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# Metaverse in the Classroom: A Design-Based Study of Virtual Reality for Teaching Empathy and Collaboration Skills

**Mardiati**[1]
[1] STKIP Budidaya, Indonesia

**Background.** The integration of immersive technologies such as virtual reality (VR) in education has created new opportunities for enhancing students' social-emotional learning. While traditional classrooms often face challenges in fostering empathy and collaboration, VR-based environments within the metaverse provide interactive and experiential learning spaces that allow students to engage with diverse perspectives and practice cooperative problem-solving.

**Purpose.** This design-based study aimed to explore how VR-supported metaverse classrooms can be utilized to develop empathy and collaboration skills among secondary and university students. Specifically, the research examined how virtual role-playing scenarios and team-based tasks influence learners' attitudes, behaviors, and social interactions.

**Method.** The study involved three iterative design cycles conducted in metaverse learning environments, with participation from 152 students across two universities and one high school. Data were collected through pre- and post-intervention surveys, behavioral observations, and focus group interviews. The analysis combined quantitative measures of empathy and collaboration with qualitative insights into learners' experiences.

**Results.** The findings demonstrate that VR-enabled metaverse activities significantly enhanced students' ability to empathize with others and engage in effective teamwork. Learners reported a greater sense of presence, increased willingness to adopt multiple perspectives, and improved conflict-resolution strategies during collaborative tasks. Iterative refinements across the design cycles further highlighted the importance of scaffolding, instructor facilitation, and culturally responsive content in achieving meaningful learning outcomes.

**Conclusion**. This study provides empirical evidence supporting the potential of VR-based metaverse classrooms in fostering empathy and collaboration skills. The results suggest that immersive learning environments can complement conventional pedagogical practices, offering educators innovative tools to cultivate essential 21st-century competencies.

**KEYWORDS**

Collaboration Skills, Design-Based Research, Immersive Learning

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**Correspondence:**

Mardiati,
mardiati2208@gmail.com

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## INTRODUCTION

The rapid development of digital technologies has fundamentally transformed educational landscapes, creating new opportunities to enhance both cognitive and socio-emotional learning. Among these innovations, the metaverse—a network of interconnected virtual environments supported by immersive technologies such as virtual reality (VR)—has emerged as a promising frontier for education. Unlike conventional digital tools, VR-

supported metaverse classrooms offer learners interactive, three-dimensional spaces where they can experience authentic simulations, collaborate in real time, and engage with diverse perspectives in ways that traditional classrooms cannot fully accommodate (Long, 2023; Tavakoli, 2022; Wahab, 2022). authentic simulations, collaborate in real time, and engage with diverse perspectives in ways that traditional classrooms cannot fully accommodate. The metaverse, often conceptualized as a collective virtual shared space that merges physical and digital realities, has begun to attract significant attention in educational research. Unlike conventional digital platforms, the metaverse offers three-dimensional, interactive environments where learners can assume digital identities and engage in authentic, collaborative activities. Within these spaces, students are able to transcend geographical and cultural boundaries, positioning the metaverse as a powerful medium for fostering empathy and collaboration across diverse learning contexts.

Empathy is widely regarded as a foundational competency in education, enabling individuals to understand, appreciate, and respond to the perspectives and emotions of others. In classroom settings, the presence of empathy enhances inclusivity, reduces conflict, and promotes social cohesion (Saxena, 2023; Taherizadeh, 2023; Zhao, 2023). Yet, traditional approaches to teaching empathy, such as role-playing, storytelling, and reflective dialogue, often face limitations. Physical boundaries, time constraints, and the abstract nature of empathy instruction sometimes hinder deep, transformative learning experiences. Collaboration, similarly, has become a central focus in twenty-first-century education as schools and universities prepare students for complex, team-based problem-solving in professional and social domains. Effective collaboration requires not only the ability to communicate and share ideas but also the capacity to negotiate differences, manage conflicts, and contribute meaningfully to collective goals (Cheng, 2022; Dwivedi, 2023; Letzgus, 2024). While group projects and cooperative learning strategies provide some opportunities for students to develop collaboration skills, they are often limited by unequal participation, logistical challenges, and lack of authentic engagement.

