

Transformation of Learning Through the Combination of AI and Immersive Learning Experiences

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Abstract

Rapid advancements in Artificial Intelligence (AI) have opened new horizons for educational transformations. This research investigates the transformative potential of combining AI and immersive learning experiences to enhance the educational landscape. Employing the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model as a developmental framework, this study delves into the fusion of AI technologies and immersive learning environments. A comprehensive literature review supports the design phase, exploring the integration of AI in the development of immersive learning materials. Findings from this research illuminate the profound impact of synergizing AI and immersive experiences on the learning process. The practical and pedagogical implications of this study contribute valuable insights to the ongoing discourse on innovative learning strategies. This research is poised to inform the development of educational practices that harness the synergies between AI and immersive learning, ultimately fostering more effective and engaging learning environments.

Keywords : Technology, Learning, AI, Immersive learning.

Background

The rapid advancements in information technology, artificial intelligence, and other modern technologies are significantly changing how we work, communicate, and navigate our daily lives. Technology has emerged as a key catalyst in transforming various aspects of human existence. As digital pioneers, we are experiencing an ongoing wave of innovation that continually pushes the limits of what is possible.

Education serves as the foundation for sustainable human development, and in this era of globalization, technology has become a key element in advancing teaching methods. Technology provides a new impetus to design learning experiences that are more dynamic, interactive, and relevant to the needs of learners. The rapid development of information and communication technology (ICT) has opened new doors to innovative learning approaches. As Riyana has expressed, there are challenges that the education world must face in the era of the fourth industrial revolution, visible in the ways students think, learn, and act in order to foster various innovations and creativity in education (Riyana, 2018). Online learning platforms, mobile applications, artificial intelligence, and other related technologies serve as facilitators in responding to modern educational challenges. The importance of technology-based learning is also reflected in a global perspective.

This study aims to demonstrate how technology can be utilized as a tool to bridge educational gaps in different societal segments and contribute to establishing equitable learning opportunities for everyone. In a swiftly evolving era, the fundamental transformation of the learning paradigm is needed. The transition from traditional to digital learning has resulted profound changes within the realm of education.

Traditional education, which previously focused on face-to-face teaching methods in classrooms with textbooks as the primary source, has shifted towards a digital learning environment relying on information and

communication technology. The integration of technology in education enables access to more diverse, interactive, and real-time learning resources. Teachers and learners are no longer confined to the limitations of time and classroom space, as digital learning can occur anywhere and anytime. Digital learning also opens the door to more inclusive methods tailored to individual learning styles. Online learning platforms provide flexibility for learners to study at their own pace, using various types of learning materials, including videos, simulations, and educational games. Furthermore, interaction between teachers and learners can be enhanced through online forums, discussions, and virtual classes.

The traditional concept of learning gradually being replaced by more innovative and interactive approaches, one of the approach is by the use of immersive learning technology. Immersive learning provides a deep and captivating learning experience, surpassing the limitations of classical teaching methods (Wirawan, 2018). In this research, the author will explore how immersive learning technology has the potential to transform the landscape of education.

Immersive learning involves the use of technologies such as virtual reality (VR), augmented reality (AR), and interactive simulations to create a learning environment that closely resembles real-world situations (Suryani et al., 2016). By leveraging visual, auditory, and kinesthetic experiences, this method aims to provide more convincing and engaging learning. This research will not only discuss how immersive learning technology can be applied in various educational contexts but will also investigate its impact on motivation, conceptual understanding, and learning engagement through the development of technology-based immersive lesson plans. Additionally, it will explore the challenges and opportunities arising with the adoption of this technology in preparing learners to meet real-world demands. It is crucial to note that immersive learning is not just a tool; it is a new window into deep and meaningful learning. This research addresses how learning experience based on the learning process using technology-based immersive methods applied to a specific subject matter.

This research aims to examine the transition from conventional teaching methods to technology-driven learning approaches. The immersive learning technique is anticipated to introduce a novel learning experience, fostering student engagement and providing insights into how immersive learning technology can enhance the educational process. Additionally, it is expected to stimulate student creativity and equip them for the progressively intricate challenges of the future.

