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Strengthening the Creativity of Junior High School Teachers Through the Integration of Immersive Virtual Spaces in Interactive Learning

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ABSTRACT
This community service initiative was designed with three primary objectives: (1) to enhance the creativity and teaching competencies of teachers and educational staff at SMP PGRI 12 Jakarta; (2) to improve teaching performance through the utilization of immersive virtual space technologies; and (3) to expand the pedagogical insights of educators by integrating immersive virtual environments into the learning process. The program was implemented in three distinct phases: preparation, implementation, and evaluation. A total of 30 participants engaged in the program, demonstrating high levels of enthusiasm and active participation. Preliminary assessments and discussions with the partner institution revealed several challenges, primarily related to the suboptimal use of digital technologies in classroom settings. Although educators had adopted basic tools such as Zoom, Google Meet, and Google Classroom, the transition to more advanced digital platforms required by Industry 5.0 remains inadequate. Many teachers appeared unprepared for the rapidly evolving technological landscape. As a response, this initiative introduced immersive virtual space technologies—particularly through metaverse-based learning platforms—as innovative tools to support and enhance interactive learning. The training facilitated a shift in perception among the teachers, who began to recognize the importance and potential of immersive technology in future education. The program successfully demonstrated that metaverse integration can significantly contribute to creative, effective, and engaging pedagogical practices.

Keywords: Immersive Virtual Space, Community Service Program, Interactive Learning, Teacher Creativity, Metaverse in Education

INTRODUCTION

The rapid advancement of digital technologies has profoundly transformed the way humans learn, communicate, and access knowledge. Almazova (2020) emphasizes that the increasing volume of data and the global diffusion of digital tools have instigated substantial and accelerated changes across all sectors, particularly in education. Traditional schools are no longer the sole arenas for learning; instead, digital learning environments now complement and, in some cases, surpass conventional educational settings. These shifts necessitate a transformation in how education is delivered—learning must now be more interactive, resource-rich, globally connected, and tailored to the digital generation, all while remaining cost-effective.

In this context, the integration of interactive digital technologies—especially immersive technologies—has become essential. The metaverse, an evolving concept that merges physical and digital realities to create highly interactive virtual environments, presents one such promising technological innovation. This concept is particularly appealing to today's learners due to its gamified, immersive characteristics that support engaging and meaningful learning experiences.

As highlighted in the study by Indarta et al. (2022), the metaverse has garnered increasing attention in the field of education, facilitated by the development

of Augmented Reality (AR) and Virtual Reality (VR) platforms. These technologies address various educational challenges such as limited classroom capacities, constraints in time and location, and diminished engagement during remote learning. By leveraging metaverse-based tools, education can become more inclusive and interactive without compromising the authenticity of learning experiences. Moreover, this approach aligns well with the learning preferences of Generation Z, who are accustomed to digital interaction and are likely to benefit from such novel pedagogical methods.

The educational potential of the metaverse has been substantiated through various studies. Erturk and Reynold (2021) concluded that immersive environments within the metaverse not only enhance motivation but also offer diverse methods of engagement that extend beyond traditional pedagogical practices. Similarly, research by Mystakidis (2022) found that metaverse-based education fosters Deep and Meaningful Learning (DML), positively influencing students' academic achievement, perceptions, satisfaction, collaboration, and motivation. Kalb (2023) further argues that the integration of the metaverse in education is no longer a distant prospect but a pressing contemporary need, given its growing role in shaping future educational frameworks.

The rationale for incorporating metaverse technologies into school-based education is underpinned by several key benefits. First, it facilitates highly engaging learning experiences through the use of simulations, visualizations, and immersive multimedia. Second, it provides access to a global repository of educational resources, allowing students and teachers to connect with diverse learning materials beyond geographical limitations. Third, the metaverse promotes global collaboration by enabling interactions among students, educators, and experts from around the world, thereby fostering cultural understanding and joint problem-solving. Fourth, it supports personalized learning experiences tailored to individual student needs, leveraging intelligent systems to recommend appropriate content and strategies.

