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Design of a PBL-based Immersive Content Production Curriculum

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Abstract

This case describes the design and implementation of a Problem-Based Learning (PBL) course in immersive content production and reports students' and experts' perceptions of it. Although the immersive content industry is expanding, systematic curricula are scarce. The 15-week course, "3D·VFX Content Production Practice," was taught to 29 third-year media content students. In weeks 1–7, students built skills in Substance Painter and Unreal Engine; in weeks 8–15, six teams responded to an ill-structured client scenario by producing interactive 3D videos of local sites in Chungbuk, Korea. Data were drawn from a survey, reflective journals, team artifacts and interviews with three industry experts. Students described growth in self-directed learning, creative design and team communication, and 62% reported being satisfied. Experts judged the workflow close to industry practice. Teamwork burden and problem complexity emerged as challenges, suggesting that problem scope should match students' skills and teams be formed deliberately.

Keywords: PBL; Immersive Content; Game Engine; Curriculum Design

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Introduction

With rapid digital development, the immersive content industry has emerged as a core growth driver in culture, healthcare, education, and defense (Kim & Park, 2023). Immersive content based on XR technologies–AR, VR, and MR–provides value differentiated from traditional media by maximizing user immersion and interactivity (Im, 2023). The Korean government supports production infrastructure and talent development through the 'Digital New Deal' and content industry policies, and the related market has recorded double-digit annual growth (Kim & Park, 2023). The sector thus functions as a catalyst for industrial convergence and digital transformation beyond mere consumer goods, and demand for professionals with creativity and technical competence is rapidly increasing. However, while research on immersive content utilization has been active, curriculum research remains lacking.

In prior research, Song and Ryou (2016) showed that VR/AR teaching materials are significant for students' learning; analyzing VR programs at institutions including Gyeonggi Content Agency, Youngsan University, Korea University of Media Arts, and Myongji College, they presented storytelling, audiovisual, and software track curricula. Nam et al. (2020) comparatively analyzed the educational effects of VR content production education for elementary and secondary students, arguing that VR curricula should enable students from elementary school to university to create subject content at each level. Nam and Kim (2018) analyzed that students or teachers need to directly create subject content rather than use company-provided VR content, and that research on teaching and learning methods is needed.

Currently, most immersive content classes are not run on independently established curricula; composition and instruction are entrusted to practitioners or VR production companies, and even universities depend on individual instructors' competence, so consistent educational quality is not guaranteed.

Prior research thus raises the need for curriculum research and for generalized teaching and learning methods rather than curricula shaped by instructors' backgrounds. Based on market expansion, the lack of curriculum research, and field demand, this study raises the need for research on curricula for training immersive content experts, aiming to develop a PBL-based curriculum that provides learners with reliable education of consistent quality.

To this end, the following research questions were established:

1. How should a PBL-based immersive content production curriculum be structured?

2. How did students and industry experts perceive and evaluate the PBL-based course?

For the first question, the researcher developed educational materials by directly producing immersive content, refined them with expert feedback, and applied them to the major course "3D·VFX Content Production Practice" as PBL-based instruction. The second was analyzed using learners' reflection journals, assignment plans, outputs, and survey data collected after 15 weeks of operation.

Theoretical background

Concept and Characteristics of Immersive Content

Immersive content provides users with an immersive experience in an environment similar to reality, implemented on eXtended Reality (XR) technologies such as AR, VR, and MR. Unlike traditional audiovisual-centered media, it enables real-time interaction reflecting user movements, gaze, and responses, and is characterized by sensory expansion, spatial experience, and participatory interaction (Kim & Park, 2023). Beyond enhancing visual effects, it maximizes 'presence' and 'immersion' by letting users intervene directly in the environment and form experiences within it — expanding it from an information delivery tool into a user–centered experience medium applicable in education, healthcare, culture and arts, tourism, and manufacturing (Koutsabasis et al., 2012).

Implementation converges multiple digital technologies: 3D modeling and animation, real–time rendering, location-based sensors, spatial audio, and UI/UX design, running on devices such as HMDs, AR glasses, mobile devices, and motion sensors (Kim, 2024). Real-time tracking of users' movements, gaze, and gestures with corresponding feedback implements personalized experiences, giving strengths in behavior-based or simulation learning (Ghaznavi et al., 2025).