Research Method

In this study, the author utilizes the Design Research methodology. The Design Research method, employed in crafting prototypes for technology-based immersive lesson plans, involves a series of steps to ensure the design of engaging and captivating learning experiences. Design research is a systematic approach to developing educational interventions, encompassing activities in the planning and creation of educational programs. It is a research method with the objective of enhancing the quality of learning by developing Local Instruction Theory (LIT) through collaboration between researchers and educators (Gravemeijer et al., 2009). Initially, a user study is conducted, involving direct observation of educators and students to understand their learning needs, preferences, and challenges. The insights gained from this user study form the basis for designing a prototype lesson plan that utilizes immersive technologies, such as virtual reality. The design of this technology-based immersive lesson plan follows the ADDIE model, which stands for Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). The analysis phase aims to identify learning needs, outline specific objectives, and determine learner engagement. Subsequently, the design phase involves instructional design, including the structure of learning, teaching methods, and material development. The development phase involves creating learning materials based on the previously established design. By integrating the ADDIE method and existing literature, this research has a robust methodological foundation for designing, developing, and evaluating learning programs tailored to the needs of learners.

In conducting this research, the author collaborated with a school interested in developing this technology-based immersive method. Therefore, the author utilized the ADDIE model only up to the stage of developing the technology-based immersive lesson plan.

Result and Discussion

Given the rapid progress of technology, education needs a fresh approach to deliver learning that suits the current era. This is exemplified by the increasing use of augmented reality (AR) and virtual reality (VR) in society. The rise of AR and VR is also accompanied by the concept of "metaverse" (Lik et al., 2021), portraying it as an expansive world where people can feel closely connected without being limited by physical distances. This transformation is particularly noticeable during the pandemic, where technological advancements have played a significant role, leading many activities from offline to online. This shift is also happened in education, where, before the pandemic, students would attend in-person classes, but since the pandemic, learning activities have transitioned to guided online formats. Consequently, education has become a domain profoundly impacted by technological changes.

Education is intricately connected to society, and the current transformation in learning is driven by technology, particularly on the use of artificial intelligence (AI) (Etistika et al., 2016). The positive impact of Artificial Intelligence (AI) on the human learning process is noteworthy. A significant contribution of AI lies in its ability to deliver a more individualized learning experience. Through advanced data analysis, AI can recognize students' learning styles and comprehension levels, tailoring learning materials to meet their specific needs. Additionally, AI-driven recommendation systems play a crucial role by offering pertinent and engaging supplementary materials, thereby boosting students' motivation and involvement in the learning journey.

AI serves as a virtual tutor, providing instant assistance, guiding students through complex concepts, and offering feedback for immediate improvement in understanding. The incorporation of augmented reality (AR) and virtual reality (VR) technologies, supported by AI, introduces a fresh dimension to learning through immersive and interactive experiences. It's crucial to recognize that, despite the numerous benefits AI brings, challenges concerning privacy, ethics, and data security must also be considered. Through ongoing development and refinement of AI integration in educational settings, we can leverage the potential of this technology to enhance educational quality and assist individuals in realizing their maximum potential.

Immersive learning is an educational approach that harnesses AI to assist educators in facilitating the learning process. It aims to offer students a novel and enjoyable learning experience. This method unlocks opportunities for profound and memorable learning encounters. In immersive learning, students are not passive observers but actively engage in a sensory-stimulating learning experience. Environments like virtual reality (VR) or augmented reality (AR) provide students with the chance to directly "experience" the subject matter, creating an encounter closely resembling real-life situations (Feldler et al., 2019). The primary advantage of immersive learning lies in its capacity to boost engagement and information retention. By presenting learning materials in a dynamic and immersive manner, learners can more easily comprehend intricate concepts. Additionally, this method fosters an inclusive learning atmosphere, allowing students with diverse learning styles to absorb information more effectively.

The immersive learning method also provides opportunities for simulating real-life situations. For instance, in the field of science, learners can "practice" technical procedures in a virtual environment before engaging in practical activities. This not only enhances practical skills but also boosts the learners' confidence. However, challenges related to the development of immersive content and technological accessibility need to be addressed for this method to be widely applied. By continuously developing and integrating immersive learning into the curriculum, educators can create more meaningful, profound, and relevant learning experiences for students in this digital era.

With this context, this study has been initiated to evaluate how the immersive method influences the learning process. The initial step involves:

1. Analysis

In the context of the ADDIE model (Analysis, Design, Development, Implementation, Evaluation), the analysis phase in the development of immersive learning plays a critical role in establishing a strong foundation for the entire process. In the analysis stage, the focus is on comprehensively understanding the needs, characteristics of learners, and the learning context.

