

Title: Project-Based Learning for Creative Technologists: A Design-Based Research Agenda for Visual Scripting Pedagogy

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1. Problem Statement

The effectiveness of lecture-based classroom teaching is called into question when disseminating knowledge about real-time game engine development in a creative technology setting. Delivered as a math-based core course and launched in 2024, this course represents a shift for game design students from sketching and modeling into coding their own interactive experiences, bringing more expression and engagement to their creative works.

However, students' focus remains on the art: modeling environments, objects, and textured materials. Code development presents a unique challenge in terms of language and structure, specifically bridging the gap between creative ideas and formatted instructions that can be understood and executed by a game engine (in this case, Unreal Engine 5). Isolated exercises to learn object-oriented programming or custom scripts that are highly specific to a single example do not promote reuse and repurposing across projects or creative concepts.

The lack of ready resources that implement a project-based methodology in content presentation and exercise organization creates a barrier for both teacher and student: no codified reference exists, and time is spent exploring workarounds to address the classroom context. In response to these challenges, a new textbook was conceived and developed, with preview chapters introduced to students in Spring 2026. Preliminary results have been shared internally at the college.

In this research proposal, we seek to examine the longitudinal impact of a shift to project-based learning using a mixed-methods design-based research approach. The design artifacts are a new textbook developed from learnings and a redesigned curriculum leveraging preliminary data

around approaches for teaching creative students software development using a node-based scripting development environment.

2. Research Question

What is the role of project-based learning in student outcomes when teaching node-based development to creative students?

Several dimensions are of particular interest in measuring learning outcomes:

- **Technical output:** Ability to accelerate creative output through code
- **Assessment progress:** Performance on quizzes and final implementation
- **Student confidence:** Perception of ability to solve complex code-based problems
- **Perceived difficulty:** Ease of using self-created modules for novel problems
- **Contribution to innovation:** Diverse use of same modules across different projects
- **Interactivity:** Using environments/objects to tell the story of student art
- **Modality flexibility:** Support for traditional classroom, lab settings, flipped classroom, and hybrid learning

Research questions will be refined during study design to address and consolidate these outcomes into a conceptual model.

3. Literature Review and Theoretical Framework

Project-based learning (PBL) is a pedagogy focused on supporting skills and knowledge acquisition through extended investigation and response to complex problems, questions, or challenges grounded in the real world (Meng et al., 2023). PBL re-centers the student as knowledge agent and active participant in knowledge creation, as opposed to the traditional view of student as recipient of knowledge through lecture and exams (Maida, 2011).

This study builds on Design-Based Research (DBR) and Design Science Research (DSR) to define principles and practices for study design and measurement of PBL effectiveness. Prior research on technology access barriers and inequality informs the study's attention to equity (de Villiers & Harpur, 2013; Muthui, 2024).

This study is grounded in four complementary frameworks. Project-Based Learning serves as the core pedagogy, with students building a complete game over 13 weeks. Design-Based Research guides the iterative refinement of the textbook artifact across multiple classroom cycles. Design Science Research frames the textbook as an information systems artifact to be evaluated for utility and fitness. Mixed Methods provide the data collection approach, combining quantitative quiz scores with qualitative surveys and classroom observation.

4. Methodology

Pedagogical implementation is a core theme of the research. Project-Based Learning is implemented with a new textbook that aligns a game story and project prompt to object-oriented principles, all implemented without writing a single line of traditional code. The research approach centers on Design-Based Research with influence from Design Science Research, using the textbook and course curriculum design as artifacts. Data collection will involve a mixed methods approach with quantitative data from regular quizzes and qualitative data from anonymized student surveys. The sample size is N=25 for Phase I and N=25 for Phase II for a total N=50.

5. Study Timeline

Phase	Timeline	Activity
Concept and Artifact Development	Apr – Dec 2025	Textbook concept, TOC, topic outline, first draft
Beta Testing	Jan – May 2026	14 chapters shared with students; preliminary data collection
Research Study Development	May – Aug 2026	Artifact publication; literature review; research model definition; PBL outcomes and DBR principles development; measurement design; IRB approval; curriculum alignment
Phase I Research	Sep – Dec 2026	Course implementation with project-based textbook; data collection; analysis; research plan for Phase II refinement

Phase	Timeline	Activity
Phase II Research	Jan – May 2027	Refined course implementation; data collection; analysis; findings publication (June 2027)

6. Conclusion and Future Implications

The initial beta results indicate a higher average quiz score of 93.5% with individual quiz averages regularly above 90%, marking an improvement from prior semesters (72.62%–96.50% range). While debugging and cross-version compatibility remain challenges, early observations point to lowered barriers when implementing solutions that perplexed students in past semesters (e.g., integrating heads-up display with real-time data from external functions). Students devoted more time to creative implementations without sacrificing scripting practice including: richer HUD design with engaging vignettes with dynamic Blueprint data connections; expanded resource systems using sanity mechanics and input-based resource management; creative worldbuilding where modules are configured into many unique instances; and higher-fidelity designs that include characters, rich materials, textures, and complex environments.

The potential exists to create a flipped classroom and support hybrid learning where core concepts are presented prior to class, leaving more time in class or lab for creative exploration of how concepts apply to each student's unique perspective on the project prompt. The goal is to preserve instructional quality and final deliverable quality while creating a more flexible environment that encourages students to explore "Level Up" opportunities: post-processing effects that respond to Blueprint data, intelligent adversaries using environment sensing, and advanced weapons systems like homing projectiles.

Future implications extend beyond this core course into elective courses where time to review foundational concepts may be limited. A self-guided framework with teaching support can fill this gap. Students would implement modular concepts from the project-based textbook artifact to address novel problems, applying node-based scripting to contextual projects like turn-based combat, in-game economies, mass entity AI, and narrative design.

We propose that a Project-Based Learning approach will contribute to greater retention of object-oriented principles; greater confidence to analyze and resolve design challenges using a data-

driven, code-based approach; and increased accessibility through node-based visual scripting compared to written lines of code. The purpose of the study is to evaluate how this approach when implemented in a creative technology environment empowers design students to tell more interactive stories with greater technical complexity while achieving higher reuse, maintainability, and buildability. Increased confidence in their technical capabilities will enable design students to focus on their passion (the art) while increasing their technical proficiency for greater market opportunities.

References

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