# Metaverse Learning Process Using MIAP to Enhance Immersive Experience

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***Abstract*—Information technology has significantly impacted education, especially computer and telecommunications technology, enhancing educational development and increasing the efficiency of the teaching and learning process. Combining information technology with traditional classroom learning through electronic media interaction enhances knowledge and understanding for learners. Additionally, it fosters new experiences, creativity, and analytical thinking, enabling learners to use acquired knowledge for personal and societal development. This study focuses on the learning process through technology that fosters knowledge creation. The research objectives are: 1) To study the process of creating immersive learning experiences for the metaverse. 2) To design a learning process through the metaverse using Motivation, Information, Application, Progress (MIAP) to promote immersive experiences.**

***Keywords*—metaverse learning process, MIAP, immersive experience**

## I. INTRODUCTION

In the modern era, technology has become an essential pillar of the education system, with the Metaverse emerging as a revolutionary tool that transforms the learning experience. By overcoming the constraints of traditional classroom settings, the Metaverse creates an interactive and immersive environment where students can form virtual communities and engage in effective knowledge exchange [1]. This integration of advanced technologies, such as virtual reality and artificial intelligence, enhances educational opportunities, offering dynamic experiences previously unattainable in conventional learning [2].

The COVID-19 pandemic catalyzed the global transition to online education, compelling institutions to adopt digital learning solutions. This abrupt shift highlighted the limitations of traditional online learning platforms, such as reduced engagement and a lack of real-world interaction. In response, the Metaverse has been increasingly adopted as an alternative that ensures continuity in education while enhancing student engagement through immersive virtual experiences. Virtual Reality (VR) technology, as a core component of the Metaverse, enables students to participate in self-directed learning, access interactive educational resources, and collaborate in real time, thereby expanding the scope of education beyond physical constraints [3].

Immersive learning, facilitated by advanced technological frameworks such as virtual and mixed reality, is shaped by three critical factors: the clarity and fidelity of visual representation, the richness of auditory stimuli, and the extent of meaningful interaction available to learners [4]. These elements collectively enhance the depth of engagement, enabling students to perceive themselves as active participants rather than passive observers in virtual environments. Research further indicates that additional factors, such as the design of user interfaces and cognitive load, significantly influence learning outcomes in immersive settings [5]. Moreover, the inclusion of haptic stimulation—such as tactile feedback—can amplify motivation and emotional involvement, enriching the sensory experience and fostering greater learner investment [6]. Despite these advantages, the application of Metaverse-based education continues to face challenges related to accessibility, adaptability, and inclusivity, necessitating careful consideration in its implementation.

A key concern in implementing Metaverse learning environments is ensuring equitable access for all learners, including those with disabilities. The concept of Universal Design (UD) plays a crucial role in addressing this issue by advocating for an inclusive approach to educational technology. Universal Design emphasizes the creation of learning environments that accommodate diverse needs, ensuring that students of all abilities can effectively engage with educational content. Systematic reviews highlight that while Metaverse-based education offers innovative opportunities, its success hinges on overcoming barriers such as technological infrastructure and digital literacy, which disproportionately affect marginalized groups [7]. By designing Metaverse-based learning experiences that prioritize accessibility and usability, educators can provide more inclusive opportunities for students with different learning styles and physical capabilities.

To address these challenges, this study explores integrating virtual reality and the Metaverse into the learning process through the Motivation, Information, Application, Progress (MIAP) Teaching Model, which comprises four key components: Motivation, Information, Application, and Progress Tracking. The MIAP model emphasizes stimulating learners' interest, delivering essential knowledge, enabling hands-on application of concepts, and monitoring students' learning progress. By incorporating immersive experiences with structured pedagogical frameworks, this approach aims to enhance student engagement, improve knowledge retention, and foster an inclusive learning environment that supports students regardless of their individual learning needs.

Therefore, this research examines the effectiveness of Metaverse-based immersive learning environments in promoting equitable access to education. Grounded in the principles of Universal Design, the study aims to develop a model that enhances accessibility, usability, and engagement in Metaverse-based education. By leveraging these immersive platforms, the approach seeks to ensure that all learners—regardless of physical or cognitive abilities—can thrive in the evolving landscape of digital learning, aligning with future trends that highlight the transformative potential of the Metaverse [2].