Through high immersion and interactivity, immersive content enables learner-centered experiential learning, particularly effective in experimental, simulation, and collaboration-based learning (Kim et al., 2022). Applying its core technologies (Table 1) to education can overcome spatiotemporal constraints by virtually implementing hard-to-access environments, and it has been reported to simultaneously promote creative problem-solving, critical thinking, and collaborative competencies aligned with future competency-centered curricula (Jang, 2022). Project-based classes using immersive content

can thus induce deep learning by letting learners experience problem situations as if real and explore solutions directly.

The table below is a revised and updated version of Kim et al. (2022) on a 3D modeling curriculum for educationally disadvantaged learners.

Technology	Description
VR: Immersion Visualization	• VR immersive environments via projection, HMD, and video visualization software
VR: Realistic Interaction	• Five-sense user–system interaction; location tracking, motion simulators, tactile/haptic technology
VR: Virtual Environment Generation & Simulation	• 360-degree panoramic-based VR environments for scenario-based visualization/interaction; avatar-based communication
AR: Tracking and Sensing	• Precise positioning of virtual objects in real space via markers or visual SLAM
AR: Image Synthesis	• Representing virtual objects as if in real space; seamless synthesis with real-space imagery
AR: Real-time Interaction	• Real-time user interaction with virtual objects synthesized in real space

Table 1. Core Technologies of Immersive Content (adapted from Kim et al., 2022).

Literature review of Problem-Based Learning (PBL)

Problem-Based Learning (PBL) is a method in which learners set the direction of learning themselves in real-life-like problem situations, explore necessary knowledge, and derive solutions. First introduced at McMaster University School of Medicine in Canada in the late 1960s, it has spread across fields as a representative strategy in modern higher education (Jang, 2006). Its core lies not in one-way knowledge transfer but in comprehensively strengthening learners' self-directedness, problem-solving, collaboration, and critical thinking, so learners develop the ability to use knowledge in real contexts.

As shown in Figure 1, PBL generally proceeds through five stages: encountering and analyzing the problem, planning how to solve it (what learners know, what they need to know and how to find out), exploration and re-exploration, deriving solutions, and reflection and evaluation. Unlike traditional subject-centered classes, this encourages active participation while enhancing practical

skills and cognitive flexibility (Jang et al., 2020). Since immersive content classes focus on open-ended problems without a single correct answer, learners must attempt multifaceted approaches and design creative solutions — activities aligned with the essence of PBL and particularly effective in project-based production classes.

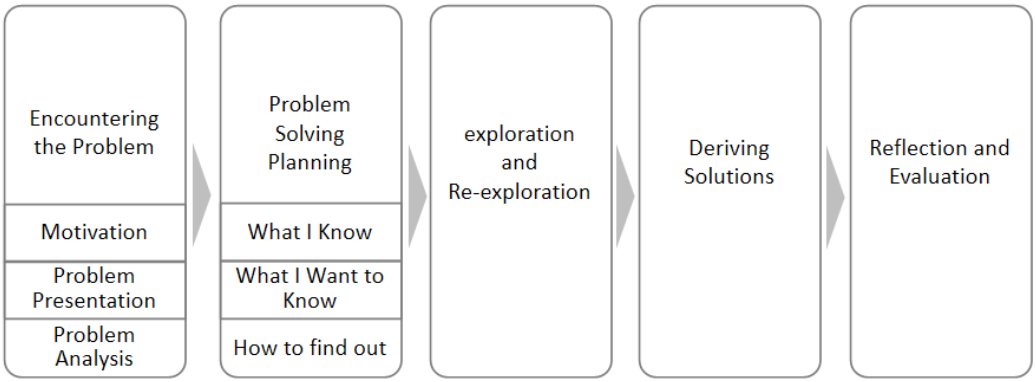


Figure 1. PBL Teaching and Learning Process.

