

# **Integrating Metaverse-Based Learning to Increase Student Engagement and Motivation**

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## **Abstract**

This research is motivated by the need for learning innovation in the digital era, where the metaverse is seen as capable of presenting a more immersive, interactive and contextual learning experience than conventional e-learning. This research uses a qualitative approach with a case study method, involving teachers and students who implement metaverse-based learning through the use of VR/AR, avatars, and virtual classrooms. Data were obtained through in-depth interviews, participatory observation, and documentation, then analyzed using thematic techniques. The results showed that teachers started to design innovative metaverse-based learning, while students responded enthusiastically and showed higher cognitive, affective and social engagement. In addition, learning motivation increased both intrinsically and extrinsically through the gamification mechanism. However, this study also found challenges in the form of device limitations, internet connection, digital skills, and teacher pedagogical readiness. The findings indicate that metaverse has the potential to be a long-term learning strategy that aligns with the characteristics of generation Z and Alpha, while supporting the transformation of Indonesian education towards the era of Education 4.0 and Society 5.0.

**Keywords:** Metaverse, Student Engagement, Learning Motivation

## **Introduction**

The rapid development of digital technology in the era of Industrial Revolution 4.0 and Society 5.0 has brought fundamental changes in various fields of life, including education (Tavares et al., 2022). This dynamic has become even more apparent since the COVID-19 pandemic accelerated the shift of learning systems from conventional face-to-face to digital learning. This transformation is not just a temporary solution, but marks a new era of education that demands the integration of technology as part of the learning process (Akour & Alenezi, 2022). This condition encourages the need for learning innovations that are more adaptive and contextual, especially to answer the needs of generation Z and Alpha who grew up in an all-digital environment. This generation has different characteristics from previous generations, where active engagement, interactive experiences, and flexibility in learning are the main factors that determine their motivation and learning success.

Metaverse is an interactive virtual space that combines Virtual Reality (VR), Augmented Reality (AR), and Artificial Intelligence (AI) technologies to provide an immersive, collaborative, and exploration-based learning experience (Damaševičius & Sidekerskienė, 2024). Globally, the Metaverse in Education market is estimated to reach USD 11.34 billion by 2024 and grow to USD 15.83 billion by 2025 at an annual growth rate of approximately 39.7% (*Metaverse in Education Market Growth And Share Report 2025*, n.d.). The application of the metaverse in education is also starting to develop, for example, the use of Meta's Quest VR headset that allows students to make virtual visits to museums or historical sites (Anwar et al., 2025), as well as the development of AR/VR-based medical simulations at the University of Michigan which proved effective in supporting practical learning. This fact shows that the

metaverse is not just a futuristic discourse, but has been implemented and has strong potential to increase student engagement and motivation in the learning process (Onu et al., 2024).

One of the challenges in education today is the low engagement of students, both in conventional learning and online systems (Kristianto & Gandajaya, 2023). Many students show passive participation, are less active in discussions, and tend to only be recipients of material. This condition is further exacerbated by the decline in learning motivation due to monotonous learning methods, lack of variety, and lack of interactivity (Feng & Xiao, 2024). Sementara itu, Generation Z and Alpha as digital natives have unique characteristics, such as being accustomed to interesting visualizations, fast interaction, and the use of technology in everyday life (Shevchenko, 2025). Unfortunately, these learning styles are often not aligned with the traditional approaches that are still dominantly used in schools, resulting in a gap that makes students quickly feel bored, lose interest, and are less encouraged to be actively involved in the learning process.

The importance of metaverse integration in education lies in its ability to provide a richer learning experience than traditional approaches and e-learning (Rajabalee et al., 2025). Through the combination of real simulations, social interactions in virtual spaces, and the application of gamification, the metaverse opens up opportunities for a more participatory and collaborative learning environment (Jovanović & Milosavljević, 2022). Students can experience immersive learning experiences, such as conducting laboratory experiments, virtual visits to historical sites, or real-life simulations, without being limited by time and space. This not only increases student engagement, but also fosters intrinsic motivation as learning feels relevant, contextualized and fun. For generations Z and Alpha who are very familiar with digital technology, the metaverse is able to bridge the gap between modern learning styles and the traditional education system (Miller, 2023). Therefore, the implementation of metaverse is not just an option, but a strategic necessity to improve learning effectiveness and shape the learning experience in accordance with the demands of the digital era.