1) To explore immersive learning experience processes for the metaverse.
2) To design learning processes through the metaverse using MIAP to enhance immersive experiences.

## II. LITERATURE REVIEW

### A. Metaverse

The metaverse is a virtual world where individuals can create new identities and live as if it were another reality. Within this world, users can engage in activities similar to those in the real world, as well as perform tasks that are impossible in real life. This technology has influenced investment trends and the future of the Internet. Accessing the metaverse typically requires key devices such as smartphones, virtual reality headsets, and digital currencies. The term "metaverse" has gained significant popularity in technology sectors, referring to a seamless virtual world where people can work, shop, and interact with colleagues. However, the metaverse's full potential is limited by current internet infrastructure, including home networks and mobile internet, which are not yet fully equipped to support these technologies.

In Tables 1 and 2, the synthesis of data and various components highlights the importance of technology in the development of the Metaverse and the essential attributes required to create high-quality and reliable experiences in virtual environments. The study identifies key technologies that contribute to the Metaverse, including Blockchain technology, Augmented Reality (AR) and Virtual Reality (VR), Artificial Intelligence (AI), 3D Reconstruction technology, the Internet of Things (IoT), and Network technology (5G).

Table 1. Analysis of technologies for the metaverse

| Technology for the Metaverse | Thien Huynh, Thippa Reddy., 2023 [8] | Swati Joshi, Pramod P.J., 2023 [9] | Agariadne Dwinggo, Usmeldi., 2022 [10] | Hang Lee, Tristan Braud., 2021 [11] | Haihan Duan, Jiaye Li., 2021 [12] |
|---|---|---|---|---|---|
| Blockchain | / | / | / | / | / |
| Artificial Intelligence (AI) | / | / | / | / | / |
| AR and VR | / | / | / | / | / |
| 3D Reconstruction | / | / | / | / | / |
| IoT | / | / | / | / | / |
| Network (5G) | / | / | / | / | / |

Table 2. Analysis of metaverse characteristics

| Metaverse Characteristics | Ge Wang, Andreu Badal., 2022 [13] | Agariadne Dwinggo, Usmeldi., 2022 [10] | Wei Yang, Bryan Lim., 2022 [14] | Lik-Hang Lee, Tristan Braud., 2021 [11] | Yuntao Wang, Zhou Su., 2022 [15] |
|---|---|---|---|---|---|
| Avatar | / | / | / | / | / |
| Content Creation | | / | | / | / |
| Virtual Economy | / | | | | / |
| Social Acceptability | / | / | / | / | / |
| Security and Privacy | / | / | / | / | / |
| Trust and Accountability | / | / | / | | / |

Additionally, the essential attributes necessary for creating immersive experiences in the Metaverse include Avatar, Content Creation, Social Acceptability, Security and Privacy, and Trust and Accountability.

### B. MIAP

The MIAP (Motivation, Information, Application, Progress) teaching process is designed to develop student learning by structuring instruction to encompass knowledge, skills, and attitudes. It emphasizes stimulating students' interest, providing essential information, applying knowledge, and monitoring student progress. This process [16] consists of four steps, as follows:

1) Motivation: This stage stimulates learners' interest in the problem, encouraging curiosity about the content. Instructors may use videos, images, or broad questions to engage most learners. Recent research highlights that incorporating gamified elements, such as interactive challenges or rewards, can significantly enhance student motivation and participation in digital learning environments [17].
2) Information: At this stage, learners receive the lesson content. Instructors must inform learners about the topics they will cover to prepare them for the class. This stage involves providing detailed content and knowledge, possibly through media or other resources. Studies emphasize that effective delivery of information, using multimedia principles like coherence and signaling, helps learners process and retain new material efficiently [18].
3) Application: This stage evaluates whether learners demonstrate behaviors that align with the learning objectives. This may involve exercises, practical tasks, or questions to assess learners' understanding and mitigate boredom. Evidence suggests that problem-based learning activities, such as collaborative problem-solving, foster critical thinking and improve learners' ability to apply knowledge in practical contexts [19].
4) Progress: This stage follows the application stage, using results from exercises or tasks to determine if the objectives are met. Instructors provide feedback if objectives are achieved; if not, they identify knowledge gaps and clarify concepts for learners. Technology-supported formative assessment enables instructors to track student progress effectively and provide tailored feedback to enhance continuous development [20].