Problem-based learning in its traditional form, as developed at McMaster University, centers on small groups that analyze an ill-structured problem and identify their own learning issues, with knowledge acquisition as the main goal (Barrows, 1996; Savery, 2006). Project-based learning, by contrast, is oriented toward producing an artifact, and learners often apply knowledge they already have (Helle et al., 2006). Between these lies the problem-oriented project work of the Aalborg model, in which teams formulate a problem and address it through an extended project (Kolmos & de Graaff, 2014). The course described here is closest to this hybrid. Weeks 1–7 build the technical skills the project requires. In weeks 8–15, teams receive an ill-structured client scenario, choose their own site and interpretation, and list facts, ideas and learning issues (Appendix A) before producing a video. This case therefore uses "PBL" in this broader, problem-oriented and project-based sense.

Curriculum design process

PBL-based Immersive Video Content Production Curriculum Course Overview

This course aims to foster convergent creative talent required by the immersive content industry. Adopting PBL as the central teaching strategy, it was structured so students perform the process from planning to production and presentation, divided into team and individual work, developing creativity and

collaboration while solving real problems in a practice-centered environment (see Table 2).

Item	Content
Course Name	3D·VFX Content Production Practice
Target Grade	Media Content Major 3rd Year
Class Time	1st Semester 15 Weeks (3 hours once a week)
Learning Method	Problem-Based Learning PBL + Project Production
Evaluation Method	Output Evaluation + Process Evaluation + Self/Peer Evaluation Combined

Table 2. 3D·VFX Content Production Practice: Course Overview.

Design of PBL-based Immersive Content Production Curriculum

Writing the problem (scenario writing) determines its presentation form, which should lead learners into the problem situation, allow actual participation, and consist of appropriate content and method. Here, an in-house email from a media production company was chosen, allowing various results through an unstructured scenario while including specific conditions by defining the content genre.

The problem scenario is as follows:

> "You are a video producer at a newly established content studio and have received a request from a Chungbuk tourism promotion company to produce a realistic short video under 3 minutes. It should represent the charm of a city or natural landscape so audiences feel as if at the actual site, evoking interest and travel desire for Chungbuk tourism resources. Under the theme 'Our Neighborhood with Four Seasons Project,' you will select a neighborhood containing Chungbuk regional culture and produce an exhibition video conveying a realistic atmosphere following visitors' footsteps, with interaction applied so audiences can walk around and appreciate the 3D space."

Development of PBL-based Immersive Content Production Curriculum

In weeks 1–7, students first learned technologies necessary for immersive content production –3D modeling, VR/AR implementation, interaction design, and game engines. As third-year students who took 'Maya' in their second year, they had a basic understanding of 3D programs; this class fully dealt with the Unreal game engine and Substance, a high-end texturing program.

The 15–week curriculum covered: orientation and program introduction (Week 1), Substance Painter basics and projects (Weeks 2–4), Unreal Engine fundamentals and advanced techniques (Weeks 5–6), mid-term evaluation (Week 7), PBL introduction and problem presentation (Week 8), team planning and individual project development (Weeks 9–11), post-production techniques (Week 12), team integration work (Week 13), feedback sessions (Week 14), and final presentations (Week 15). Details are in Table 3.

Week	Class Content
1	Orientation: course, game engine, PBL, Substance Painter
2–4	Substance Painter: interface; prop and character texturing
5–6	Unreal Engine: interface, materials, Blueprints, blockout, decals
7	Midterm review and submission
8	PBL introduction: team formation, problem scenario, project plan
9	Team planning: problem analysis, site, map, roles, schedule; blockout; journal
10–11	Individual work: modeling (Maya, Unreal), landscape, texturing (Substance); journal
12	Post-production in Unreal: Post Process Volume, Cine Camera, Movie Render Queue
13	Team integration: merging levels, post-processing, editing; journal
14	Project review and team feedback
15	Final presentation, PBL reflection, peer and self-evaluation

Table 3. 3D·VFX Content Production Practice: Weekly Course Plan.

