

## PAPER

# Fostering Engagement and Motivation: Evaluating Gamified Learning in the Metaverse for Architectural History Education

**Miram Ali** (✉)

Department of Architecture,  
College of Engineering and  
Information Technology,  
Onaizah Colleges, Qassim,  
Saudi Arabia

[miramali@oc.edu.sa](mailto:miramali@oc.edu.sa)**ABSTRACT**

Engagement and motivation are critical factors in effective learning, particularly in educational contexts that require deep understanding and retention, such as architectural history. This study investigates the role of gamified learning in the metaverse as a tool to enhance student engagement and motivation. Using the Spatial platform, a virtual learning environment was developed where participants interact with digitally reconstructed historical landmarks and complete tasks that explore architectural styles, techniques, and cultural contexts. The research evaluates the impact of this immersive approach on learning outcomes by focusing on participant engagement and intrinsic motivation. A mixed-methods approach is employed, collecting data through pre-and post-tests, engagement questionnaires, usability surveys, and in-game analytics such as task completion rates and time spent in the virtual environment. Qualitative insights are gathered through interviews to understand user perceptions of the gamified experience. These results show that metaverse-based gamified learning can make people more interested and motivated, making it a great way to teaching architectural history and other complex subjects.

**KEYWORDS**

gamification, learning engagement, motivation, metaverse, architectural education

## 1 INTRODUCTION

Technology facilitates access to information and promotes knowledge growth and exchange, but teachers still need to figure out how to boost students' motivation and engagement [1, 2]. Many attempts have been made to create creative teaching methods that will increase students' concentration, commitment, and retention of the subject matter. Among other strategies, educators have recently started looking into how gamification could enhance student learning [3].

Ali, M. (2025). Fostering Engagement and Motivation: Evaluating Gamified Learning in the Metaverse for Architectural History Education. *International Journal of Interactive Mobile Technologies (IJIM)*, 19(6), pp. 48–59. <https://doi.org/10.3991/ijim.v19i06.53841>

Article submitted 2024-12-17. Revision uploaded 2025-01-20. Final acceptance 2025-01-22.

© 2025 by the authors of this article. Published under CC-BY.

As a cutting-edge technology that could transform many aspects of our lives, the metaverse concept has received a lot of attention recently. The metaverse a virtual reality environment allows users to interact simultaneously with one another and a digitally created environment. Although the metaverse has historically been primarily associated with games and entertainment, its potential impact on education and student engagement is becoming more and more apparent [4].

In architectural education, the metaverse is also being used increasingly often [5]. Conventional education frequently has trouble keeping pupils interested and motivated, which can cause them to stop studying and provide less than ideal learning results. In order to create a more engaging and rich learning environment, educators and students are actively working to take advantage of the metaverse immersion and interaction [6].

One of the major issues in teaching architecture and civil engineering in many countries is teaching construction. Because architectural components (structure, foundations, façades, etc.) are frequently concealed in existing structures, students frequently struggle to comprehend how they materialize constructively. Site visits have become crucial since the majority of relevant learning resources, which demonstrate these features through writing and visuals, are insufficient for architecture students [7]. However, there are several disadvantages to site visits to construction sites, including security hazards that require specialized insurance or transportation to locations that aren't usually reachable by public transportation.

Augmented reality (AR) visits to works in a metaverse setting can be used to enhance conventional media in the field of architecture education, which is encouraged by a context where students are digital natives. A novel paradigm based on technologies such as AR, virtual worlds (VWs), mirror worlds (MWs), and lifelogging is represented by the metaverse, immersive, and interactive settings [8].

Gamification components are essential to the metaverse learning process because they apply game design concepts to improve user engagement and participation [9]. Gamification gives students a more engaging and joyful educational experience by including components such as challenges, incentives, and social engagement. Though the metaverse has enormous educational potential, it is still difficult to implement gamification in a way that improves user learning experiences.