The MIAP instructional model enhances learning through a structured approach. It starts by motivating students with creative activities like storytelling and analytical questioning to spark interest. Next, essential information is delivered in diverse formats, linking to students' prior knowledge for better understanding. In the application phase, students engage in hands-on practice through problem-solving to reinforce their skills. Finally, the progress tracking phase uses assessment tools to monitor development and provide feedback for continuous improvement. This holistic method creates an effective learning environment by blending content with practical, real-world applications.

### C. *Immersive Experience*

An immersive learning experience is defined by a memorable environment, making you feel as if you are inside and part of it. It involves technological environments controlling sensory inputs, such as virtual and mixed reality. Three key factors contribute to creating memorable experiences: image quality, sound quality, and interaction.

Table 3. Analysis of steps for creating an immersive learning experience

| Immersive Learning Experience Creation | Leonel Morgado, Manuel Torres., 2022 [21] | Siyu Bian, Xiwei Liu., 2022 [22] | Lana Franceska Dreimane 2022 [23] | Aarón Ramirez, Eréndira Gabriela., 2022 [24] | Liu Shuguang, Ba Lin 2021 [25] |
|---|---|---|---|---|---|
| Define objectives and learning outcomes | / | / | / | / | / |
| Establish 3D modeling guidelines | / | / | / | / | |
| Determine data visualization formats and attributes | / | / | | / | |
| Design and build virtual environments | / | / | / | / | / |
| Evaluate and improve | / | | / | / | |

In Table 3, the study and synthesis of the steps for creating an immersive learning experience reveal that there are five key steps, as follows:

1) Define learning objectives and scope.
2) Determine content based on learning objectives to serve as a guideline or framework for designing 3D simulations.
3) Specify the format and characteristics of data presentation, including setting the level of realism (the more detailed, the more realistic), Defining the type of immersion (e.g., resolution of the environment and 3D avatars), and Identifying interaction methods through devices such as gloves.
4) Design and develop the virtual environment according to the defined objectives and presentation format using relevant software.
5) Evaluate and refine the virtual environment for effective implementation.

## III. Research Methodology

This research involves reviewing relevant documents and studies to analyze components and steps for designing learning processes through the metaverse using MIAP to enhance immersive experiences. Therefore, this process includes the study of related documents and the design of a learning process to enhance immersive experiences with details as follows:

### A. *Literature Review*

The researcher reviewed information including documents, textbooks, research papers, articles, and theses related to the steps for creating immersive learning experiences, technologies for the metaverse, characteristics of the metaverse, and the steps for creating immersive learning experiences to analyze and synthesize into steps for creating immersive learning experiences through the metaverse.

### B. *Design of the Learning Process Model*

Based on document review and research, the researcher designed a learning process through the Metaverse to promote immersive learning experiences using the MIAP process and immersive learning experiences. The learning process through the Metaverse using MIAP to promote immersive learning experiences refers to the MIAP teaching process, which effectively promotes student learning and skills, aligning with the objectives of this research., as shown in Fig. 1. It includes: 1) Motivation; 2) Information; 3) Application; and 4) Progress. Additionally, the design for immersive learning experiences (PRAS Model) [26] includes four fundamental components that support learners and the learning environment. 1) Autonomy: Encourages learners to take control of their learning process, such as selecting topics or study methods. This fosters a sense of responsibility and motivation for learning. 2) Presence: Refers to the sense of connection or presence in the learning environment, particularly in online learning or technology-enhanced education. It helps learners feel engaged and able to interact with peers and content. 3) Realism: Involves creating a comprehensive and lifelike learning experience through real-world scenarios or case studies, making learning more meaningful. And 4) Subject: Represents diverse and challenging learning activities that promote learner engagement and knowledge development through research and hands-on practice.