Problem Presentation and Team Formation

In week 8, PBL and the team learning method were introduced, with a problem scenario inspired by the actual industrial field. Students formed teams of about five by region of interest and wrote task performance plans. Under the theme "Our Neighborhood with Four Seasons Project," the teams respectively selected 'Dongbu Warehouse,' 'Seowon University,' 'Seongan-gil,' 'Yukgeori Traditional Market,' 'Suamgol Mural Village,' and 'Ochang Miraegi Hanok Village' in Chungbuk, each preparing a project plan tailored to the scenario (Appendix A).

Information Search and Planning Concept

In week 9, each team conducted market research, technical analysis, and case studies, then wrote and presented content plans including storyboards, user flow diagrams, and technical application plans, using generative AI such as

ChatGPT and Midjourney in parallel for storyboards. Weekly reflection journals let students reflect on what they learned, their thoughts, and future plans (Appendix B).

Prototype Production and Implementation

From weeks 10 to 14, students developed immersive content prototypes by applying 3D modeling, VR/AR implementation, and interaction design step by step, while the instructor adjusted technical difficulty and work distribution through interim checks and mentoring. Students worked in divided team and individual tasks while learning production software weekly. Some projects were so large that finishing by the deadline was difficult when modeling each region and importing it into the game engine; weekly feedback and revisions therefore continued, such as reducing project scale and focusing on details. Figure 2 shows the class process (team meeting → project proposal → game engine production → final presentation).

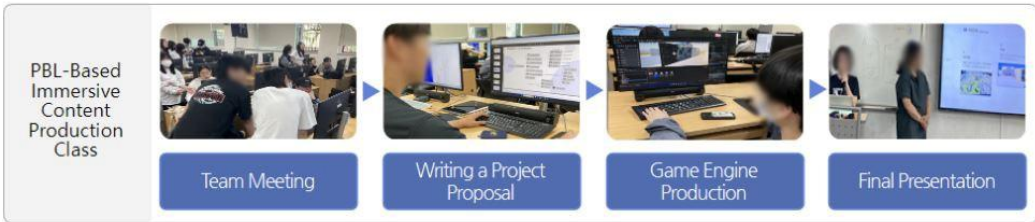


Figure 2. PBL-Based Immersive Content Production Class.

Presentation and Reflection

In the final week, each team presented their outputs, reflected feedback through actual user testing, and looked back on the learning process via self-reflection reports and peer evaluations. Six teams successfully completed immersive video projects showcasing different aspects of Chungbuk's regional culture and landscapes through interactive 3D environments (Table 4): Team A — Dongbu Warehouse; B — Seowon University; C — Seongan-gil; D — Yukgeori Traditional Market; E — Suamgol Mural Village; F — Ochang Miraegi Hanok Village (each with a demonstration video link).

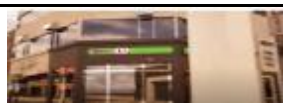
Team Name	Project Name	Image
A	· Dongbu Warehouse (https://www.youtube.com/watch?v=RSJCLikVhuA)	
B	· Seowon University (https://www.youtube.com/watch?v=_JkZtTsgRZE)	
C	· Seongan-gil (https://www.youtube.com/watch?v=HHPnQ656vVU)	
D	· Yukgeori Traditional Market (https://www.youtube.com/watch?v=Q2zatCO-ZQ4)	
E	· Suamgol Mural Village (https://www.youtube.com/watch?v=A_0AZ2g5Ijo)	
F	· Ochang Miraegi Hanok Village (https://www.youtube.com/watch?v=Tbe86G5LcX8)	

Table 4. 3D·VFX Content Production Practice: Class Outcomes.

Data Collection and Analysis

Four types of data were collected during and after the course. They were used to describe how the course unfolded and how participants perceived it, not to measure learning gains.

Survey. In week 15, all 29 enrolled students were invited to complete an anonymous online survey. It contained three items on prior familiarity with immersive content, class satisfaction and willingness to recommend the course, each rated on a five-point scale. All 29 students responded, and the results are reported descriptively as frequencies (Figure 3).

Reflective journals. Students wrote reflective journals in weeks 9, 10 and 13, answering seven open questions (Appendix B). 71 journals were collected. The author read them repeatedly and grouped recurring statements into themes such as technical difficulty, collaboration, local identity and career relevance.