Many previous studies have reviewed e-learning and hybrid learning as technology-based learning models (Bali et al., 2022; Kamsin, 2024). However, studies that specifically address metaverse integration in student learning are still very limited, especially in the formal education context. Most existing research still focuses on the potential of immersive technologies in general without directly measuring their impact on student engagement and motivation to learn (Zhang & Miao, 2025). In Indonesia, studies exploring the application of the metaverse in the classroom are also still rare, so it has not provided a comprehensive picture of its effectiveness. The limitations of this study indicate that there is a space that needs to be filled to understand the extent to which the metaverse can be an innovative strategy in improving the quality of students' learning experience.

Based on the background and research gap described, this study aims to analyze the integration of metaverse-based learning in the context of student education. More specifically, this research seeks to identify the extent to which the use of metaverse can influence student engagement and learning motivation as important factors in the success of the learning process. In addition, this research is also directed to provide recommendations for the development of immersive technology-based learning innovations that can be a strategic alternative in improving the quality of learning experiences in the digital era.

## **Method**

This research uses a qualitative approach with a case study method to gain an in-depth understanding of the integration of metaverse-based learning in improving student engagement and motivation. The research location was determined purposively in educational units that have implemented or piloted metaverse-based learning. The research subjects involved teachers and students as the main informants, while the school principal and related parties were used as supporting informants to strengthen the research findings. Data collection was conducted through three main techniques, namely participatory observation of the learning process to see the dynamics of student involvement, in-depth interviews to explore the experiences, perceptions, and motivations of students and teachers, and documentation in the form of learning notes, virtual activity recordings, and student reflection results. To ensure the validity of the data, this study used triangulation of sources and techniques, member checks, and peer discussions.

Data analysis was conducted interactively through the stages of data reduction, data presentation, and conclusion drawing according to the Miles and Huberman model. Data reduction is done by sorting out important information related to student engagement and motivation, data presentation is done in the form of descriptive and thematic narratives, while conclusion drawing is done inductively based on patterns, themes, and relationships between categories. With this approach, the research is expected to provide a comprehensive picture of how metaverse integration affects the learning process, especially in the aspects of student engagement and motivation, and produce recommendations for future immersive technology-based learning innovations.

## **Result and Discussion**

### **Description of Metaverse Implementation in Learning**

The implementation of metaverse-based learning in this study shows that teachers design learning scenarios by utilizing virtual classrooms that allow students to attend through their respective avatars. Teachers use a combination of simple VR technology and smartphone-based AR devices to enrich learning experiences, such as interactive simulations of science materials and exploration of three-dimensional environments. The learning design is focused on collaborative learning, where students can interact, discuss and complete tasks together in a virtual space that resembles real situations. This is in line with the concept of immersive learning that emphasizes not only knowledge transfer, but also contextual and meaningful learning experiences.

Students' initial response to the use of metaverse was quite diverse. Most students showed high enthusiasm because they found the learning experience more interesting than conventional methods or e-learning based on video conference platforms. They revealed that the presence of avatars and virtual environments made the learning process more fun, interactive, and different from their previous learning routines. However, there were also students who initially felt awkward or had difficulty adapting to the virtual environment, especially those who were not used to using VR/AR technology. This indicates a different level of technology readiness among students.

On the other hand, this study found a number of technical and non-technical barriers in the metaverse integration process. Technical barriers include device limitations, especially for students who do not have high-specification devices or access to VR headsets. Unstable internet networks are also a factor inhibiting smooth interaction in virtual spaces, causing some students to fall behind in learning activities. Non-technical barriers arise from varying digital skills

among both students and teachers. Some teachers admitted that they needed special training to design learning activities in the metaverse, while some students needed assistance to operate the virtual platform effectively.

This finding shows that metaverse integration in learning still faces serious challenges in the aspects of educational technology readiness and digital literacy. In relation to the literature, the results of this study support the view that Alam et al (2024) which states that the successful adoption of immersive technologies in education is strongly influenced by infrastructure availability and user readiness. However, this research adds a new perspective to the Indonesian context, where gaps in device access and digital literacy are the dominant factors that differentiate the effectiveness of metaverse implementation from other more technologically advanced countries. The novelty of this research lies in the detailed identification of differences in student responses as well as teacher adaptation barriers in the context of metaverse-based learning, which has rarely been explored in depth in Indonesian education literature.