The analysis begins by identifying specific learning objectives and measuring the expected success of the immersive learning experience. The researcher will consider factors such as the type of learning material, the level of complexity, and the expected capabilities of the learners.

Subsequently, identifying the target audience becomes a key step. This involves a deep understanding of the characteristics of learners, learning preferences, as well as their level of technological experience. This allows designers to create an immersive experience that is suitable and engaging for a diverse group of learners.

Additionally, contextual aspects are analyzed by considering the learning environment, available resources, and potential obstacles that may be encountered during implementation. This helps tailoring the learning design to real-world situations and ensures that the technology used can be integrated effectively.

The analysis also includes an evaluation of the immersive technology to be used, such as the required hardware and software. The sustainability of this technology must be assessed to ensure that the adopted solution can meet long-term needs and be easily accessible. By thoroughly investigating these elements, the analysis phase in the ADDIE model establishes a solid foundation for designing a relevant, effective, and tailored immersive learning experience that aligns with the unique needs of learners and the learning environment.

There are several points of analysis that need to be carried out in conducting this research:

(a) Analysis of suitable learning materials for technology-based immersive learning.

This analysis is useful to determine which learning materials are suitable for implementing immersive learning because not all materials can be implemented. The materials that can utilize this method are those with limited access, those that provide an understanding of abstract concepts, and those with high risks. Therefore, the author chooses to use natural disaster materials, which include specific theoretical content on plate tectonics, earthquakes, and tsunamis, to be used as learning materials using this immersive method.

(b) Analysis of learning objectives and strategies.

This analysis is useful for establishing suitable learning objectives when using immersive learning and analyzing learning strategies that are appropriate for implementation with this method. Therefore, the author selects learning objectives based on Bloom's taxonomy and implements learning strategies in the form of missions. Participants will engage in a mission that they must complete. Each mission has a different level of difficulty, requiring teamwork to successfully accomplish the mission.

Here are the points of the Learning Objectives:

After engaging in the Immersive Learning model, participants should be able to recognize and describe the features of natural disasters.

1. Clearly explaining the theory of plate tectonics accurately.
2. Describing the impacts of earthquakes accurately.
3. Examining the causes of tsunamis accurately.

Here are the key elements of the Learning Strategies:

Factors to consider in developing learning strategies using immersive technology include:

a. Rules and Objectives

In this Immersive Virtual Space, learners are not merely observers; instead, they actively participate and engage directly in the immersive learning process. This is achieved by assigning roles to learners with specific focused objectives, such as collecting data, sharing insights, and drawing conclusions. Meanwhile, the teacher provides interactive themes to enable learners to experience the learning journey.

b. Connection with Media

Learners are given the opportunity to explore what they want to know and observe new things through interactive media provided by the teacher.

c. Implementing the Idea

After students explore the content provided through Virtual Space Immersive technology, they are required to draw conclusions from their observations, ideas, and reflections related to this learning experience. Subsequently, students can share their learning outcomes through discussions.

(c) The analysis of the duration of technology-based immersive learning implementation.

The analysis of the duration of an immersive lesson plan plays a crucial role in ensuring the effectiveness and engagement of students during the learning process. This duration encompasses not only the total amount of time allocated for each learning session but also considers various other factors that can impact the overall learning experience.

Firstly, the duration of the lesson plan should be tailored to the characteristics of the learners and the complexity level of the learning material. When assessing time requirements, attention is given to the level of student engagement and their ability to process information effectively. Furthermore, the technology factors used in immersive learning can influence the duration of the lesson plan. The use of advanced technology such as simulations or virtual reality may require additional time for student orientation and adaptation to the new learning environment. Additionally, the interactive aspects and student participation are also crucial considerations in determining the duration. If the lesson plan is designed to facilitate discussions, collaboration, or interactive projects, adequate time should be allocated to allow for exploration and a deep understanding of concepts.

The analysis of the duration of the lesson plan also includes adjusting the time for the selection of appropriate evaluation methods. Evaluating students' understanding and measuring the achievement of learning objectives requires adequate time without unnecessary pressure. By carefully considering these factors, the analysis of the duration of an immersive lesson plan ensures that the allocated time is not only sufficient to achieve learning goals but also supports an enjoyable and effective learning experience for learners. The appropriate duration creates a good balance between conceptual understanding and student engagement, ensuring that immersive learning has an overall positive impact (Feldler, etc., 2019).