## 2 LITERATURE REVIEW

[10] investigated using gamification in education to increase student engagement and motivation. The report also makes ideas for successfully using gamification in education, such as explicitly identifying learning objectives and matching them to game elements, giving fast feedback, and fostering teamwork. Furthermore, the possible obstacles of gamification in education are discussed, such as the danger of instilling extrinsic motivation, the impression of gamification as a gimmick, and the necessity to ensure that gamified learning activities correspond with learning objectives.

[11] examined the impact of gamification on the education industry, with an emphasis on improving metaverse-based learning among university students. This study establishes a conceptual framework and finds variables from all three models. These characteristics were utilized to develop the structured questionnaire. Acceptable hypotheses demonstrated a substantial link between GAM, SN, PBC, and MBL adoption. ATT had a favorable correlation with the GAM for adopting MBL. PU is significantly associated with TRU and ATT, respectively. PU and PEOU showed no significant correlation with INS or DIS. PEOU also had non-substantial contact with TRU or ATT.

[12] created a metaverse virtual learning management model utilizing gamification techniques (MVLM-Gt model) and assessed its effectiveness. The MVLM-Gt model was shared with seven specialists, who subsequently completed an appropriateness survey. The MVLM-Gt model included four primary elements: inputs, learning, evaluation, and feedback. The learning pathway included five phases: motivation and goal establishment, content formulation, interaction and involvement, practice and assignments, and recap and feedback. The specialists evaluated the MVLM-Gt model as exceptional (mean = 4.82, SD = 0.38). The findings indicated that the MVLM-Gt model could enhance students' overall experience.

[13] presented a gamified online tool for architecture education that uses a metaverse foundation. Eduverse uses game-engine technology to create a multi-layered infrastructure that incorporates computational methodologies, content development, and user experience design, reimagining the traditional curriculum. The system's efficacy is measured by comparing it to current digital pedagogy literature and analyzing user input after evaluating a live version.

[14] analyzed the conception and implementation of immersive, gamified experiences within the metaverse to enhance student learning. We examine the theoretical underpinnings of gamification and immersive learning and demonstrate how these concepts can be effectively leveraged in a metaverse context to boost student engagement and motivation. They conclude by exploring the potential of gamified learning in the metaverse and suggesting directions for future study and advancement. Their study contributes to the growing body of research on education in the metaverse and provides useful guidance for educators and instructional designers who want to take advantage of this new technology's potential for innovative teaching and learning.

### 3 METHODOLOGY

This study employed a mixed-methods approach to investigate how metaverse-based gamification impacts student engagement and motivation in historical architecture courses. Central to this research was the development of the Near East Civilization Metaverse Game, a gamified virtual learning environment designed using the spatial platform. This environment provided participants with an immersive experience, enabling them to explore digitally reconstructed landmarks and interact with tasks related to the architectural styles, techniques, and cultural traditions of Mesopotamian civilizations.

#### 3.1 Development of the metaverse game

The Near East Civilization Metaverse Game was a key component of this study, designed to simulate a historical classroom and foster engagement through gamification.

#### 3.2 3D modeling and reconstruction

Landmarks from Near Eastern civilizations were meticulously reconstructed using Blender to ensure historical and cultural accuracy. Architectural details, such as inscriptions, textures, and artifacts, were integrated to provide an authentic and educational experience. The 3D modeling and reconstruction are depicted in Figure 1.



Fig. 1. 3D modeling and reconstruction of Mesopotamian architecture, creating an immersive educational experience

**Interactive features.** Gamified elements, including quizzes, artifact discovery tasks, and narrative-based storytelling, were added to enhance participation.