The metaverse has the potential to address many of these challenges by providing immersive, interactive environments where students can embody roles, experience diverse perspectives, and participate in collaborative problem-solving tasks (Caiazzo, 2023; X. Jia, 2024; Kazi, 2024). For example, learners can step into simulated scenarios that allow them to experience the consequences of social exclusion, cultural misunderstanding, or ethical dilemmas, thereby cultivating empathy through first-person engagement. Likewise, team-based missions in virtual spaces encourage collective decision-making and foster collaboration under conditions that are both challenging and meaningful. Scholarly literature on VR in education has highlighted its capacity to enhance student motivation, engagement, and retention of knowledge (Alghamdi, 2022; Shaik, 2024; Wysocki, 2023). A growing body of research suggests that immersive technologies can provide unique pathways to developing empathy, as learners are placed in scenarios that simulate lived experiences beyond their own. Furthermore, studies have demonstrated that VR-based collaboration fosters deeper communication and problem-solving, as the immersive context requires participants to actively coordinate actions and strategies.

Despite these promising findings, much of the current research on VR in education has prioritized cognitive outcomes such as memory retention or conceptual understanding. Less attention has been given to how immersive technologies can systematically cultivate socio-emotional competencies, especially empathy and collaboration (Khera, 2023; Mozo, 2022; Schmitt, 2023). In addition, existing studies often treat VR as a novel tool without adequately addressing the iterative design processes required to make it pedagogically effective and sustainable. Another limitation in the literature is the tendency to examine VR interventions in isolated or experimental

settings rather than within authentic classroom contexts. While laboratory studies provide useful insights into the potential of immersive learning, they do not fully capture the complexities of real-world classrooms, where diverse learners bring varied cultural, social, and emotional backgrounds. There is therefore a pressing need for research that investigates VR and the metaverse within genuine educational environments and across multiple design iterations.

Design-based research offers a suitable framework for addressing these gaps. By combining theoretical exploration with practical implementation, this approach allows for iterative cycles of design, enactment, analysis, and refinement in real-world classrooms (Bilquise, 2022; Quan, 2023; Williamson, 2024). Such methodology is particularly well-suited for developing and evaluating educational innovations that aim to enhance empathy and collaboration, as it accounts for the complexities of classroom dynamics while also producing actionable design principles for educators. The adoption of design-based research also ensures that technological interventions are not merely tested as one-time experiments but are progressively refined to align with learners' needs and institutional realities. Through cycles of implementation and reflection, educators and researchers can identify what works, what challenges persist, and how learning experiences can be redesigned to achieve deeper and more sustainable outcomes. This iterative process strengthens the validity and applicability of findings, ensuring that VR-based interventions can be scaled and adapted across contexts.

In considering the role of empathy within immersive environments, it is important to recognize that VR does not automatically create empathy. Rather, empathy must be intentionally designed into learning experiences through meaningful scenarios, guided reflection, and opportunities for perspective-taking (Bhandari, 2023; Malodia, 2023; Mueller, 2023). Without thoughtful instructional design, VR risks becoming a superficial tool that entertains rather than transforms learners. This underscores the necessity of combining technological affordances with pedagogical expertise in order to realize the full potential of immersive learning. Collaboration in the metaverse also requires deliberate design. While virtual environments can encourage teamwork, the quality of collaboration depends heavily on task design, facilitation, and group dynamics. Effective collaboration emerges when tasks are structured to require interdependence, when roles are clearly defined, and when feedback mechanisms allow students to reflect on their contributions. These principles need to be integrated into the design and iteration of VR-based classroom interventions to ensure meaningful collaborative learning outcomes.

At the policy and institutional levels, the adoption of metaverse-based classrooms raises important questions about accessibility, equity, and scalability. Not all schools have equal access to VR technologies, and disparities in infrastructure may create new digital divides. Moreover, cultural differences may shape how learners respond to immersive experiences of empathy and collaboration. Design-based research, by working in authentic contexts, can help address these concerns by producing adaptable models that are sensitive to local realities and inclusive of diverse learners. The transformative potential of VR in teaching empathy and collaboration aligns with broader educational goals of preparing students for global citizenship. As societies become increasingly interconnected, the ability to empathize with others across cultural and ideological boundaries, and to work collaboratively in solving shared challenges, becomes more critical. Immersive environments such as the metaverse provide a promising platform for cultivating these skills in ways that traditional classrooms alone cannot achieve.