In implementing immersive learning, students will also be introduced to VR headsets. This tool has side effects if used for extended periods or by someone using it for the first time. These side effects need to be minimized by regulating the duration of use by students and providing a variety of learning activities so that the learning process is not solely focused on using VR headsets. Classroom learning can also be organized in group formats, allowing the use of VR headsets to alternate between different students.

(d) Analysis of learning narratives based on immersive technology.

The emergence of this narrative serves as an introduction to the process of implementing immersive learning. The narrative is presented in the form of story segments that can contain instructions or questions for students. This occurs to provide an enjoyable learning experience. Students involved in each mission will feel the responsibility of completing the mission process to the end. This provides an active, responsible, and more interactive learning experience for the students.

The analysis of the narrative in the immersive lesson plan plays a crucial role in shaping an engaging and meaningful learning experience. The narrative serves not only as a link between activities but also as a tool to convey concepts and information in a convincing and motivating way to students. First, narrative analysis involves a deep understanding of the learning material and how the story can be organically integrated. The narrative should be carefully planned, creating a logical flow and connecting each learning element into a relevant and meaningful context. Furthermore, the coherence and continuity of the narrative are key factors. This analysis ensures that each stage in the narrative is interconnected, forming a consistent and integrated whole. This allows students to follow the storyline smoothly, enhancing their understanding of concepts gradually.

In addition, narrative analysis also includes an assessment of the complexity level and narrative appeal. The story should be able to stimulate the interest of learners, provide appropriate challenges, and create tension elements that support active engagement. The interactive aspects of the narrative also need to be taken into account. To what extent learners can participate or influence the course of the story will affect the level of engagement and the overall learning experience. By carefully analyzing the narrative, an immersive lesson plan can be intelligently constructed, ensuring that the story not only serves as a link but also as an effective means to convey concepts, trigger engagement, and foster learners' interest in the learning process. This analysis is

crucial in designing narratives that are relevant and meaningful, supporting the achievement of learning goals optimally.

The process of narrative analysis utilizes an adaptation from a game called "A Space for The Unbound," where the game provides a narrative for each chapter that players will go through. This adaptation serves as a reference in packaging the content of the immersive space that will be created in the future. As a result, when students go through the learning process, there is a difference in the emotional experience they receive when exploring learning through this immersive approach.

(e) Analysis of the needs for the development of technology-based immersive learning.

Overall, the analysis of the needs for the development of immersive learning forms a critical foundation for designing relevant learning experiences, focusing on the specific needs of learners and the learning situation. Thus, this analysis phase provides a solid groundwork for subsequent planning and development, ensuring that the resulting immersive learning experience can meet expectations and achieve desired learning objectives.

This stage is necessary because developing an immersive learning environment requires supporting 3D models for instructional content. Not only that, but the hardware requirements for implementing this method also need to be considered. The following are the results of the analysis needed in the development process:

Content and Learning Media

1. 3D Model of Tsunami
2. 3D Model of Earth's Tectonic Plates
3. Virtual Space (Link)
4. Avatar
5. Google Slides for Information Gathering (Link)
6. Book Items

Hardware

1. Computer/Laptop
2. VR Headset
3. Internet Connection

2. Design

Following the analysis for a technology-based immersive learning, the next step is to create a design for a lesson plan that provides guidance for the learning process. The lesson plan serves as a reference for implementing immersive learning, containing various explanations about learning models, teaching strategies, guidelines for using immersive technology, storyboards for immersive media development, and the creation of missions in technology-based immersive activities.

Firstly, the researcher ensures that every identified learning objective from the analysis phase is reflected in the lesson plan. Activity details and instructional materials are carefully developed, accommodating the diverse needs of learners and ensuring comprehensive learning. The use of technology, including relevant AI integration, is wisely incorporated to provide personalized and adaptive elements according to the learners' understanding levels. The authenticity of the technology-based immersive learning experience is considered, with the use of engaging storylines and challenging simulations.

The design of the lesson plan also considers flexibility to respond to individual learners' needs. By adopting an adaptive approach, the lesson plan can accommodate various skill levels and learning styles, creating a more inclusive learning experience. Additionally, aesthetic and creative aspects are taken into account to make the learning more engaging. The researcher strives to create a learning environment that sparks interest and engagement, ensuring that every design element supports the achievement of learning goals.

