Collaborative Development of 3D Game Assets for Visualizing Malang's Iconic Places in a VR 360 Presentation

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Abstract

The development of immersive technologies such as Virtual Reality (VR) opens new opportunities in the visualization of cultural heritage and educational innovation. This research aims to design and implement a collaborative project-based learning model for creating 3D game assets to visualize Malang's iconic places in a VR 360 presentation format. The study involves students and lecturers in the 3D asset production cycle, from modeling and texturing to optimization for VR platforms, using an interactive educational media design approach combined with collaborative practices. The output includes five high-quality 3D assets representing Tugu Malang, Singosari Temple, Kotabaru Station, Kayutangan Heritage, and Simpang Balapan, all integrated into an immersive VR environment. Beyond improving production efficiency and asset quality, this initiative emphasizes cultural preservation and the enhancement of digital competence through immersive technology. It provides a meaningful project-based learning experience, strengthening technical and collaborative skills while supporting the local creative industry. This research demonstrates the potential of synergy between academia and students to create immersive digital content that promotes local identity and educational advancement in the digital transformation era.

Keywords: *3D Game Assets, Virtual Reality (VR), Project-Based Learning, Digital Heritage, Malang City Icon, Environment and Props Design*

1. Introduction

Digital transformation has penetrated various sectors, including education and cultural preservation. One of the most significant manifestations of this transformation is the use of immersive technologies such as Virtual Reality (VR) and Augmented Reality (AR) (Kamińska et al., 2023; Yulando et al., 2024). These technologies offer new ways to interact with digital content, creating more profound and engaging experiences than traditional media. In the context of education, 3D immersive learning environments have been shown to increase student engagement and understanding (Mystakidis et al., 2017), aligning with the emergence of the Massive Open Metaverse Course (MOMC) concept, which integrates the metaverse for richer learning experiences (Zhang et al., 2023).

In Indonesia, the potential of the metaverse and immersive technologies for education and other sectors is being seriously analyzed (Setiawan, 2022). The use of this technology opens opportunities for cultural preservation through more trendy and engaging media for the younger generation, such as 3D games and VR applications (Ahmad et al., 2022). Malang City, with its rich history and architectural icons, is an ideal subject for digital

visualization (Wijaya et al., 2023). However, creating high-quality 3D assets that accurately represent these places for immersive platforms requires significant resources and expertise.

To address this challenge, this research proposes a collaborative project-based learning model. This model involves Animation students in the 3D asset production process for five iconic locations: Tugu Malang, Singosari Temple, Kotabaru Station, Kayutangan Heritage, and Simpang Balapan. Its purpose is not only to produce digital assets for a VR 360 presentation but also to build a collaborative, project-based learning model, involving students across classes within a single academic year and lecturers to work together in a standard industry production workflow. Through this model, students gain direct experience that enhances their digital competence as well as technical and collaborative skills, in line with efforts to improve graduate employability (Yulando et al., 2024).Thus, this research seeks to make a dual contribution: Developing 3D Game Aset that promotes local identity and developing an effective pedagogical model for vocational education in the digital era.

2. Method

This research adapts a multimedia production workflow that aligns with the interactive media development model. The research stages are structured based on standard production phases in the digital creative industry by Villamil and Molina Multimedia Development Model (1998), which include concept development, pre-production, production, post-production, and delivery (Eriya & R.Putri, 2018).

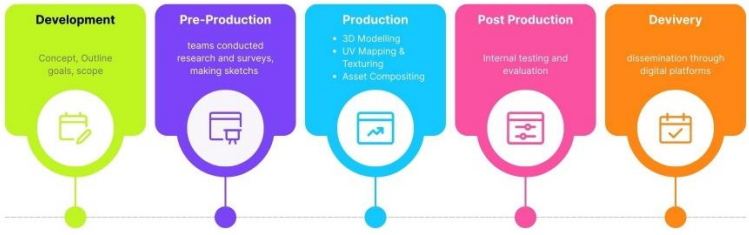

Figure 1. Villamil and Molina Multimedia Development Model

This approach was chosen to effectively structure the collaborative process between the researcher and the students. , which include:

- **Concept Development:** Students from four classes were divided into small groups to formulate ideas and visual concepts for each iconic location. This process began with internal group discussions, which were then presented to the entire class for feedback. This model encouraged information exchange between groups, especially those working on the same location.
- **Pre-production:** The teams conducted research and surveys to gather visual references and historical data. The results were translated into concept art and detailed asset lists, managed using collaborative tools like Google Drive.
- **Production:** In this phase, the technical process of asset creation took place, including modeling, UV mapping, and texturing. The lecturer acted as a facilitator and art director, providing technical and artistic guidance. Progress was tracked using spreadsheets with a system similar to sprints in Agile methodology.
- **Post-production and Delivery:** Finished assets were internally tested, integrated into a game engine, and evaluated for performance before being prepared for distribution.

This approach was chosen to effectively structure the collaborative process between the researcher and the students and to simulate a professional work environment.

educational or tourism exhibitions and as teaching material in an academic setting.