Team artifacts. Project plans (Appendix A), storyboards and final videos (Table 4) were used to describe each team's process and outcomes, not to assess learning gains.

Expert interviews. Three practitioners (Table 5) reviewed the course plan, problem scenario and final outputs. Each was interviewed face-to-face or online

via video call for about 40 minutes in July 2025, and their responses were summarized by theme.

Ethics: At the start of the PBL phase in week 8, all students were informed of the purpose of this case report and gave verbal consent for their anonymized journals, survey responses and project outputs to be used. As the report is based on routine course activities, formal ethical review was not required by the institution. Participation did not affect course grades. Faces in Figure 2 have been blurred, all student names are pseudonyms, and the linked videos contain no faces or names of students.

Class Satisfaction and Curriculum Validity Verification

After one semester, a satisfaction survey was conducted with 29 students. As shown in Figure 3, 19 of 29 students (66%) reported low familiarity with immersive content before the course. Eighteen students (62%) were satisfied with the class. Willingness to recommend the course to other students was more mixed: 11 students answered positively, 12 were neutral and 6 answered negatively.

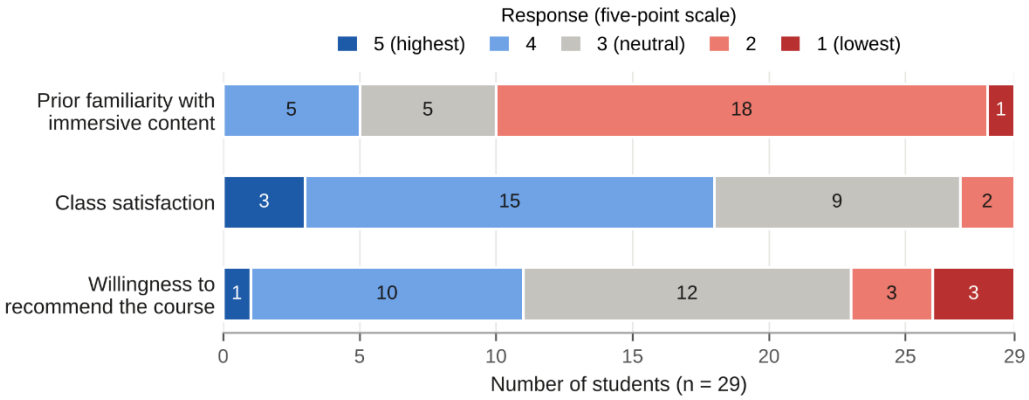


Figure 3. Student Survey Results.

Note. Responses were given on a five-point scale. For prior familiarity, 5 = very familiar and 1 = not at all familiar; for class satisfaction, 5 = very satisfied and 1 = very dissatisfied; for willingness to recommend, 5 = very willing and 1 = not at all willing.

Expert interviews were conducted with three professionals experienced in post-production (18+ years), university education (7+ years) and animation production (20+ years) (Table 5). The experts noted that team formation was a recurring problem and suggested identifying members' personalities and skill levels beforehand. They also considered the problem difficult to solve within

class time and recommended adjusting its complexity. Overall, however, they found the production process convincing: because industry practice proceeds in a similar way, they judged that the course helped students experience a professional environment and prepare for professional work.

Category	Company Category	Responsibilities	Experience
A	Post-production company	Post-production team manager	18+ years
B	University	Immersive media lectures	7+ years
C	Animation company	Production Supervisor	20+ years

Table 5. Expert Interview Participant Information.

Conclusion

This case described a one-semester course that applied PBL to immersive content production and reported how 29 third-year students and three industry experts perceived it. Three observations emerge from the case.

First, the course was structured in five stages: technology-based competence formation (Weeks 1–7), problem presentation and team formation (Week 8), information search and planning (Week 9), prototype production and implementation (Weeks 10–14), and presentation and reflection (Week 15). Building on students' prior experience with Maya, the first phase introduced Substance Painter and Unreal Engine, so the tools the project required were in place before the problem was presented. This sequence may serve as a modular model for similar production courses.