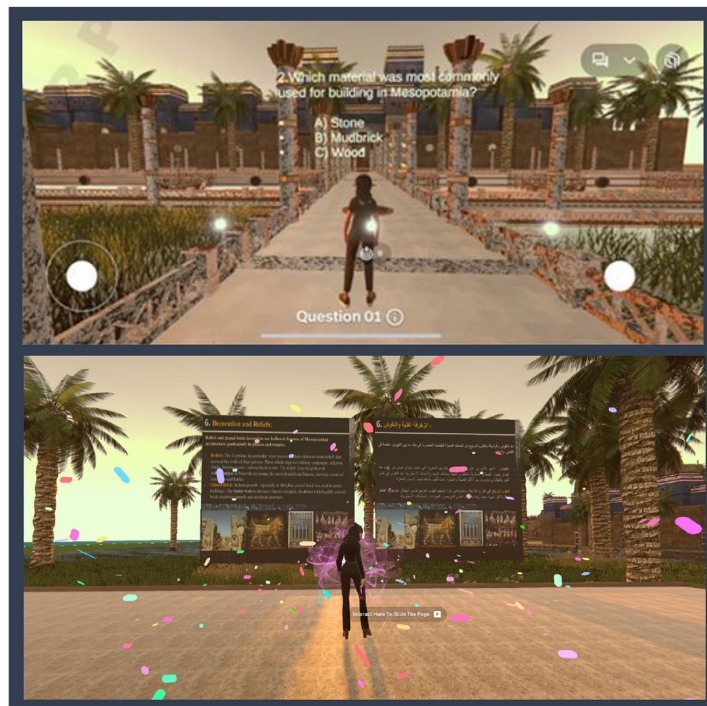


Fig. 2. Interactive features enhancing gamified learning through quizzes, exploration, and storytelling in a virtual environment

A token and reward system encouraged users to complete tasks, explore virtual environments, and achieve milestones. Figure 2 represents interactive features in gamified learning.

### 3.3 Integration and optimization

The 3D models were imported into Unity 3D, where the Spatial SDK enabled features such as avatar navigation, real-time user interaction, and compatibility across devices (e.g., VR headsets, mobile devices, and desktops). The game was optimized for performance and accessibility to ensure seamless interaction for a wide range of participants.

**Study design.** Participants were divided into two groups to evaluate the effectiveness of the metaverse game.

1. Traditional Group: Engaged in conventional teaching methods, such as lectures and textbook-based learning.
2. Gamified Group: Used the Near East Civilization Metaverse Game, completing interactive tasks, exploring reconstructed landmarks, and participating in gamified activities.

### 3.4 Gamified activities and engagement metrics

The Near East Civilization Metaverse Game incorporated activities designed to measure engagement and learning outcomes.

#### Gamified activities

- Exploring reconstructed historical landmarks.
- Completing quizzes and challenges related to architectural styles and cultural contexts.
- Collecting tokens and earning rewards for task completion.

**Engagement metrics.** Time Spent on Activities: Total time participants spent navigating and interacting in the virtual environment.

Frequency of Interactions: Number of meaningful in-game actions, such as artifact clicks, completed tasks, and peer collaborations.

### 3.5 Data collection methods

A combination of quantitative and qualitative methods was used to evaluate the impact of the gamified metaverse environment.

**Intrinsic Motivation Inventory (IMI).** Pre- and post-tests measured participants' motivation, perceived competence, and interest in the learning process.

**In-Game Analytics:** Data such as task completion rates, tokens earned, time spent in the game, and interaction frequency was collected to assess engagement.

**Usability Testing:** Engagement surveys and usability questionnaires assessed the ease of use, satisfaction, and overall effectiveness of the metaverse game.

**Semi-Structured Interviews:** Interviews captured participants' qualitative feedback about their experiences, perceptions of the gamified approach, and its influence on their learning.

**Ethical Considerations:** The study adhered to ethical guidelines to protect participants' rights.

**Informed Consent:** Participants were fully informed about the study's objectives, procedures, and their right to withdraw at any time.

**Privacy Protection:** Participant data, including in-game analytics and survey responses, were anonymized to ensure confidentiality and data security.

**Framework for engagement scoring.** An engagement score (ES) was calculated to quantify participants' level of engagement in the virtual environment.

- **Time Spent on Activities:** Reflects the level of immersion and sustained interest in the game.
- **Frequency of Interactions:** Measures the active participation and involvement in gamified tasks and virtual environment features.