3. Results and Discussion

a. Collaborative Development Process and Workflow

The collaborative process in this research was designed as a simulation of a creative industry workflow, adopting project-based learning principles. The workflow was divided into several main production phases:

Concept Development

In this initial stage, the idea, goals, and objectives of the virtual reality application were formulated. Students from four classes were divided into small groups, with each group responsible for one iconic location. The process began with internal group discussions to formulate concepts, which were then presented to the entire class. This model encouraged information exchange between groups, leading to a mutual enrichment of ideas. The lecturer acted as a facilitator and art director, providing technical and artistic guidance. The main concept was to create an engaging 3D visualization of Malang's five iconic locations (Wijaya et al., 2023), complete with asset specifications, visual style, and target audience determination.

Pre-production

This stage focuses on gathering materials and detailed production planning. The team conducted research to collect visual references as well as historical and architectural data. For project management, the team used collaborative tools like Google Drive for sharing references and assets. The results of this research were then translated into concept art and a detailed asset list with technical specifications.

Figure 2. Team Conducting Observation and Research

Production

This is the technical implementation stage of visual asset creation. Production progress was tracked using spreadsheets adopting a system similar to sprints in Agile methodology, where each production stage had clear targets and deadlines. The main processes in this stage include:

- **3D Modeling:** Creating 3D models of every object, from main buildings to supporting environmental assets, using software like Blender.

- **UV Mapping & Texturing:** Performing UV mapping and creating material textures to give each model a realistic surface appearance, using software like Adobe Substance Painter.
- **Asset Compositing:** Ensuring all created 3D assets are efficient and optimized to run smoothly on the VR platform.

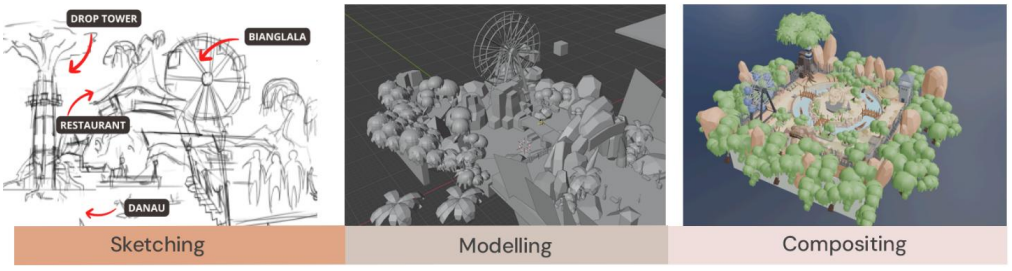

Figure 3. Production of Simpang Balapan 'Jurrasic Theme Assets'

Post-production

At this stage, the completed 3D assets enter internal testing and evaluation by the team. The assets are imported into a adobe after effects be assembled into a complete scene into VR. Internal evaluation is conducted based on the aspects of Visual Quality, Accuracy, and Technical Performance. Iterative review sessions were held for continuous improvement until all assets were finalized.

Delivery

This is the final stage of the development process. Once all assets are integrated and the VR application has passed final testing, the product is ready for distribution. The distribution plan includes packaging the application for VR devices, dissemination through digital platforms, and its use as media in educational or tourism exhibitions and as teaching material in an academic setting.

By following the structured production phases, students focused not only on the technical output but also on the teamwork process. This workflow proved effective in enhancing students' skills in communication, project management, and team-based problem-solving, providing them with an experience that closely mirrors a professional work environment. The use of collaborative tools, presentation sessions, and feedback between groups ensured that collaboration and iteration were keys to success.

b. Output of 3D Game Assets and Creative Interpretation

This development process successfully produced five game-ready 3D assets that are not only architecturally accurate but also rich in creative interpretation. Each asset was integrated into a VR 360 environment to create an immersive digital diorama.

- **Tugu Malang (Post-war Theme):** This asset retains the iconic structure of the monument and City Hall but adds atmospheric post-war visual elements like cracks, wild vegetation, and military vehicle remnants, providing a strong visual narrative for an adventure game setting.
- **Singosari Temple (Pirate Theme):** The temple structure is reinterpreted as an ancient pirate stronghold, blending temple architecture with nautical elements like shipwrecks, cannons, and treasure chests, creating a unique backdrop for a treasure-hunting game.

- **Kotabaru Station (Sci-fi Theme):** The historic station facade is reimagined with a science fiction touch, merging its classic structure with holographic panels and neon lighting, suitable for the cyberpunk genre.
- **Kayutangan Heritage (Steampunk Theme):** The colonial ambiance of Kayutangan is enriched with steampunk elements like gears and steam pipes, creating a fantastic setting for an RPG or puzzle game.
- **Simpang Balapan (Jurassic Theme):** The Ijen Street area is transformed into a prehistoric landscape with exotic vegetation and dinosaur fossils, perfectly suited for a survival game.