Second, the open-ended "Our Neighborhood with Four Seasons Project" gave students a production context resembling industry practice. They moved through problem definition, research, planning, production, post-production and presentation, and adjusted project scope to technical and time constraints. Students' reflective journals described communication, coordination and negotiation as necessary for completing the project, particularly through role distribution within teams (e.g., team leader, map production, modeling, level integration, presentation). At the same time, many students identified teamwork as a burden in the survey.

Third, the experts judged the assignment to be close to actual production workflows and valuable for previewing industry processes and standards.

However, they considered the problem too complex to solve within class time. This suggests adjusting problem difficulty to students' competence, forming teams more deliberately, and strengthening the instructor's role as a coach.

Taken together, the case suggests that a problem-oriented, project-based format can give students in technology-convergent fields such as immersive content an experience close to professional practice. Whether the format improves problem-solving, creativity or collaboration, however, cannot be determined from this case.

This case has several limitations. It did not measure learning gains, as there was no pre- and post-assessment and no comparison group. The findings are based on self-reports (a survey and reflective journals) from a single cohort of 29 students at one institution, together with the views of three experts, and cannot be generalized. Future studies could compare PBL implementations across majors and institutions, combine validated quantitative measures with qualitative data, and examine whether any learning effects persist over time.

References

Barrows, H. S. (1996). Problem-based learning in medicine and beyond: A brief overview. *New Directions for Teaching and Learning, 1996*(68), 3–12. https://doi.org/10.1002/tl.37219966804

Ghaznavi, S., Haghparast, F., Pourahmad Ghalejough, A., & Sakian Mohamadi, H. (2025). Implementing user-centered design in architecture using virtual reality: A case study of a micro coworking space. *Design Studies, 99*, Article 101329. https://doi.org/10.1016/j.destud.2025.101329

Helle, L., Tynjälä, P., & Olkinuora, E. (2006). Project-based learning in post-secondary education – Theory, practice and rubber sling shots. *Higher Education, 51*(2), 287–314. https://doi.org/10.1007/s10734-004-6386-5

Im, K.-H. (2023). News analysis and visualization related to metaverse and realistic media. *The Journal of the Korea Contents Association, 23*(2), 372–378. https://doi.org/10.5392/JKCA.2023.23.02.372

Jang, H. J. (2022). *Development of virtual reality (VR) educational contents design framework* [Doctoral dissertation, Hanyang University].

Jang, J. A. (2006). A case study of problem design process for PBL. *The Journal of Yeolin Education, 14*(1), 65–92.

Jang, K. W., Choi, J. I., & Jang, S. Y. (2020). Development of design guidelines for PBL problem and implementation plan. *The Journal of Learner-*

Centered Curriculum and Instruction, 20(16), 569–594. https://doi.org/10.22251/jlcci.2020.20.16.569

Kim, G. Y. (2024). PBL based motion capture curriculum. *Journal of Digital Art Engineering and Multimedia, 11*(2), 243-252. https://doi.org/10.29056/jdaem.2024.06.09

Kim, H. A., Kim, J. W., Lee, Y. Y., Chae, Y. G., & Kim, D. H. (2022). A study on the 3D modeling curriculum for the education vulnerable. *Proceedings of the Korean Society of Computer Information Conference, 30*(2), 115–116.

Kim, J. H., & Park, J. C. (2023). *Survey on the current state of immersive content and mid- to long-term strategy research*. Ministry of Culture, Sports and Tourism; Korea Creative Content Agency.

Kolmos, A., & de Graaff, E. (2014). Problem-based and project-based learning in engineering education: Merging models. In A. Johri & B. M. Olds (Eds.), *Cambridge handbook of engineering education research* (pp. 141–160). Cambridge University Press. https://doi.org/10.1017/CBO9781139013451.012

Koutsabasis, P., Vosinakis, S., Malisova, K., & Paparounas, N. (2012). On the value of virtual worlds for collaborative design. *Design Studies, 33*(4), 357–390. https://doi.org/10.1016/j.destud.2011.11.004

Nam, C. M., & Kim, C. W. (2018). A comparative study of virtual reality content creation education by learner. *Journal of the Korean Association of Information Education, 22*(5), 585–592. https://doi.org/10.14352/jkaie.2018.22.5.585