The current study used a mixed-methods approach to examine the effects of metaverse-based gamification on students' motivation and engagement in historical architecture courses. Using the spatial system, a historical classroom simulation was created that included a variety of building styles, architectural designs, and traditions. We employed interactive tests, token-and-reward-based research, and other gamified activities to encourage participation and evaluate progress.

Traditional teaching methods were employed by one group while the gamified metaverse interface was utilized by the other. The Intrinsic Motivation Inventory (IMI) was used to measure a number of metrics before and after the tests, including accomplishment rates, time spent in the environment, and frequency of interactions. Usability testing of in-game analytics and engagement surveys was also employed to monitor these factors. The study employed semi-structured interviews to collect qualitative data regarding the perspectives and experiences of the participants. To receive IRB clearance, two ethical standards that must be strictly followed are informed consent and participant privacy protection. A thorough framework for assessing how gamified learning in the metaverse boosts motivation and engagement is offered by this creative method of teaching architectural history.

Two examples of variables that can be used to calculate the *ES* are the amount of time spent on activities and the frequency of interactions in the virtual world.

$$ES = w_1(TS) + w_2(TCR) + w_3(IF) \quad (1)$$

Where,

*TS* – Time Spent in the virtual environment

*TCR* – Task Completion Rate

*IF* – Interaction Frequency

$w_1, w_2, w_3$  – Weights assigned to each factor, summing to 1 ( $w_1 + w_2 + w_3 = 1$ ).

The motivation index (*MI*) can be assessed using survey data on intrinsic motivation and perceived usability.

$$MI = \frac{\sum_{i=1}^n S_i}{n} \quad (2)$$

Where,

$S_i$  – Score for each motivation-related survey item (e.g., Likert scale scores from 1 to 5)

$n$  – Total number of survey items.

The performance difference between pre- and post-tests determines the improvement in learning outcomes.

$$LOI = \frac{PT - P_rT}{P_rT} \times 100 \tag{3}$$

Where,  $PT$  – Post-test score and  $P_rT$  = Pre-test score  
 Task efficiency ( $TE$ ) evaluates how effectively participants complete tasks in the virtual environment.

$$TE = \frac{TCR}{TS} \tag{4}$$

Where,  
 $TCR$  – Task Completion Rate  
 $TS$  – Time Spent in the virtual environment  
 Retention measures the amount of knowledge that students retain after a lesson.

$$RR = \frac{R_{post}}{R_{total}} \times 100 \tag{5}$$

Where,  
 $R_{post}$  – Number of correctly recalled concepts in the post-test  
 $R_{total}$  – Total number of concepts tested