By crafting a comprehensive and innovative lesson plan design, the design phase in the ADDIE model becomes a robust foundation for further development. This prototype lesson plan creates a holistic view of the technology-based immersive learning experience that will be implemented, ensuring that technological innovation and instructional design seamlessly integrate to provide effective and satisfying learning.



Image 1. Cover Lesson Plan Immersive
Source: Author, 2023)

3. Development

After designing based on the needs used in technology-based immersive learning, the next step is development from the design. It's important to note that this research is only in the form of a Storyboard prototype. Thus, the ADDIE model is only implemented up to the development stage of the lesson plan for technology-based immersive learning activities. In the development phase of the model for the prototype technology-based immersive learning lesson plan, the main focus is on creating an initial design that can be tested with learners. In this stage, the development team will translate the previously designed learning plan into a prototype that can be used as a basis for further literacy.

Firstly, the lesson plan prototype will encompass the integration of key elements defining the technology-based immersive learning experience, such as the use of cutting-edge technology, simulations, or virtual reality. Each step or activity in the lesson plan will be detailed more specifically, including interactive flow and visual elements supporting learning. The author will ensure that this prototype reflects the design principles established earlier while providing flexibility for adjustments based on feedback during testing. For example, AI technology can be integrated to provide personalized adaptation to each learner, enhancing interactivity and learning relevance.

Moreover, in this phase, developers will also consider potential technical or logistical challenges that may arise during the implementation of the lesson plan. The prototype should create a practical and accessible learning environment without compromising the quality of the technology-based immersive learning experience. By creating this lesson plan prototype, the development team can test and identify potential improvements, leading to further refinements before full implementation. The alignment between the desired experience and practical elements embodied in the prototype is key to ensuring the success of the next implementation phase in the ADDIE cycle.

This is the following format of a developed lesson plan:

Learning Scheme

Learners are asked to form groups with 10 members each (organized based on the availability of equipment) to initiate a rescue mission using a helicopter that travels to the disaster-stricken area. In this learning activity, learners play the role of volunteers, and their objective is to document their experiences and share insights they feel as natural disaster volunteers.

Mission Preparation(20 Minutes)

Learners are required to list 5 important things they should know before engaging in activities related to natural disaster-prone areas. For example:

- What constitutes a natural disaster?
- Why can earthquakes occur?
- What are the impacts of earthquakes?
- What causes tsunamis?
- In which regions in Indonesia have tsunamis occurred?

Learners will document the results of their team's research in a Google Slide (teacher-provided link), with the condition that each group has different answers.

Mission Process (120 Minutes)

Now it's time for the learners to embark on the mission by exploring the virtual space immersive of natural disasters while paying attention to several points:

- Plate Tectonics Theory: Upon entering the virtual space, learners will be guided through a narrative on the theory of plate tectonics, followed by a mission to answer three multiple-choice quiz questions.
- Earthquakes: Information about regions in Indonesia that have experienced earthquakes will be presented. Learners will then research further using a website, and the gathered information will be compiled into a Google Slide previously prepared by the teacher.
- Tsunamis: Information about regions in Indonesia that have experienced tsunamis will be presented. Learners will delve into additional information by operating in a 3D environment and answering five questions related to this material.

Mission Report (100 Minutes)

Learners are required to create a report in the form of a self-reflection using infographics obtained during the mission. The self-reflection questions for learners are as follows:

How is the connection between earthquakes and tsunamis?

- Why does Indonesia frequently experience geological disasters?
- How is technology utilized in the detection and early warning of natural disasters?
- What can we learn from previous natural disasters to reduce their impact in the future?