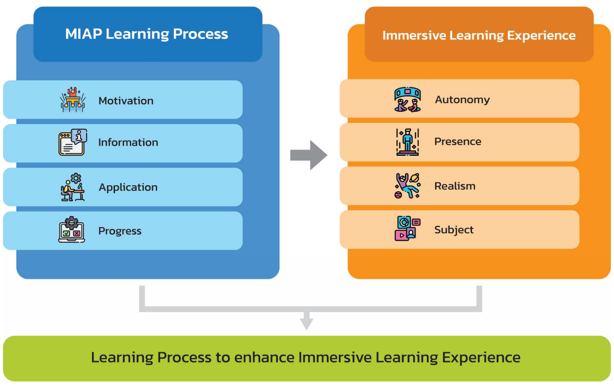


Fig. 1. The MIAP learning process to enhance immersive learning experiences.

The integration of the MIAP (Motivation, Information, Application, Progress) teaching process with the PARS Model helps create a deeply immersive learning experience: Motivation focuses on stimulating learners' interest by connecting lessons to their personal experiences and fostering an engaging learning environment. Information delivers accurate content through technology and realistic simulations, enabling learners to understand concepts within real-life contexts. The application provides hands-on activities that challenge learners and require practical knowledge application, such as project-based learning and scenario simulations, to enhance engagement. Progress includes effective feedback mechanisms and a tracking system that allows learners to monitor their development and continuously improve their learning process.

### *C. Design of the Learning Process through the Metaverse Using MIAP to Enhance Immersive Experiences*

The researcher designed the learning process by incorporating the content of museum design, which is part of the Exhibition Design course for second-year students in the Faculty of Architecture and Design. This content serves as the objective for this learning experience. The researcher developed a step-by-step learning process to promote an immersive learning experience following the MIAP learning model, with separate activities for instructors, students, learning support materials, and assessments at each stage, as detailed in Table 4. For this design, the chosen learning support material is the Metaverse. The evaluation is divided into two stages:

Stage One—After the Motivation and Information phases, assessment is conducted through an online quiz with 30 questions to measure achievement.

Stage Two—After completing the Application and Progress phases, the assessment is based on the students' museum design projects.

Table 4. Steps for the learning process to enhance immersive learning experiences through MIAP

| MIAP | Instructor Activities | Learner Activities | Supporting Tools | Evaluation |
|---|---|---|---|---|
| Motivation (M) | Stimulate and motivate interest.<br>- Use questions to stimulate interest<br>- Give examples of exhibition and museum formats<br>- Provide consultation | - Explore sample exhibitions or museums provided by the instructor<br>- Inquire | -Online museum | |
| Information (I) | - Guide students to study museum design through the metaverse museum<br>- Answer questions<br>- Conclude learning result | - Learn through the metaverse museum<br>- Inquire<br>- Take online survey | - Online museum<br>- VR glasses<br>- Online survey | - Evaluate results from immersive learning experience |
| Application (A) | - Demonstrate designing and developing a museum using Spatial.io<br>- Provide consultation and answer questions | - Learn to design and develop a museum through Spatial.io<br>- Inquire | - Spatial.io | |
| Progress (P) | - Provide consultation and answer questions<br>- Evaluate learner's design based on set objectives | - Design and develop a museum through Spatial.io<br>- Present their design work<br>- Inquire | - Spatial.io<br>- VR glasses | - Evaluate students' immersive design work |

### *D. Develop the Metaverse according to the Learning Process Using MIAP to Enhance Immersive Experiences*

In developing the Metaverse Museum, the researcher focused on creating an immersive learning experience by following a systematic process that integrates all five stages of immersive learning design. The design approach was based on a detailed study of the relevant literature and research in the field. By applying the MIAP teaching method, the researcher aimed to create a learning environment that is not only educational but also engaging and memorable, allowing students to interact with digital environments meaningfully.