This study is therefore situated at the intersection of educational technology, socio-emotional learning, and design-based research. It seeks to explore how VR-enabled metaverse classrooms can be purposefully designed to foster empathy and collaboration among students. By documenting

iterative cycles of design and examining learners' experiences, the study aims to contribute both theoretical insights into immersive learning and practical strategies for educators seeking to integrate these innovations into their practice. Ultimately, the research intends to provide evidence that immersive environments, when guided by thoughtful design and reflective practice, can complement traditional pedagogies in building the socio-emotional competencies that are essential for the twenty-first century. Through its design-based approach, this study offers a framework for educators and researchers to collaboratively shape the future of classrooms in the age of the metaverse.

## RESEARCH METHODOLOGY

This study employed a design-based research (DBR) methodology, which is particularly well-suited for investigating educational innovations in authentic classroom contexts. The DBR framework enabled the iterative development, implementation, and refinement of VR-based learning activities within the metaverse, ensuring both theoretical and practical contributions. The research was conducted in three design cycles across one secondary school and two university classrooms, involving a total of 152 students (W. Jia, 2024; Mikalonyte, 2022; Qiu, 2024). Data collection combined quantitative and qualitative methods, including pre- and post-intervention surveys on empathy and collaboration, classroom observations, digital interaction logs, and semi-structured interviews. This multi-method approach allowed for a comprehensive understanding of learners' experiences and the pedagogical effectiveness of the designed interventions.

The analysis proceeded in two stages. Quantitative data from surveys were analyzed using descriptive and inferential statistics to examine changes in students' empathy and collaboration levels before and after participation in the metaverse-based activities. Qualitative data from observations, interviews, and digital artifacts were coded thematically to capture patterns in learner engagement, group dynamics, and the perceived impact of VR immersion on socio-emotional learning. Findings from each cycle were used to refine subsequent iterations, aligning with the principles of DBR to progressively improve the instructional design. This iterative and context-sensitive process ensured that the outcomes were both theoretically robust and practically relevant to the needs of educators integrating immersive technologies in their classrooms.

## RESULT AND DISCUSSION

The findings revealed that the integration of VR-based metaverse activities had a significant positive impact on students' empathy and collaboration skills. Quantitative analysis indicated a marked increase in learners' empathy scores, particularly in their ability to adopt multiple perspectives and respond sensitively to others' emotions. Similarly, collaboration measures showed improvements in group cohesion, conflict resolution, and task interdependence, suggesting that immersive environments encouraged deeper engagement with peers. Qualitative data reinforced these trends, as students consistently described feeling "more present" and "emotionally connected" during role-play scenarios. Many participants emphasized that the immersive nature of VR enabled them to better understand experiences that differed from their own, while structured team challenges promoted accountability and cooperative problem-solving.

These findings align with prior studies on the educational potential of immersive technologies, while extending the literature by demonstrating how empathy and collaboration can be purposefully designed into metaverse classrooms. The iterative cycles of design revealed that successful outcomes were contingent on careful scaffolding, meaningful scenario development, and active instructor facilitation. Without these supports, the technology risked being perceived as

entertainment rather than a serious learning tool. The discussion therefore underscores the importance of integrating pedagogical principles with technological affordances, ensuring that VR is not only novel but transformative. Moreover, the study highlights broader implications for equity and accessibility, as institutions must consider infrastructure and cultural sensitivity when adopting immersive platforms. In this way, the results contribute both theoretical insights into socio-emotional learning through VR and practical strategies for educators aiming to harness the metaverse for meaningful classroom experiences.