Fifth, the metaverse enables realistic simulations for practical skill development, which is particularly advantageous in disciplines such as health, engineering, and vocational education. Sixth, it empowers teachers to innovate their instructional approaches, blending traditional methods with technological advancements. Seventh, it enhances students' digital literacy and readiness for the demands of a technology-driven world. Eighth, it stimulates creativity and innovation through virtual content creation and project-based learning. Ninth, while initial infrastructure investment may be required, long-term educational costs can be reduced by minimizing the reliance on physical resources. Tenth, and most importantly, metaverse integration prepares students for an increasingly digital and interconnected future.

Given these considerations, introducing immersive virtual technologies into the school system is not merely an innovation but a necessity. This community service initiative aimed to socialize and demonstrate the practical benefits of using the metaverse in classroom settings. Through structured training, collaborative workshops, and experiential learning sessions, the program sought to enhance teachers' creativity and digital competence while fostering a culture of innovation within the school environment.

By equipping educators with the skills to utilize immersive virtual spaces, we take a significant step toward creating an educational paradigm that is not only

technologically relevant but also pedagogically progressive. In doing so, we ensure that students are better prepared to navigate the complexities of a rapidly evolving digital society. The success of this initiative underscores the importance of continuous professional development for teachers in adapting to new technologies and pedagogical strategies.

METHOD

The training program provided to teachers and educational staff was fundamentally designed to enhance their understanding and performance in utilizing metaverse-based technology as an innovative approach to teaching and learning. The implementation team followed a structured process consisting of monitoring, needs assessment, and the acquisition of necessary institutional permits.

In the monitoring stage, the implementation team conducted an initial assessment to collect comprehensive information regarding the current conditions and readiness of the partner school, SMP PGRI 12 Jakarta. This stage involved direct observation and documentation of existing practices and technological utilization at the school.

Following this, during the preparation stage, the team conducted in-depth observations and engaged in structured discussions with the school principal. These efforts were aimed at accurately identifying the specific needs and expectations of the school, thereby ensuring that the training materials would be relevant and applicable. In parallel, the implementation team arranged the necessary administrative requirements, including the drafting and approval of a formal cooperation agreement signed by the school as the designated community service partner.

During the implementation stage, the program commenced with an orientation session delivered to the participating teachers and educational staff. This session introduced the foundational concepts of the metaverse and its potential integration into the teaching and learning process. After the initial presentation, participants were given the opportunity to engage in an interactive discussion and Q&A session, allowing them to explore practical applications and raise questions about the use of immersive virtual spaces in education.

The final component of the program involved a comprehensive evaluation stage. This stage was designed to assess both the process and outcomes of the entire training activity. Evaluations were conducted systematically at each phase of the implementation—preparation, execution, and post-activity reflection. The evaluation included the analysis of participant engagement, learning outcomes, and overall satisfaction with the training. The findings from these evaluations were compiled into a formal report, which serves as documentation of the community service program's implementation and its impact.

RESULTS AND DISCUSSION

A total of 30 participants took part in the Community Service Program conducted at SMP PGRI 12 Jakarta. The participants exhibited a high level of enthusiasm throughout the activity, and the topics presented were perceived as both appealing and engaging. Based on observations and in-depth discussions with the partner school, several field challenges were identified. The primary issue identified was the suboptimal utilization of technology in teaching and learning at SMP PGRI

12 Jakarta. To date, teachers have only engaged in limited forms of classroom digitalization using basic platforms such as Zoom, Google Classroom, and Google Meet, alongside several other free or subscription-based educational applications. However, in light of the emergence of Industry 5.0—an era characterized by rapid technological advancement and the need for continual adaptation—many teachers remain unprepared for these shifts.

Through this community service initiative, teachers at SMP PGRI 12 Jakarta began to expand their perspectives and deepen their understanding of the metaverse. They acknowledged that immersive digital environments will become a normalized and integral part of the educational landscape in the near future. In response to this, the community service team from Universitas Indraprasta PGRI designed and delivered a training program focused on the pedagogical potential of the metaverse, equipping teachers with practical skills to incorporate immersive technologies into interactive classroom practices.