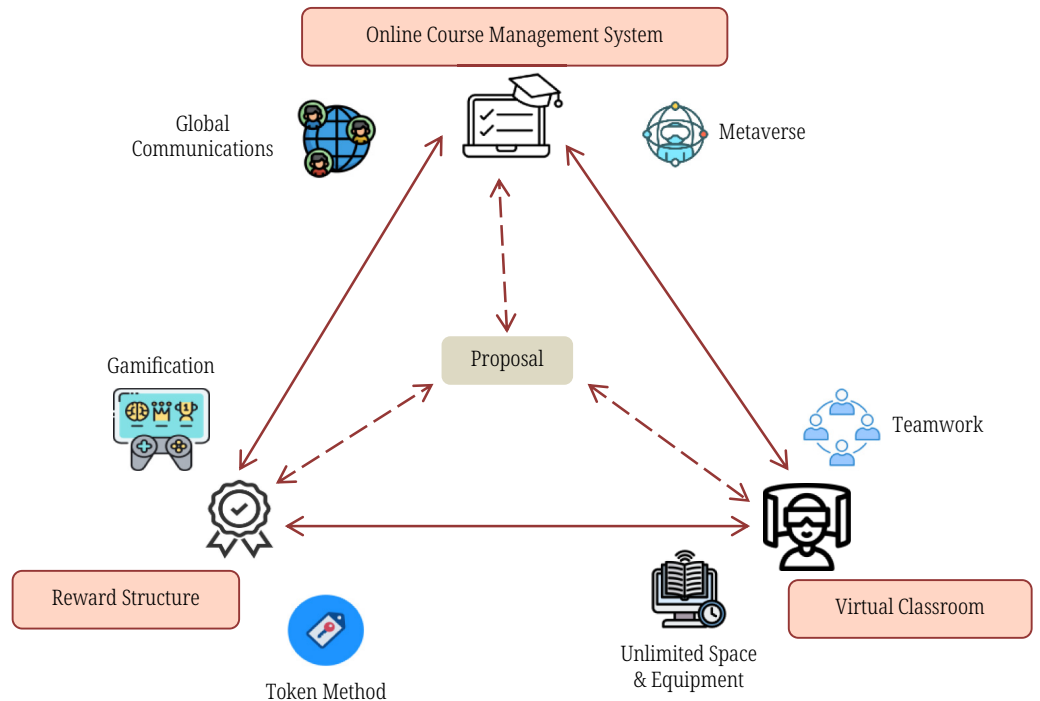


Fig. 3. Proposed architecture of metaverse-based gamified learning

The architecture of a Metaverse-based Gamified Learning System is shown in Figure 3, which combines three crucial components—the Virtual Classroom, the Reward Structure, and the Online Course Management System—to produce an engaging and immersive learning environment. The core hub is the online course

management system, which facilitates global communication and organizes instructional materials. It has features such as metaverse integration to create immersive virtual experiences and global communications to help users interact with one another.

The goal of the Reward Structure is to increase motivation by incorporating gamified elements such as a token system in which participants receive virtual tokens as rewards and gamification strategies that promote participation and engagement. The Virtual Classroom is an online setting that uses the metaverse to simulate interactions in a traditional classroom. Physical restrictions are removed, and teamwork is promoted to improve participant cooperation by offering an infinite amount of space and resources.

Since a central proposal node connects these components, seamless coordination and communication throughout the system are ensured. The mutual ties among the components demonstrate their interdependence. For example, an online course management system sends instructional materials to the virtual classroom, which are subsequently upgraded in response to classroom comments. Gamification in the virtual classroom endorses student commitment by triggering incentive structures.

To enable efficient progress tracking and prize distribution, the Online Course Management System and prize structure are also connected. By removing physical barriers, this paradigm fosters a cooperative, productive, and interesting learning environment. Additionally, it offers incentives and boosts motivation to promote positive online interactions and collaboration.

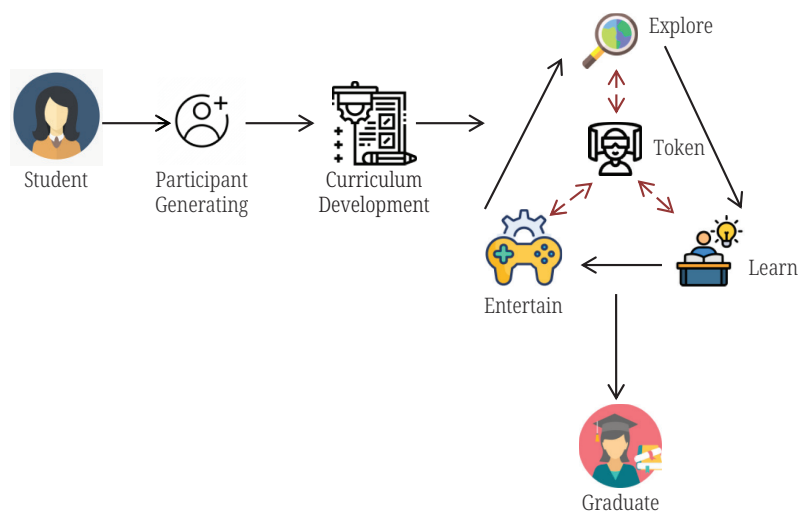


Fig. 4. Working process of proposed metaverse-based gamified learning

The metaverse-based proposed gamified learning process is shown in Figure 4. In the metaverse-based gamified learning approach, enrolling in the course and actively participating in the onboarding process is the first step. In order to increase student engagement and align with learning objectives, a customized curriculum that includes gamified components such as interactive exercises and assignment problems is created in the metaverse.