The Metaverse Museum was designed to simulate the experience of a real-world museum, allowing learners to virtually explore and study artifacts as if they were walking through the actual space. The research also considered the principles of Universal Design to ensure accessibility for all learners, including those with disabilities. This is consistent with the Web Content Accessibility Guidelines (WCAG) that focus on making digital content perceivable, understandable, operable, and robust [27].

The Metaverse Museum was developed using Blender to define the museum's layout and proportions, ensuring the virtual space was accurately scaled to match real-world dimensions. Blender was used to create the 3D models and the overall structure of the museum, while Unity was utilized to develop the interactive user interface and user experience , as shown in Fig. 2. Spatial.io was also integrated to enhance spatial interaction and provide a more dynamic and flexible environment for the users. This combination of tools allowed for the creation of a highly interactive and immersive virtual learning space.

Throughout the design process, careful attention was paid to the integration of both educational content on museum design and the technology required to create a high-quality, immersive experience. By incorporating these elements into the design, the researcher aimed to ensure that the Metaverse Museum serves as an effective platform for promoting learning through exploration and interaction, offering students a chance to engage deeply with the material and the learning process itself.

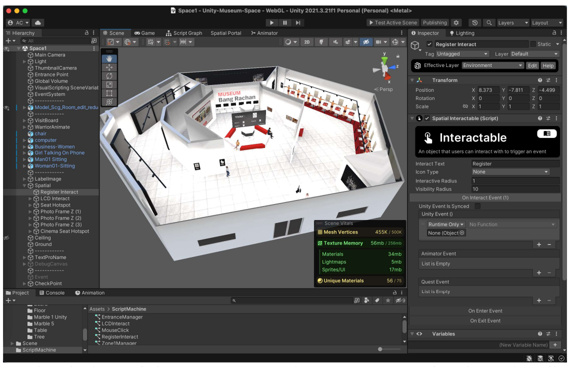


Fig. 2. The design of the User Interaction component for data visualization in the Metaverse Museum, used as an educational tool developed with Unity. This component enables users to explore information interactively, featuring touch inputs, 3D navigation, and real-time feedback to create an immersive learning experience.

### *E. Evaluation of the Learning Process through the Metaverse Using MIAP to Enhance Immersive Experiences*

The researcher defined the scope of the study by selecting a sample group consisting of 65 undergraduate students from the Interior Design Management and Business Development program at the Faculty of Architecture and Design. The sample was selected using simple random sampling. The study employed an experimental research design and a one-sample t-test to test the hypothesis for a single group.

The instructor followed the predefined teaching plan, as detailed in Fig. 3, while students engaged with the learning content and objectives before attending class by exploring the Metaverse Museum via Spatial.io, as shown in Fig. 4. After completing the exploration, students took a 30-question online test to assess their learning achievement. The results were analyzed using the mean ($\bar{X}$), standard deviation (S.D.), and t-test.

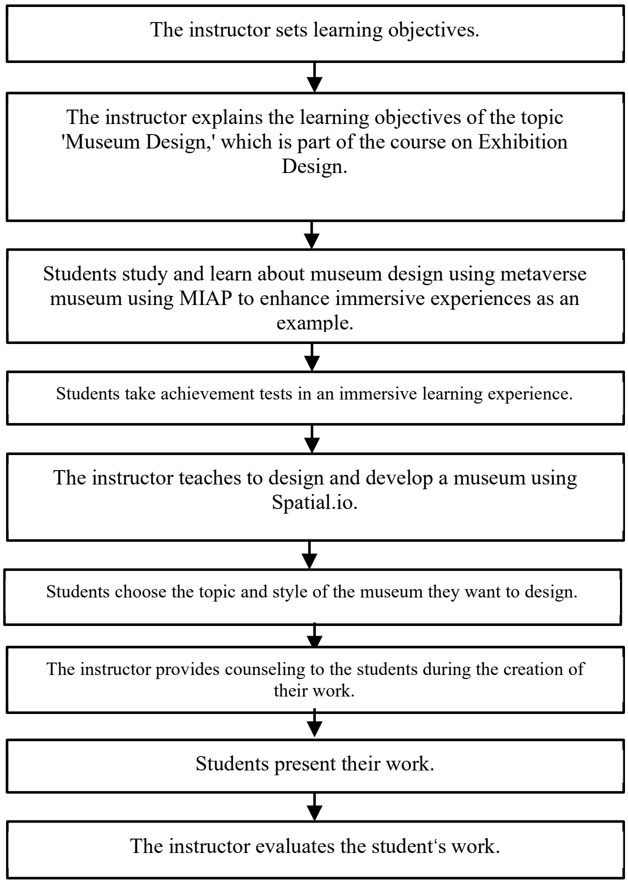


Fig. 3. The learning process of students in the Exhibition Design course through the MIAP learning approach within the Metaverse Museum.