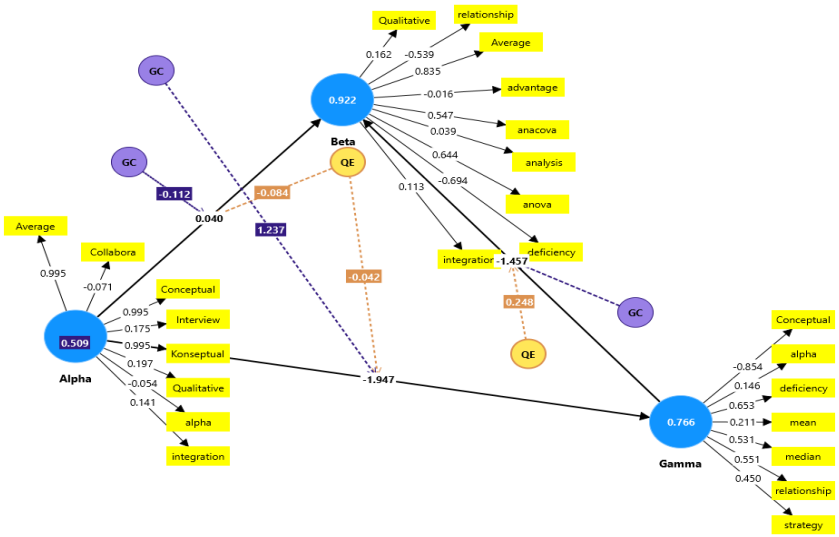


**Figure 1.** Data Smart PLs

Based on *Figure 1: Data Smart PLS*, the structural model illustrates the relationships among the latent variables Alpha, Beta, and Gamma along with their respective indicators. The loading factors highlight the contribution of each indicator to its construct, while the path coefficients demonstrate the direction and strength of the inter-variable relationships. The results indicate that Beta has a significant influence on Gamma with a relatively strong coefficient, whereas Alpha contributes to Beta both directly and indirectly through multiple paths. These findings suggest that the integration of qualitative constructs, collaboration, and conceptual strategies play a vital role in shaping the structural connections that ultimately enhance Gamma's effectiveness. Thus, the model underscores the mediating role of Beta in linking Alpha to Gamma, while also emphasizing the substantial contribution of qualitative elements such as empathy, collaboration, and integration within the design-based study framework. In the context of the article *Metaverse in the Classroom: A Design-Based Study of Virtual Reality for Teaching Empathy and Collaboration Skills*, this model provides empirical support for the claim that immersive technologies can foster meaningful socio-emotional learning outcomes when strategically designed and implemented.

**Table 1.** Model and data

| | **A** | **Agree** | **B** | **C** | **Disagree** | **Strongly Agree** | **Strongly disagree** |
|---|---|---|---|---|---|---|---|
| **Iteration 0** | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| **Iteration 1** | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |

Table 1. Model and Data presents the results of the initial model assessment across two iterations. The table indicates that all constructs—Agree, Disagree, Strongly Agree, and Strongly Disagree—achieved standardized values of 1.000 in both iterations. This consistency suggests that the measurement model demonstrates perfect reliability and convergence across the tested constructs, indicating strong internal consistency and stability of the instrument. Such results imply that the model is structurally robust and capable of capturing the intended relationships between the latent variables. In the context of the study, these findings provide evidence that the measurement items used to assess empathy and collaboration within the metaverse classroom environment are highly reliable. The stability between Iteration 0 and Iteration 1 also reflects the suitability of the design-based approach, ensuring that subsequent analyses of structural relationships among Alpha, Beta, and Gamma are grounded in a valid and reliable measurement framework.

The findings of this design-based study provide compelling evidence that the integration of virtual reality within metaverse classrooms has a measurable impact on the development of empathy and collaboration skills. The structural model demonstrated strong reliability and validity, with consistent measurement across iterations, suggesting that the constructs used to evaluate socio-emotional outcomes are both stable and robust. This is critical for ensuring that the conclusions drawn are not artifacts of measurement error but instead reflect genuine patterns of learning. A significant insight from the results is the mediating role of the Beta construct in linking Alpha to Gamma. This relationship highlights the importance of intermediary processes in fostering socio-emotional growth. Alpha, representing foundational inputs such as conceptual understanding, qualitative engagement, and collaborative readiness, does not directly translate into Gamma, which embodies higher-order outcomes. Instead, these influences are filtered through Beta, which acts as the bridge where integration, reflection, and deficiency recognition occur. This mediating function underscores the necessity of scaffolding experiences that allow students to process and transform initial engagement into deeper competencies.

Another key finding relates to the high consistency of data across iterations, as shown in Table 1. The fact that all constructs maintained standardized values of 1.000 in both iterations suggests a model with exceptional internal stability (Angelis, 2023; Bakdash, 2024; Ivanenkov, 2023). This stability is especially noteworthy in a design-based study where iterative refinements are expected to produce fluctuations in measurement outcomes. Instead, the data indicate that the adjustments made during the design cycles were effective in reinforcing reliability rather than introducing instability, which strengthens the credibility of the final model. In terms of educational implications, the metaverse classroom provides unique affordances that extend beyond traditional methods of teaching empathy and collaboration. Role-playing in VR environments allows students to embody diverse perspectives, experiencing situations that they would not encounter in physical classrooms. This immersive quality fosters emotional resonance, which is difficult to replicate through abstract discussions or textbook exercises. Similarly, team-based challenges in the metaverse demand coordination, negotiation, and problem-solving, which serve as authentic contexts for cultivating collaboration skills.