Students can explore the virtual environment, complete tasks, and receive tokens for their achievements by using digitally replicated resources. Because they act as motivating incentives, these tokens raise engagement and intrinsic motivation. The teaching and learning process is made more dynamic and engaging by including entertainment components. As a result, students maintain their motivation.

This methodology provides a robust framework for assessing the impact of metaverse-based gamified learning on motivation and engagement. By integrating the Near East Civilization Metaverse Game into an educational context, this study offers insights into how immersive technologies can enhance traditional teaching methods and foster deeper connections with historical and cultural subjects.

## 4 RESULTS AND DISCUSSION

Several important educational concepts, including the importance of participation and experiential learning, are supported by the study's findings. Game-based learning environments such as the metaverse used in this study use intrinsic motivators such as challenges, rewards, and feedback to encourage students to take an active role in their education. In this case, interactive assignments and token-based incentives inspired students, boosting their confidence and commitment to the subject.

Student engagement was enhanced by the metaverse's multimodal learning environment and other alluring elements. Students are given a comprehensive environment that helps them comprehend and remember challenging architectural history topics when virtual environments with interactive visual and aural elements are included. It has been shown that learning environments with a range of media and interactions improve comprehension and memory of information.

As the experimental groups showed, maintaining a balance between ability and difficulty is crucial for achieving consistent increases in student excitement and engagement. Appropriately difficult assignments aid in focus and maintain students' interest in the subject. It appears that the gamified metaverse activities were successful in striking this balance because participation levels steadily increased throughout the program. Furthermore, the immersive experiential features of the metaverse platforms made it possible to interact directly with historical sites and learn contextual information. By relating abstract concepts to real-world uses, students were better able to comprehend and retain architectural ideas. According to the study, students' academic performance and motivation can be significantly raised by gamified immersive settings such as the metaverse. Through the provision of engaging and immersive activities, these platforms make challenging subjects such as architectural history more approachable and fascinating while encouraging students to actively participate in the learning process.

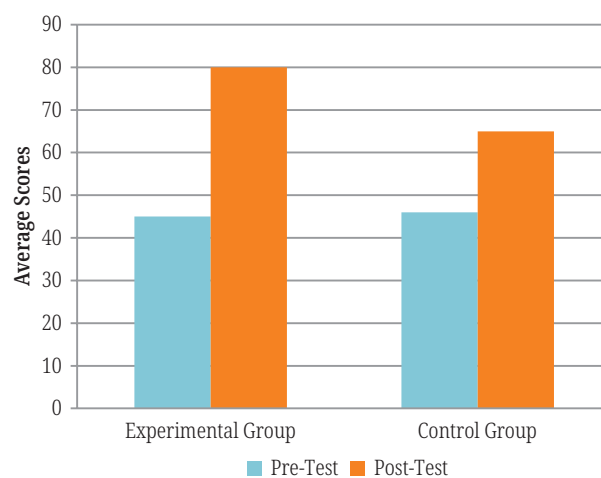


Fig. 5. Pre- and post-test scores

The experimental and control group participants pre- and post-test results are shown in Figure 5. After learning in the metaverse through gamification, the experimental groups' post-test scores significantly increased, going from an average of 45 to 80. The control group that received instruction using conventional methods increased less from 46 to 65. This notable discrepancy highlights how effective gamified learning is at enhancing students' comprehension and memory of architectural history.