### **Student Engagement**

The observation results show that students' engagement in metaverse-based learning increases in three main dimensions, namely cognitive, affective, and social. From the cognitive aspect, students were more active in participating in discussions compared to face-to-face learning or conventional e-learning. Some students who were previously passive began to dare to express their opinions and ask questions through the avatar communication feature, because they felt more confident when they did not appear in person. In addition, understanding of the material is better when students can explore virtual objects in three-dimensional form, for example on science topics involving simulation of natural phenomena.

On affective engagement, the majority of students showed high expression of enthusiasm throughout the learning process. This enthusiasm is reflected in the students' positive comments while in the virtual space, eagerness to follow the teacher's instructions, as well as their increasing interest to continue exploring the material outside of formal learning time. Some students claimed to feel "more at home" learning in the metaverse environment due to the gamified environment that reduces boredom that usually arises in online learning. Meanwhile, on social engagement, students showed more intense collaboration patterns. They not only work together in small groups, but also actively interact with peers in virtual spaces, both in the form of discussions and information exchange. The avatar feature and collaborative space allow for more fluid communication, thus facilitating the creation of a participatory learning climate. This is different from video conference-based online learning, where student interaction is often limited to teacher instruction and one-way communication.

When linked to the literature, these results support the findings of Putra et al (2024) which shows that VR-based virtual environments are able to increase student engagement through immersive learning experiences. However, this study makes a new contribution by showing that student engagement is not only increased in terms of affective motivation, but also in cognitive and social aspects which were previously often a weakness in traditional e-learning. Thus, it can be concluded that the integration of metaverse has the potential to overcome the limitations of engagement in online learning, while answering the needs of the digital native generation who want a more interactive and fun learning experience.

### **Student Learning Motivation**

Students' learning motivation in metaverse-based learning showed significant improvement in both intrinsic and extrinsic aspects. In terms of intrinsic motivation, students

showed greater curiosity towards the subject matter. This can be seen from their tendency to explore the virtual space further than the instructions given by the teacher, such as trying additional features, observing details of three-dimensional objects, and asking more in-depth questions. This spirit of exploration was also accompanied by a feeling of enjoyment in learning, as the game-like learning atmosphere made students not feel pressured or burdened by the task.

On the extrinsic motivation aspect, the gamification system implemented in the metaverse platform, such as awarding points, badges, or rankings, successfully encouraged students to complete tasks faster and more thoroughly. Students feel encouraged to achieve the best results in order to gain recognition in the virtual space, both from teachers and peers. In addition, the digital rewards provided are able to increase healthy competition among students, without reducing the collaboration aspect that is maintained in group learning. Changes in students' attitude towards learning are also evident after the integration of metaverse. Previously, some students tended to perceive online learning as a boring monotonous activity. However, after using metaverse, they started to show a more positive view. Some students even stated that learning in the metaverse is "more real" and "more exciting" than just watching presentations or videos. This change in attitude shows that the metaverse is not only an alternative medium, but is also able to catalyze the transformation of students' perspectives on learning.

This finding is in line with Keller's ARCS framework, which emphasizes the importance of Attention, Relevance, Confidence, and Satisfaction aspects in building learning motivation. Metaverse is able to attract students' attention through visual and interactive experiences (attention), present relevance to the real world through simulation (relevance), foster students' confidence in mastering the material through hands-on practice (confidence), and provide learning satisfaction through fun experiences (satisfaction). In addition, the results of this study can also be explained through Self-Determination Theory (Deci & Ryan), where the metaverse supports students' basic needs for autonomy (freedom to explore virtual space), competence (feeling able to complete challenges), and relatedness (social connection with friends through avatars). Thus, this study reinforces the understanding that metaverse integration contributes significantly to fostering students' learning motivation holistically, beyond traditional online learning approaches.