Currently, the phenomenon of technological disruption is transforming numerous sectors, including education. Much of this change has been accelerated by the global COVID-19 pandemic, which significantly impacted educational systems worldwide. Online learning—once considered difficult to implement effectively within the Indonesian context—has now been widely adopted across all educational levels. Nevertheless, its implementation has often been suboptimal. Concerns have been raised regarding potential learning loss, particularly due to the use of emergency curricula and the fragmented nature of remote instruction in many schools.

As technological developments continue to progress, new digital innovations are increasingly influencing education. Among these innovations, the concept of the "metaverse" has gained considerable attention in recent years, especially following Mark Zuckerberg's announcement of the rebranding of Facebook to Meta Platforms Inc., signaling a strategic pivot toward a digital future (Dalvis, 2022). Although the term “metaverse” originated in Neal Stephenson’s 1992 science fiction novel *Snow Crash* (Phil, 2021), it has now entered mainstream discourse. Mystakidis (2022) defines the metaverse as a post-reality universe—a persistent multi-user environment that blends physical and virtual realities, enabled through converging technologies that support multisensory interaction with digital environments, objects, and other users. Technologies such as Virtual Reality (VR) and Augmented Reality (AR) are central to enabling these interactions.

According to Milgram et al. (as cited in Mystakidis, 2022), immersive technologies encompassing VR, AR, and Mixed Reality (MR) collectively form what is known as Extended Reality (XR) or Cross Reality. These technologies are becoming foundational to the emerging digital ecosystem. Kye et al. (2021) explore how avatars—digital projections of the self—facilitate social, economic, and cultural interactions within the metaverse. Importantly, these applications are not confined to everyday life but are increasingly utilized in educational settings.

During the COVID-19 pandemic, the shift to remote learning led to widespread adoption of web-based educational platforms, typically involving two-dimensional (2D) learning environments. These environments can be classified into two main types: asynchronous and synchronous e-learning (Stöhr, Demazière, & Adawi, as cited in Mystakidis, 2022). Asynchronous e-learning allows learners to access materials at any time and location, offering greater flexibility. In contrast, synchronous e-learning requires real-time interaction between instructors and

learners, typically facilitated through video conferencing tools such as Zoom, WebEx, Microsoft Teams, and Google Meet.

During the implementation of the training program, the community service team from Universitas Indraprasta PGRI presented comprehensive instructional materials to participants. These materials included an overview of the definition of the metaverse, its relevance and applications in education, specific examples of metaverse usage in educational settings, and a critical evaluation of its strengths and limitations. The delivery of this material was complemented by visual documentation and interactive discussions to foster greater understanding and engagement among the participants.

Figure 1. Explanation of the Definition of Metaverse

Figure 2. Teachers listening to the presentation

In a study conducted by Means and Neisler (as cited in Phil, 2020) on student satisfaction with online courses, a sample of 1,000 students from higher education institutions in the United States was analyzed. The findings indicated that prior to the COVID-19 pandemic, approximately 90% of respondents reported being satisfied with their courses. However, this figure declined to 60% following the shift to online learning during the pandemic. Interestingly, two-thirds of the participants reported a better understanding of course materials in online learning environments compared to face-to-face settings. Conversely, 65% of respondents expressed that opportunities for collaboration were diminished and that there was a lack of meaningful social interaction with fellow students. These findings align with surveys conducted among university students in Europe, who acknowledged that while distance learning is modern, practical, and convenient, it cannot replace the experience of direct social engagement with peers and instructors (Kedraka & Kaltsidis, as cited in Phil, 2020).