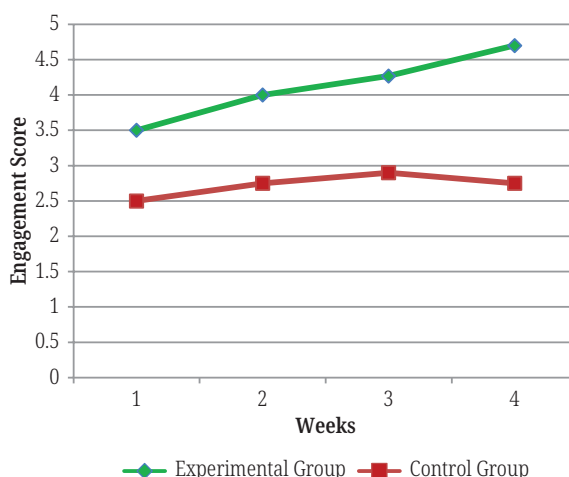


Fig. 6. Engagement levels over time

For both the experimental and control groups, Figure 6 tracks participant engagement rates over four weeks. From 3.5 in Week 1 to 4.7 in Week 4, the experimental group's engagement level steadily increased. In contrast, the control group's scores varied only slightly, ranging around 2.8. According to this pattern, the metaverse can, in contrast to traditional teaching techniques, sustain and improve student engagement throughout the learning process.

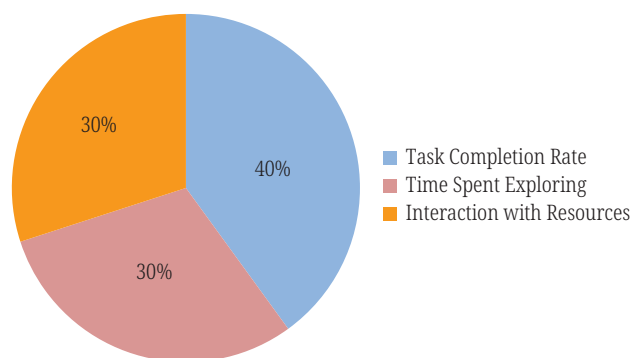


Fig. 7. In-game metrics

The distribution of tasks completed by participants in the gamified virtual environment is shown in Figure 7. Task completion accounted for the largest portion of activity (40 percent), while exploration and interaction with educational materials each accounted for 30 percent. This fair distribution shows that the gamified approach effectively combines opportunities for self-directed exploration with structured learning objectives, resulting in a comprehensive and engaging learning environment.

## 5 CONCLUSION

The potential for transformation through gamified learning in the metaverse for enhancing motivation and engagement in architectural history education is emphasized in this paper. By combining gamification strategies with immersive virtual environments, students could interact with historically accurate digital recreations, finish interactive tasks, and learn about architecture in a very interesting way. Students are much more intrinsically motivated and engaged with the learning outcomes when using the gamified metaverse platform as opposed to traditional teaching methods. According to quantitative data, gamified components such as challenges and token-based rewards increased the task rate of completion while maintaining user engagement. According to qualitative comments, the immersive environment improved participants' comprehension and retention of complicated architectural concepts. This study demonstrates that when teaching challenging subjects such as architectural history, gamification and metaverse technologies work effectively together. Educators may use it as a foundation to create fascinating dynamic classes that motivate and engage students. Modern technology and increased gamified tactics in numerous fields may make it possible to increase the learning impact.