### **Challenges and Barriers to Metaverse Integration**

The implementation of metaverse in learning is inseparable from various challenges and obstacles identified in this study. From the technical side, device limitation is the most dominant problem, considering that not all students have devices with adequate specifications to run VR/AR-based applications. Some students could only access the simplified version through smartphones, so the learning experience was not fully immersive. In addition, the stability of the internet connection is a major obstacle, especially for students who live in areas with limited network infrastructure. These technical barriers were also exacerbated by uneven technology skills among both students and teachers, so some participants took longer to adapt to the metaverse platform.

From the pedagogical side, teachers' readiness in designing metaverse-based learning is still a challenge. Teachers who are accustomed to conventional methods tend to have difficulties in designing interactive activities that match the characteristics of the virtual environment. Some teachers even admit that they need additional training to integrate the curriculum with metaverse features so that learning remains focused and achieves the desired

goals. This shows the gap between technological development and teachers' pedagogical capacity.

In addition, environmental factors also have a significant influence. School support has not been optimal, especially regarding funding for device procurement and metaverse platform licenses. The relatively high cost of implementation means that the adoption of this technology is still limited to certain schools with better resources. Accessibility for all students is also a crucial issue, as there is still an imbalance between students who have adequate devices and connections and those who do not. This condition has the potential to create a digital divide in education.

When further analyzed, these challenges are in line with the findings of Nisiforou & Kosmas (2024) which emphasizes that the successful integration of immersive technologies in education is highly dependent on infrastructure readiness, teacher competencies and institutional support. However, this study makes a novel contribution to the Indonesian context by highlighting the role of environmental factors, particularly limited school support and uneven student access, as key constraints. Solutions that can be considered include strengthening teachers' digital literacy through continuous training programs, collaboration with the private sector or government for infrastructure provision, and the implementation of hybrid learning models that allow students to still get a metaverse experience without relying entirely on high-tech devices. Thus, this research confirms that the sustainability of metaverse integration in Indonesian education requires a systemic approach that combines technical, pedagogical and environmental aspects together.

### **Implications for Learning Innovation**

The results show that the integration of metaverse in learning has important implications for the direction of educational innovation, both in the short and long term. From a long-term perspective, the metaverse has the potential to become a sustainable learning strategy because it is able to deliver immersive, collaborative and flexible learning experiences. Teachers and students alike recognize that the metaverse is not just a temporary supporting medium, but can serve as the main learning platform that complements conventional face-to-face and online learning.

The findings also confirm the relevance of the metaverse to the needs of generations Z and Alpha who grew up in a digital native environment. These generations tend to be more responsive to technology-based learning that is interactive, visual and gamified. Through the metaverse, they feel more connected to the material being learned, as it resembles the real world while fulfilling their expectations of a fun digital experience. Thus, the integration of metaverse can be a bridge between the characteristics of the digital generation and formal education objectives that demand high engagement and motivation.

In terms of policy, the results of this study recommend the development of immersive technology-based education directions in Indonesia. The government and education stakeholders need to consider the metaverse as part of the education 4.0 transformation agenda towards Society 5.0, where technology is not only used as a tool, but also as a learning ecosystem that supports creativity, collaboration and complex problem solving. Policies that encourage teacher training, infrastructure provision and adaptive curriculum development will be key to success in integrating the metaverse more widely in schools.

In terms of global trends, these results are in line with the UNESCO report (2022), which emphasizes that digital education must move from mere access to technology towards creating immersive learning experiences relevant to 21st century needs. However, this research makes

a novel contribution by showing how the metaverse can be adapted in the Indonesian educational context which still faces infrastructure limitations. Thus, the main implication of this research is the need for an adaptive, inclusive and future-oriented educational innovation strategy, so that the metaverse can become an integral part of the transformation of national education.

## Conclusion

The study concludes that the integration of metaverse in learning is able to increase students' engagement in cognitive, affective and social aspects, and motivate them both intrinsically through curiosity and spirit of exploration, and extrinsically through task achievement and gamification rewards. Nonetheless, technical, pedagogical and environmental barriers remain a challenge that needs to be addressed through improved digital literacy, teacher training, infrastructure provision and policy support. The findings confirm that metaverse has the potential to be a long-term learning strategy relevant to the characteristics of generation Z and Alpha, while supporting the direction of Indonesia's education transformation towards the era of Education 4.0 and Society 5.0 through learning that is more immersive, inclusive and adaptive to technological developments.

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