Additionally, students were required to design their own Metaverse Museum as part of their assessment. Their work was evaluated based on two key Metaverse Components and Design Quality.

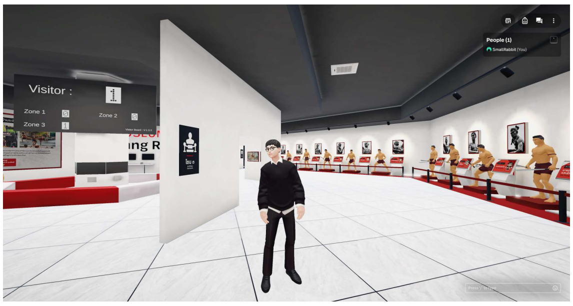


Fig. 4. A Metaverse Museum designed based on the MIAP learning approach, incorporating fundamental principles and key components of museum design.

## IV. Research Findings

1) After completing the Motivation and Information phases, students took a 30-question online test. The test was divided into five key areas, covering types of exhibitions, planning, artistic elements, operations, and exhibition outcomes. This assessment provided a comprehensive evaluation of students' understanding of exhibition design and management.

The assessment results of 65 students who engaged in immersive learning through the Metaverse Museum showed an average post-test score ($\bar{X}$) of 24.88 out of 30, with a standard deviation (S.D.) of 1.63.

The comparison of learning outcomes from the immersive learning experience through the Metaverse museum with the expected average (80%) was conducted using a one-sample t-test.

Table 5. The results of comparison of achievement results from the students' immersive learning experiences through metaverse

| Group | n | $\bar{X}$ | S.D. | t-test | Sig |
|---|---|---|---|---|---|
| Experimental Group | 65 | 24.88 | 1.63 | 4.325 | 0.001 |

The Table 5 shows that the average score of the experimental group who learned through metaverse using MIAP to Enhance an immersive learning experience was 24.88, with a standard deviation of 1.63 compared to the benchmark of 80% or equivalent to 24 points. This concludes that the average achievement score of students who learned through the metaverse was statistically higher than the benchmark at the .01 significant level.

2) The evaluation of students' design performance after learning through the Metaverse Museum was assessed in two aspects: Metaverse Components and Design. An example of a student's work is shown in Fig. 5.

Table 6. Table of evaluation results on students' design performance by category in each aspect

| Aspect | Components | Assessment list | $\bar{X}$ | Quality level |
|---|---|---|---|---|
| Museum Components | Accessibility within the Museum | 1.1 Clarity of objectives | 4.4 | High quality |
| | | 1.2 Consistency | 3.8 | Medium quality |
| | | 1.3 Simplicity | 3.9 | Medium quality |
| | | 1.4 Aesthetic value | 4.4 | High quality |
| | Museum Information Presentation | 1.5 Well-categorized and easily memorable information | 3.4 | Medium quality |
| | | 1.6 Engagement | 5 | Very high quality |
| Museum Design Based on Universal Design Principles | | 2.1 Perceptibility | 4.0 | High quality |
| | | 2.2 Comprehensibility | 4.4 | High quality |
| | | 2.3 Usability | 4.4 | High quality |
| | | 2.4 Adaptability | 4.0 | High quality |

The results showed that in the Metaverse Components aspect, the "Engagement" criterion received an excellent quality rating with a mean score of 5.0. In the Design aspect, both "Comprehensibility" and "Usability" were rated at a high-quality level, with a mean score of 4.4 each, as detailed in Table 6.