Nam, C. M., Kim, C. W., Hong, K. S., Cho, C., & Hong, J. H. (2020). A study on the learner characteristics in virtual reality by a school level curriculum. *Journal of the Korean Association of Information Education, 24*(1), 71–78. https://doi.org/10.14352/jkaie.2020.24.1.71

Savery, J. R. (2006). Overview of problem-based learning: Definitions and distinctions. *Interdisciplinary Journal of Problem-Based Learning, 1*(1), 9–20. https://doi.org/10.7771/1541-5015.1002

Song, P.-J., & Ryou, H.-S. (2016). A study on VR curriculum. *Journal of the Korea Internet of Things Society, 2*(4), 21–25. https://doi.org/10.20465/kiots.2016.2.4.021

Appendix A

Team Name:	*Team C*	***Date:***	*May. 8. 2025*
Ideas	Facts	Learning Issues	Action Plan
- Created an immersive video exhibition capturing the essence of autumn, centered around the alleys of Seongan-gil in Cheongju - Conveys a sense of realism by utilizing perspectives and sounds that make viewers feel as if they are actually walking through the alleys - Designed to allow visitors to freely explore every corner of the alleys through 3D interactions, enabling them to experience the culture and atmosphere of Cheongju - Maximizes visual appeal by incorporating representative seasonal elements into the video	- Seongan-gil is Cheongju's premier commercial district and cultural alley, home to a concentration of small businesses and art spaces - The alley is a space where retro charm and modern elements coexist - Cheongju is a region with distinct four seasons, and the scenery and atmosphere of the alley change significantly with the seasons - Interactive exhibitions are gaining attention as a content format that enhances visitor engagement and the quality of the experience -Video content should be planned to leave a strong impression, despite its short format of less than one minute	- Whether filming is permitted in the alley - Selection of a technical platform for implementing interactive exhibits (e.g., Unity, Unreal, WebGL, etc.) -Availability of materials such as local sounds, interviews, and Foley sounds to be used in the video -Need for specific research on representative seasonal events and locations -Analysis of the age groups, interests, and movement patterns of the primary target audience visiting Seongan-gil -A structure that allows for effective storytelling within one minute -Verification of data from public institutions	- Select specific alleys and main pathways along Seongan-gil to include in the project Identify areas suitable for filming and implementing interactions on a map - Conduct preliminary site visits to collect imagery - Create 3D models of buildings, signs, and streets in the selected alley areas - Design camera angles, cinematic effects (lighting, color palette, etc.), and interaction points - Prepare demonstration videos and 3D interactive experience materials

Table A1. Project Plan of Team C.

Appendix B

Student Name:	*Student A*
Question	Answer (summarized by the author)
1. What did you learn from this lesson?	Beyond producing video, I reflected on incorporating local character and realism into Seongan-gil-based content, and my first experience integrating 3D spatial design with interactive elements taught me about content scalability.
2. What activities did you find difficult in class?	Creating the 3D map and interactions in Unreal Engine, a completely new tool; balancing realism with performance was hard, but repeated revisions and teammate feedback gradually improved quality.
3. What would you like to learn next?	VR/AR exhibition content technologies — sound design, lighting effects, and UX-prioritized spatial design for content that lets audiences "walk through a space."
4. How can you apply it?	Local-theme video planning applies to travel vlogs, tourism promotion, and exhibition design; I gained a foundation for planning content that lets audiences "experience," not just "see."
5. What are your weaknesses in this class?	Lack of 3D modeling and game engine skills, which limited communication and implementation; continuous technical study is needed.
6. What did you feel while going through this course?	Content planning means understanding a subject's essence so audiences can "experience" it; production is a complex creative process where research, field surveys, spatial design, and audiovisual composition must interconnect organically.
7. Please feel free to share any other thoughts.	The project deepened my affection for my neighborhood and showed the power of local content; collaborating taught me the joy of co-creation and how I want to create content in the future.

Table B1. PBL Reflection Journal of a Student.

Note: Answers were summarized by the author from the student's original journal, written in Korean and translated into English.