The artistic value of these thematic reinterpretations lies in their ability to connect cultural heritage with popular imagination. By presenting Malang's icons in genres familiar to the younger generation (like sci-fi and fantasy), the project enhances the appeal and cultural relevance of these locations, paving a new way for appreciating historical heritage.

c. Pedagogical Impact through Project-Based Learning

The application of Project-Based Learning (PBL) had a significant pedagogical impact. The improvement of student skills was measured through self-assessment and peer assessment conducted at the beginning and end of the project. Evaluation indicators included technical skills (modeling, texturing, UV mapping, optimization) and soft skills (teamwork, problem-solving).

Figure 4. Final Product of Singosari Temple 'Pirate Theme'

As the culmination of the learning process, a final evaluation session was held where all students from the four classes gathered. In this session, each group presented their work, both in the form of physical miniatures and through a scannable QR code that linked to the VR video they had created. Students from other groups then provided evaluations through voting, suggestions, and constructive criticism.

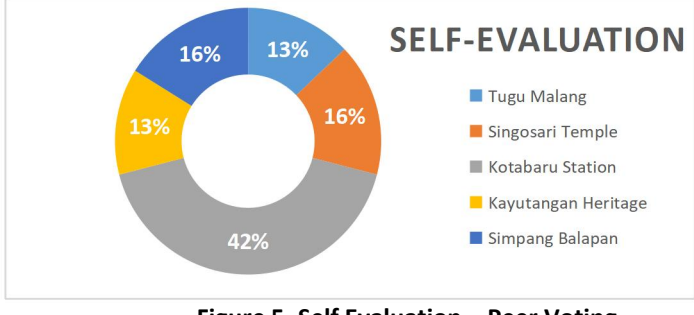

Figure 5. Self Evaluation – Peer Voting

The results of this peer voting, which garnered a total of 31 votes, highlighted the 'Kotabaru Station' project as the standout favorite, receiving 13 votes (43.33%) from the

students. This moment served not only as a showcase of their work but also as a rich peer assessment forum for feedback

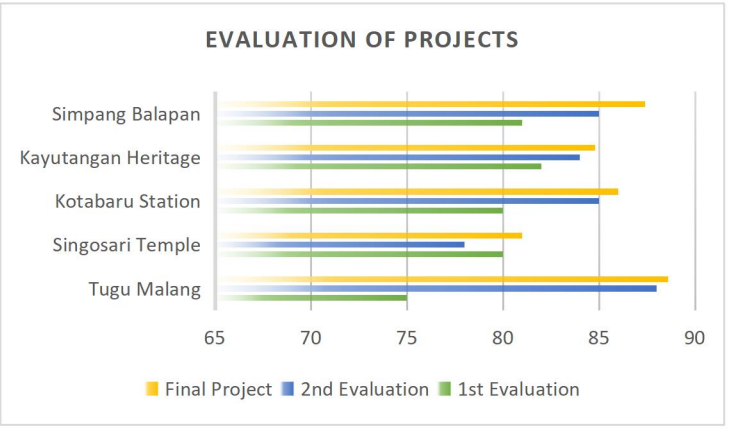

Figure 6. Evaluation of Projects

A comparison of scores from the initial and final assessments provides concrete evidence of this improvement across all projects. Data from the progressive evaluations showed that the average score for the five main projects rose from 79.6 in the first evaluation to a final average of 85.56. The "Tugu Malang" project, for instance, showcased a remarkable trajectory, improving its score from 75.0 in the initial evaluation to a final score of 88.6. This quantitative progress demonstrates that direct involvement in a real production cycle, with genuine challenges and deadlines, effectively accelerates learning

The impact was not only on the improvement of individual digital competence but also on their ability to collaborate effectively within a team, a crucial skill in the creative industry. This finding strongly aligns with the research of Sutrisno et al. (Sutrisno et al., 2025), who implemented a team-based project model for a 3D animation course. Their research confirmed that this collaborative approach not only simulates professional industry workflows but also significantly and evenly improves student learning outcomes (Wardani et al., 2025). Furthermore, the peer assessment forum implemented in this project addresses a need identified by Sutrisno et al. for a stronger peer feedback mechanism to foster greater independence in completing group projects.

These findings are consistent with previous research by Wijaya et al. (Rahmawati et al., 2024), which showed that the use of VR media for historical sites like Singosari Temple proved valid and effective as a learning medium. This reinforces the argument that an immersive approach combined with the PBL model not only enhances technical skills but also deepens student engagement and understanding of cultural heritage material.

4. Conclusion

This research has successfully designed and implemented a collaborative project-based learning model for the production of high-quality 3D assets. Through this model, five VR dioramas visualizing the icons of Malang City have been produced, serving not only as promotional and educational media but also as a form of digital cultural preservation.

The collaborative model, involving synergy between the lecturer and students, proved effective in accelerating production, improving output quality, and most importantly, providing a learning experience relevant to the needs of the creative industry. The success of this project indicates that vocational higher education institutions have great potential to

become centers for innovative digital content production that elevates local identity and advances digital competence in the era of digital transformation.

For future development, these assets can be integrated into a more interactive VR experience. Furthermore, this collaborative model can be replicated for other cultural heritage digitization projects throughout Indonesia.

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