Chapter 12
Game Development as a Pedagogical Innovation for Project-Based Learning in Computer Graphics and Gaming

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ABSTRACT

The advent of project-based learning (PBL) as a pedagogical method has made the Computer Graphics and Gaming course a practical, real-life learning experience to undergraduate computer engineers. Creating and producing their own video games, students combined the knowledge of graphics programming, storytelling, user interface design, animation, and game mechanics. It was a step-by-step process, starting with basic ideas and going into practice, and ending with demonstrations judged on technical implementation, creativity, interactivity and teamwork. The approach incorporated use of iterative design, peer feedback, and reflective practices and was inspired by the experiential learning cycle and multiple intelligences of Kolb and Gardner respectively. The chapter provides planning, implementation and evalua-

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tion approaches, discusses possible obstacles like resource shortage and diversity of learners, and provides flexible information on transferring this PBL model to other STEM fields involving creativity, technical skill and teamwork.

INTRODUCTION

Engineering education has undergone a major change in the last twenty years (Kamp, 2023). As a result of the recent rapid technological development, an enlarged interdisciplinary convergence, and the constantly changing industry demand, there is now a greater need to have academic institutions re-engineer their pedagogical approach (Froyd et al., 2012). Computer Graphics and Gaming, which constitutes a subject that sits at the border of mathematics, programming, design, and visualization, provides a special opportunity to apply and take advantage of innovative instructional models in the context (Jayakanthan, 2002). Nevertheless, the conventional lecture-practical divide does not always allow making the most out of this discipline, including its ability to engage students in a way that goes beyond algorithmic knowledge (Du & Yang, 2017).

Having taught and researched engineering education for more than 20 years and published over 100 research articles in the leading journals, we have noticed a very long time ago that there was a gap between theoretical knowledge and the application of this knowledge in technical subjects (Hatlevik, 2012). Students learn in a disjointed manner--doing assignments, attending labs, passing exams--and never really internalizing ideas and seeing their larger significance (Everwijn et al., 1993). This disjuncture is especially problematic in Computer Graphics, where the ability to know algorithmic solutions to drawing a line (Bresenhams, Bezier curves, etc.) does not imply the ability to be creative or competent in the real world.

The contrast between the conventional teaching techniques and PBL is quite radical, including the style of learning and evaluation, the intensity of student engagement and acquisition of skills (Lavado-Anguera et al., 2024). Traditional approaches tend to be based on passive learning and uniform assessment as shown in figure 1, whereas PBL promotes active, student-centered investigations and real-life assessments that are relevant to practice.