Overall, considering all evaluation criteria, the students' design performance was rated at a high level, with an average total score of 41.78 points.

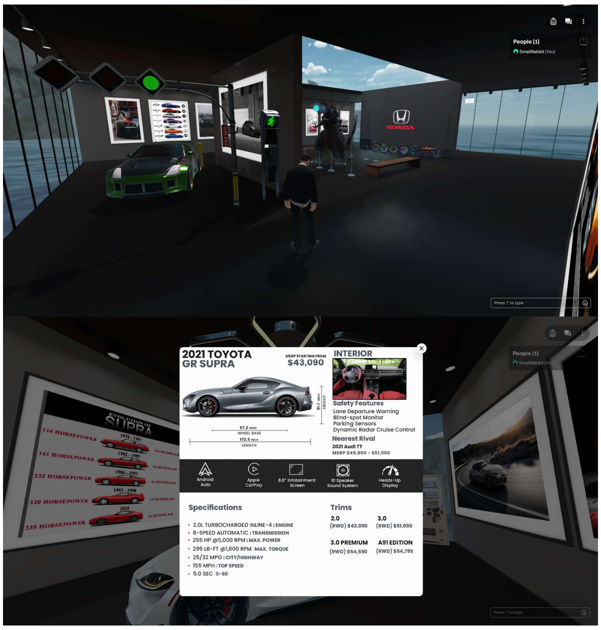

Fig. 5. Examples of student-designed Metaverse Museums created on Spatial.io.

## V. Conclusion and Recommendations

The application of the MIAP learning process in the Metaverse to create an immersive learning experience represents a significant innovation in integrating technology to enhance student learning. This approach not only enables students to interact with digital environments but also fosters their abilities in analysis, synthesis, and creative thinking. The findings indicate that by applying this model, students were able to develop a Metaverse Museum that effectively promotes knowledge dissemination successfully.

Throughout the process, students engaged in information research, planning, and designing interactive media within the Metaverse Museum. The results align with previous research [28, 29], which demonstrated that immersive learning experiences in Metaverse environments significantly enhance student comprehension, retention, and practical application of knowledge. Similarly, this study found that students who participated in the MIAP-based Metaverse Museum development exhibited higher proficiency in virtual environment design and a deeper understanding of museum curation principles compared to traditional learning methods. These results reinforce the effectiveness of immersive learning in fostering practical and conceptual knowledge.

The MIAP learning model in Metaverse-based education offers significant pedagogical benefits by fostering engagement, critical thinking, and knowledge retention through immersive digital experiences. This approach bridges theoretical concepts with hands-on application while ensuring inclusivity by aligning with Universal Design (UD) and Web Content Accessibility Guidelines (WCAG). The integration of WCAG principles Perceivable, Operable, Understandable, and Robust enhances accessibility, allowing students of diverse abilities to interact effectively within the Metaverse Museum. By embedding these principles, the MIAP process supports a more adaptable and inclusive learning environment, making immersive education accessible to a broader range of learners.

Despite these promising findings, this study has some limitations. The sample size was relatively small, limiting the generalizability of the results. Additionally, access to high-quality VR equipment varied among students, which may have affected their level of engagement and interaction within the Metaverse Museum. Moreover, this study primarily focused on short-term learning outcomes, and further research is needed to examine long-term impacts on student performance and skill development.

Future research should explore the scalability of the MIAP learning model across different educational levels and contexts, including secondary education and professional training programs. Additionally, developing more robust evaluation metrics for immersive learning experiences will further enhance the understanding of its effectiveness. Expanding the study to include a more diverse group of participants and integrating real-world applications of Metaverse-based learning will contribute to broader adoption and refinement of this innovative approach.

## Conflict of Interest

The authors declare no conflict of interest.

## Author Contributions

Mr. Sitthisak Chomjan is responsible for conducting research on the Metaverse learning process using MIAP to enhance immersive experience. Professor Dr. Panita Wannapiroon and Professor Dr. Prachyanun Nilsook provided expert guidance on the design of research instruments and offered recommendations on research methodologies, ensuring their refinement and equitable support throughout the study. All authors reviewed and approved the final version.

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