## 6 REFERENCES

- [1] K. Al-Said, "Influence of teacher on student motivation: Opportunities to increase motivational factors during mobile learning," *Education and Information Technologies*, vol. 28, pp. 13439–13457, 2023. <https://doi.org/10.1007/s10639-023-11720-w>
- [2] Z. Snezhko, D. Babaskin, E. Vanina, R. Rogulin, and Z. Egorova, "Motivation for mobile learning: Teacher engagement and built-in mechanisms," *International Journal of Interactive Mobile Technologies (IJIM)*, vol. 16, no. 1, pp. 78–93, 2022. <https://doi.org/10.3991/ijim.v16i01.26321>
- [3] D. E. Cahyani, S. Wahyuningsih, D. Rahmadani, K. Khotimah, and N. A. Atan, "User interface design for dyslexia children learning application using design thinking approach," *International Journal of Interactive Mobile Technologies (IJIM)*, vol. 18, no. 6, pp. 84–96, 2024. <https://doi.org/10.3991/ijim.v18i06.47973>
- [4] A. Al Yakin and P. M. I. Seraj, "Impact of metaverse technology on student engagement and academic performance: The mediating role of learning motivation," *International Journal of Computations, Information and Manufacturing (IJCIM)*, vol. 3, no. 1, pp. 10–18, 2023. <https://doi.org/10.54489/ijcim.v3i1.234>
- [5] S. Shakeri and M. A. Ornek, "How metaverse evolves the architectural design," *Architecture and Planning Journal (APJ)*, vol. 28, no. 3, 2023. <https://doi.org/10.54729/2789-8547.1230>
- [6] S. Salloum *et al.*, "Sustainability model for the continuous intention to use metaverse technology in higher education: A case study from Oman," *Sustainability*, vol. 15, no. 6, p. 5257, 2023. <https://doi.org/10.3390/su15065257>
- [7] B. Onecha, C. Cornadó, J. Morros, and O. Pons, "New approach to design and assess metaverse environments for improving learning processes in higher education: The case of architectural construction and rehabilitation," *Buildings*, vol. 13, no. 5, p. 1340, 2023. <https://doi.org/10.3390/buildings13051340>
- [8] J. de la Fuente Prieto, P. Lacasa, and R. Martínez-Borda, "Approaching metaverses: Mixed reality interfaces in youth media platforms," *New Techno Humanities*, vol. 2, no. 2, pp. 136–145, 2022. <https://doi.org/10.1016/j.techum.2022.04.004>

- [9] C. C. Liu, Y. Y. Lin, F. Y. Lo, C. H. Chang, and H. M. Lin, “From readers to players: Exploring student engagement in a gamified metaverse and its effect on reading interest,” *Education and Information Technologies*, vol. 30, pp. 421–447, 2024. <https://doi.org/10.1007/s10639-024-13068-1>
- [10] R. B. Nacional, “Gamifying education: Enhancing student engagement and motivation,” *Puissant*, vol. 5, pp. 1511–1524, 2024.
- [11] T. Das, S. Ganesh Kondamudi, M. Dawood Babakerkhell, D. Pal, R. Roy, and S. Funilkul, “Intention for enhancing metaverse-based learning using gamification among university students: A study using Delphi and structural equation modelling approaches,” *Cogent Business & Management*, vol. 11, no. 1, 2024. <https://doi.org/10.1080/23311975.2024.2380016>
- [12] S. Srisawat and P. Piriyasurawong, “Metaverse virtual learning management based on gamification techniques model to enhance total experience,” *International Education Studies*, vol. 15, no. 5, pp. 153–163, 2022. <https://doi.org/10.5539/ies.v15n5p153>
- [13] M. Tsiliakos and S. Bassing, “Eduverse: Exploring gamification and the metaverse in architectural pedagogy,” in *ACCELERATED DESIGN, Proceedings of the 29th International Conference of the Association for Computer Aided Architectural Design Research in Asia (CAADRIA) 2024*, 2024, vol. 3, pp. 59–68. <https://doi.org/10.52842/conf.caadria.2024.3.059>
- [14] R. Damaševičius and T. Sidekersniene, “Designing immersive gamified experiences in the metaverse for enhanced student learning,” in *2023 International Conference on Intelligent Metaverse Technologies & Applications (iMETA)*, 2023, pp. 1–6. <https://doi.org/10.1109/iMETA59369.2023.10294971>

## 7 AUTHOR

**Dr. Miram Ali** is an Assistant Professor of Architecture and specializes in innovative teaching methods and immersive learning technologies. Her research focuses on integrating the metaverse and gamified approaches to enhance engagement, motivation, and accessibility in architectural education, heritage, and tourism (E-mail: [miramali@oc.edu.sa](mailto:miramali@oc.edu.sa)).