Thus, despite the advantages offered by two-dimensional (2D) learning platforms, there are notable limitations that affect the quality of interaction and engagement. According to Mystakidis (2022), several inherent limitations of 2D learning environments include:

a. **Limited self-perception**: Users experience a diminished sense of personal presence as they are represented merely by static images or webcam feeds with minimal customization or personal expression.

b. **Lack of presence**: Web conferencing platforms are often perceived as impersonal video calls. Prolonged sessions tend to lead to distraction, with participants engaging in unrelated activities and losing focus.
c. **Limited interactivity**: The scope for real-time, meaningful interaction among participants is often restricted in 2D environments.
d. **Minimal emotional expression**: Emotional communication is reduced to the use of basic emojis, which limits the depth of expressive interaction.

These challenges, however, can be mitigated through the implementation of three-dimensional (3D) platforms, particularly through the integration of metaverse technologies in education. Augmented Reality (AR) and Virtual Reality (VR) offer several educational advantages, as outlined by Kim (in Kye et al., 2021):

Augmented Reality (AR):

a. AR allows learners to visualize and interact with elements not physically present, thereby supporting more effective problem-solving.
b. It facilitates deeper engagement with complex concepts that are difficult to convey through text alone, enabling experiential learning that fosters knowledge construction.
c. AR provides interactive learning opportunities—such as reading, writing, and speaking—within a focused and immersive educational context.

Virtual Reality (VR):

a. VR enables learners to engage in simulated practice environments that substitute direct training, particularly in high-cost or high-risk scenarios (e.g., firefighting, flight simulation, or operation of advanced equipment).
b. VR provides immersive experiences that allow learners to understand abstract concepts related to time and space, such as historical events or future projections.
c. It supports the development of strategic thinking, problem-solving abilities, and other essential real-world skills through 3D, game-based learning experiences.

In addition, Dalvis (2022) notes that the metaverse promotes the principles of edutainment and gamification, making learning processes more enjoyable and engaging. The use of metaverse platforms also enables educators to deliver content to larger audiences with increased accessibility and scalability.

Despite the promising benefits of integrating the metaverse into educational practices and daily life, several risks and challenges must be considered. Mystakidis (2022) highlights the following concerns:

a. **Persuasive technology**: Both VR and AR are considered persuasive tools that may influence users' cognition, emotions, and behaviors in unintended ways.
b. **High implementation costs**: The financial burden associated with acquiring and maintaining the necessary hardware remains a barrier to widespread adoption.
c. **Risks associated with AR use**: These risks include four categories—(i) threats to physical well-being, health, and safety; (ii) psychological concerns; (iii) ethical and moral implications; and (iv) data privacy issues.
d. **Health risks of VR**: Users commonly report symptoms such as motion sickness, nausea, dizziness, and musculoskeletal fatigue during or after VR sessions.

e. **Psychosocial impact**: Prolonged use of VR environments can lead to addiction, social isolation, diminished real-world self-awareness, and may even trigger traumatic experiences in vulnerable individuals.
f. **Security and identity theft**: Artificial intelligence (AI) and deep learning algorithms can potentially be exploited to create deceptive avatars, leading to identity theft or fraudulent activities.

Given these complexities, it is imperative that educators provide students with clear and comprehensive guidance regarding the responsible and critical use of metaverse technologies. As the metaverse becomes increasingly embedded in daily life and educational practices, equipping students with the knowledge and skills to navigate and utilize such environments is essential (Witono, 2022).

CONCLUSION

The outcome of this community service activity indicates that the training program was successfully implemented according to the predetermined schedule. The participants demonstrated a high level of enthusiasm during the session themed *"Utilizing the Metaverse Concept in Learning."* However, it was observed that prior to this activity, the participants had limited exposure to the effective and engaging application of metaverse-based technology in their instructional practices.

This training session has contributed positively to the partner school by enhancing the teachers' awareness and understanding of innovative teaching strategies. As a result, it is recommended that similar training programs be conducted in the future, with a wider range of community service themes. Such initiatives will enable the teaching staff at SMP PGRI 12 Jakarta to adopt more diverse and creative instructional approaches, which are expected to foster greater student motivation and ultimately improve learning outcomes within the classroom setting.

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