theoretical and practical. Theoretically, this study reinforces the idea that deep learning and curriculum flexibility are not separate strategies, but rather interconnected pillars of effective digital-age education. Practically, the success of ADLX and adaptive curriculum depends on systemic support, including professional development, adequate infrastructure, collaborative networks of fellow educators and a supportive policy environment. Without these, the potential of these innovations may remain limited to isolated cases rather than becoming scalable models for broader educational transformation.

In conclusion, while ADLX and adaptive curricula offer powerful tools for redesigning education, their sustainable integration into practice requires careful planning, strategic investment and cultural shifts at the institutional and classroom levels. These findings should inform education policymakers, school administrators and teacher training institutions in designing responsive and equitable learning ecosystems that meet the demands of 21st century learners.

Conclusion

This research confirms that the integration of the Adaptive Deep Learning Experience (ADLX) and an adaptive curriculum is an effective and scalable strategy for inclusive, student-centered secondary education in the digital era. Evidence from multiple school settings demonstrates that ADLX promotes critical thinking, collaboration, and reflective learning, while the adaptive curriculum allows teachers to adjust content, pace, and assessment to meet diverse learner needs. Together, these approaches enhance student engagement, independence, and equity. The findings can be generalized to other secondary education contexts that face similar challenges of technological change and diverse student populations. To translate these results into practice, schools and policymakers should invest in continuous professional development focused on adaptive pedagogy and digital literacy, strengthen ICT infrastructure, and cultivate leadership that supports innovation and teacher collaboration. These steps will help education systems build sustainable, technology-supported learning ecosystems that meet the demands of 21st-century learners. Beyond the specific schools studied, the findings can be generalized to other secondary education settings where technology access and student diversity demand flexible learning. They suggest that ADLX, when supported by an adaptive curriculum, offers a scalable model for future student-centered, technology-supported learning ecosystems. Practical implications include the need for continuous professional development in digital pedagogy, investment in ICT infrastructure, and school leadership that fosters collaboration and innovation. Education policymakers and curriculum designers can use these insights to guide reforms that promote equitable, personalized, and sustainable learning.

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