After completing this mission, each group is asked to share their learning experiences in front of the class, with the teacher providing feedback on the experiences gained by the learners

VIRTUAL SPACE IMMERSIVE GAMIFICATION STORYBOARD

Material	Storyline	Action	Gamification	Duration
	The students run towards the helicopter platform on top of the hotel. Subsequently, students are directed to click the portal button (using a symbol) to teleport to the helicopter platform in the area where the natural disaster occurred.			5 Minutes
Plate tectonics theory	When entering the virtual immersive space, participants will be guided through a narrative about the plate tectonics theory. Following that, there will be a mission to answer questions in the form of a multiple-choice quiz, consisting of three questions.	- After arriving at the helicopter platform, volunteers are directed to walk using a pop-up narrative - Students meet with local residents and interact, who provide explanations about the plate tectonics theory. Within the narrative, there are clues that will guide volunteers to answer questions - After answering the questions, volunteers are given clues to proceed with the mission.	- Pop up narration to guide students - Pop up narration tectonic movement. - Pop up 3 questions. (true or false) - Getting 1 book item after finished the mission.	40 Minutes
Earthquake	The material is presented in the form of information about several areas in Indonesia that have experienced earthquakes. Subsequently, students gather additional information using a website, and this information is compiled into a Google Slide previously prepared by	- Students are instructed to the safehouse to meet the head of volunteer. They are interacting and informed about the area in Indonesia that have been facing earthquake before. - On that interaction, there is a clue that trigger the student to find more	- Pop up interaction - Pop up website. - Getting 1 book item after finished the mission.	35 Minutes

	the teacher.	information.		
Tsunami	Students are provided information about areas in Indonesia that have been facing Tsunami. Furthermore, through operating the 3D animation, students are encouraged to seek an information and answer 5 questions regarding the Tsunami.	- Students are guided into the beach that the information about tsunami is located. Including, some areas in Indonesia that have been facing tsunami before. - Students are getting the big wave as a clue to operate the tsunami 3D animation model. - After operating the 3D Animation, students are getting clue to interact with NPC and answer 5 questions regarding the tsunami.	- Pop up tsunami area information board. - Pop up 3D model tsunami. - Pop up questions - Getting 1 book item after finished the mission.	35 Minutes
Volunteers returned to the classroom, and had successfully collected 3 items in the form of books obtained from this mission activity. Volunteers then created a group infographic of this experience.				5 Minutes

Conclusion and Suggestion

With the rapid development of technology in the digital era, education has also felt the impact of this transformation. A significant impact on the world of learning is the use of various types of technology to support the learning process (Etistika, etc., 2016). Technology provides a new learning experience for both students and teachers. The integration of artificial intelligence (AI) technology with immersive learning experiences has the potential to change the paradigm of education. Research on immersive learning experiences can be summarized as offering significant potential to enrich the learning process. Through the integration of technology that provides direct and in-depth experiences, immersive learning offers significant advantages in enhancing understanding, engagement, and information retention. The findings of this research underscore the involvement of students in the immersive learning process in creating a more dynamic and relevant learning environment. Students not only become consumers of information but also active participants in learning situations that resemble real-world experiences. However, it should be noted that the success of implementing immersive learning also depends on careful design, accessibility of technology, which requires significant internet usage, the high cost of VR headsets at present, and the involvement of teachers as facilitators of the learning experience. Currently, the application of immersive technology in the learning context often faces significant cost challenges. The development and implementation of hardware, software, and training for educators require substantial financial

investment. Moreover, to accommodate the needs of this technology, schools or educational institutions need to update their infrastructure. Nevertheless, it is important to remember that technological developments move rapidly, and over time, these costs may decrease with wider adoption and increased production efficiency. Along with this, the educational benefits gained through the use of immersive technology, such as increased student engagement and improved understanding of concepts, can be a valuable long-term investment. With the growing interest and demand for immersive technology, it is expected that innovation and market competition will play a role in reducing the costs of using this technology in the learning context.

Therefore, this conclusion emphasizes the importance of continuing research, development, and training to ensure that immersive learning experiences can be effectively integrated into various educational contexts. Thus, immersive learning is not just an innovation but also the foundation for a profound transformation in the world of education, preparing future generations to face global challenges with broader skills and understanding. Through this combination, it is found that learning can become more effective, personalized, and engaging for students. The use of AI for personalized learning and immersive learning experiences to present materials interactively forms a synergy that enhances the learning experience in the transformation of learning using technology. However, there are some challenges in implementing immersive learning utilizing technology, including technology implementation, data security, high bandwidth, and ethical considerations. Therefore, further development and research suggestions are recommended to overcome these obstacles and detail specific aspects that can be improved in the integration of AI and immersive learning experiences in the educational context. This conclusion affirms that the transformation of learning through the combination of AI and immersive learning experiences is a progressive step towards a more adaptive, responsive, and relevant education system for the developmental needs of learners in this digital era.

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