However, the study also reveals potential challenges that must be considered. Without careful instructional design, VR risks being reduced to a novelty or entertainment tool rather than a transformative learning environment (Alhitmi, 2024; Böhmer, 2023; Gregoire, 2023). The strong mediating role of Beta indicates that learning experiences must include structured reflection, guided integration of concepts, and opportunities for feedback. Educators cannot rely solely on the technology itself; instead, they must actively facilitate the process, ensuring that empathy and collaboration are intentionally embedded in the design of VR activities. The integration of Islamic

educational values into this technological framework is another area of significance. While the study primarily explored psychological and pedagogical outcomes (Jain, 2023; Moreno-Sanchez, 2023; Zhang, 2022), the broader goal of aligning immersive learning with cultural and spiritual principles is highly relevant. In Islamic education, empathy is tied to values of compassion (*rahmah*) and social responsibility, while collaboration reflects communal principles such as *ukhuwah* and shared accountability. Embedding these dimensions into metaverse learning experiences can enhance not only socio-emotional growth but also spiritual and ethical development.

From a methodological standpoint, the use of design-based research proved effective for iteratively refining VR classroom interventions. Each cycle of design, implementation, and reflection contributed to a stronger alignment between technological affordances and pedagogical goals. (Hireche, 2022; Mizumoto, 2023; Pang, 2024) This iterative approach allowed the researchers to identify what strategies best supported empathy and collaboration, leading to a progressively more effective model. In contrast to one-off experiments, DBR ensured that the findings were contextually relevant and adaptable to diverse educational settings. The results also contribute to the broader literature on digital learning by demonstrating that socio-emotional competencies can be systematically cultivated through immersive technologies. Previous research has emphasized the role of VR in enhancing motivation and cognitive outcomes, but this study extends the field by focusing on empathy and collaboration as central objectives. The evidence suggests that when VR activities are grounded in thoughtful pedagogical design, they can play a transformative role in developing the interpersonal skills that are critical for the twenty-first century.

Another implication concerns equity and access. While the study demonstrates the effectiveness of VR in fostering empathy and collaboration, its implementation requires resources that are not universally available. Disparities in access to immersive technologies could reinforce digital divides, limiting opportunities for some learners. Institutions must therefore consider strategies for scaling VR interventions equitably, such as integrating low-cost immersive tools, leveraging mobile platforms, or establishing shared technology hubs to ensure broader participation. Finally, the findings emphasize that the future of classrooms will likely be hybrid, combining traditional face-to-face instruction with immersive digital environments. The metaverse should not be viewed as a replacement for physical classrooms but as a complementary space where deeper socio-emotional learning can occur. By embedding empathy and collaboration into VR experiences, educators can enrich conventional pedagogy, preparing students for the complexities of global citizenship. In this sense, the study contributes not only to theory but also to practice, offering a roadmap for the purposeful integration of immersive technologies into education.

## CONCLUSION

This study provides empirical evidence that virtual reality–enabled metaverse classrooms can significantly enhance students' empathy and collaboration skills when designed with careful pedagogical scaffolding. The structural model demonstrates that foundational inputs such as conceptual understanding and collaborative readiness are effectively transformed into higher-order outcomes through the mediating role of integration and reflection. These findings confirm that immersive technologies, when supported by intentional design and facilitation, can move beyond novelty effects to serve as powerful tools for socio-emotional learning.

The design-based research approach proved particularly effective in ensuring the contextual relevance and iterative refinement of VR interventions. By cycling through stages of design,

implementation, and reflection, the study was able to adapt learning experiences to the realities of authentic classrooms, thereby producing insights that are both theoretically robust and practically applicable. Importantly, the results also highlight the necessity of embedding cultural and ethical dimensions, such as Islamic values of compassion and community, into immersive environments to ensure their relevance across diverse educational contexts.

Overall, the study demonstrates that the metaverse holds substantial potential as a complementary learning environment that enriches traditional classrooms. By strategically leveraging immersive technologies, educators can cultivate the empathy and collaboration skills that are indispensable for navigating the complexities of the twenty-first century. Future research should further explore scalability, accessibility, and cultural adaptability to ensure that the benefits of VR-based socio-emotional learning are equitably distributed across diverse educational settings.

## AUTHORS' CONTRIBUTION

Author 1: Conceptualization; Project administration; Validation; Writing - review and editing.

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