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Crossing the Boundaries of Conventional: Examining Various Approaches in Teaching Video Game Development

ABSTRACT

Working as a teacher, professor, or instructor involves many roles, one of the most important being the conveyance of knowledge to students. Or is it? A shifting and unstable job market, inaccessible equipment, a lack of information, and many other factors represent obstacles that should be addressed in order to update a potentially obsolete curriculum and remain current. In addition, the emerging use of machine learning tools raises questions about the educational system as a whole and the way it conveys knowledge and adapts its programs and curricula to this new environment. The ever-changing job market also influences the way teachers approach designing their classes and how they interact with students. This paper examines the existing literature on different practices for teaching game development in order to better understand contemporary teaching frameworks. It also investigates different methods of teaching video game development to contribute to the scientific community and the existing body of research. As a result of this investigation, a comparison of the reviewed literature, and insights gained from three years of conducting various courses and programs in the field of game development, several suggestions for teaching approaches and possible future directions are proposed in the hope of improving the way game development is taught in schools and universities, and perhaps even help changing how the educational system is perceived in today's rapidly changing world.

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KEY WORDS
Video game development, education, video game, curriculum development, studio-based learning, project-based learning, teaching frameworks, mentorship

1. Introduction

Games and their development, technology, industry, jobs, and market demands- the whole world is changing rapidly. It surely should not be different for video game development courses, teaching program structure, and curricula in higher education. If education is viewed alongside Industrial Revolutions, then Education 1.0 begins with the First Industrial Revolution in the 18th century. It assumes the lecturer at the centre and learners who have a mostly passive role (Miranda et al., 2021). The Second Industrial Revolution brought Education 2.0, with learners a little bit more engaged in the education process. Education 3.0 characterized computerization where learners were empowered to educate themselves independently from the teaching process. Lastly, in Education 4.0 teaching process characterize technological advancements enabling digitalization, virtualization, datafication and smartification (Ramírez-Montoya et al., 2022; Kowalski et al., 2026). In works of Banjanin and his colleagues (Banjanin et al., 2022; Banjanin et al., 2024), the authors investigated different perspectives on incorporating games into university curriculum. In the first paper, some definitions of games and video games

are discussed, along with the influence of simulations, simulation games, and serious games on learning, as well as advantages of using game-based learning (GBL) in education. The authors concluded that both artistic and technical skills can be and should be developed by using simulation games in the studies of Graphic engineering and design and that further research should be done to propose detailed guidelines and best practices on incorporating game elements in simulation (e.g., of the printing process) and combining knowledge from different branches of engineering and art industry. In the second paper, the authors investigated different approaches to using games in education. The first approach is by using non-educational and educational games (see chapter 2, section 2.1) in the teaching process, and the second one is by implementing constructivist approaches where students learn about certain topics by making games. They also suggested teaching with Community of Inquiry (CoI) in mind, from which they adopted Teaching Presence from the overall educational experience originally introduced by Garrison, Anderson, and Archer (1999).

They implemented all these principles in university lectures and different courses outside of the university curricula which utilized Unreal Engine and Unreal Editor for Fortnite (UEFN) as primary game engines. They analysed the relationship between the number of working hours in one class compared to the total number of hours in the semester. The authors also reported and compared the number of hours spent on traditional follow-along type of teaching (traditional approach), number of working hours in teams, and mentor consultation hours. They discovered a trend where an increased number of working hours on projects, in contrast to the traditional ex cathedra, follow-along approach, can lead to numerous benefits not only for students but also for teachers. Students better understand game design concepts and develop technical skills more independently and with greater understanding of the matter. Teachers, on the other hand, had the opportunity to work on a variety of projects, which led to broadening their knowledge and gave them experience of how to approach similar projects and problems in the future. This approach, combined with the teaching presence adopted from the CoI framework, led to creating open and more enjoyable learning environments. The conclusions were tested in practical settings but were based on qualitative assessment acquired by conversations with the students and backed up by experience from different teaching courses throughout several years of teaching practice.

This paper aims to continue the research discussed in the abovementioned investigations and to build upon them by exploring different approaches found in the recent literature. This is also supported by findings from the recent teaching practice, and the possible framework is suggested according to the examined body of scientific papers.

2. Methods

This study employs a narrative literature synthesis method (Bourhis, 2017) to examine the evolution of educational approaches used in teaching video game development. Narrative synthesis was selected because the field incorporates diverse pedagogical traditions, including research on serious games, game-based learning, constructionist learning, project-based learning, studio-based learning, and professional practice frameworks.

The primary corpus consisted of five influential studies explicitly focused on game-development education, curriculum design, assessment, and professional preparation (Banjanin et al., 2022; Banjanin et al., 2024; Pierce et al., 2025; Hughes & Kavanagh, 2025; Gunnars & Palmquist, 2026).

To strengthen the synthesis, additional systematic reviews related to game-based learning, serious games, project-based learning, and Education 4.0 were incorporated (Huang et al., 2023; Brandl & Schrader, 2024; Mingyu et al., 2024; Khoo et al., 2025; Mushtaq et al., 2025). These sources provided broader contextual understanding regarding emerging trends in higher education and their relevance for contemporary game-development curricula.

The analysed studies were compared according to: (1) Educational objectives, (2) Teaching methodologies, (3) Assessment approaches, (4) Collaboration structures, (5) Industry integration, (6) Learning outcomes, (7) Curriculum recommendations.

The resulting synthesis was used to help identify common themes, developmental patterns, and recurring challenges within the field.

2.1. Serious games and educational applications

The relationship between games and education has attracted considerable scholarly attention over the last three decades. One of the most obvious ways of implementing games into educational practice is by using serious games. Serious games, as defined by Abt (1971) presents fusion of serious thinking and problem-solving with experimental and emotional freedom of gaming. Another definition given by Michael and Chen (2005) defines serious games as games whose main purpose is not entertainment, fun, or pleasure.

Research consistently indicates that serious games provide meaningful opportunities for experiential learning by encouraging active participation rather than passive information consumption (Banjanin et al., 2022; Brandl & Schrader, 2024). The educational value of serious games is closely linked to their ability to create simulated

environments that allow experimentation without real-world consequences. Such characteristics are particularly valuable in disciplines involving expensive equipment, hazardous procedures, or highly complex processes (Banjanin et al., 2022). Brandl and Schrader (2024) suggested that serious games contribute positively to student engagement and motivation but also highlighted the need for more adaptive systems capable of responding to individual learner needs. Importantly, research regarding serious games helped redefine the relationship between technology and education. Rather than treating digital technologies solely as mechanisms for content delivery, researchers increasingly viewed interactive systems as learning environments within which students could construct and test understanding through participation (Banjanin et al., 2022; Brandl & Schrader, 2024).

2.2. Constructionist learning and learning through game creation

While serious-games research focused on the educational use of games, another line of inquiry examined educational value in the process of game creation itself. This perspective draws heavily from constructionist theory, particularly the work of Jean Piaget (1951) and later educational researchers such as Kafai and Burke (2015). Constructionist learning emphasizes the creation of meaningful artifacts through which learners externalize and refine their understanding of concepts and systems. Within this framework, learning emerges through design, experimentation, reflection, and reconstruction. Educational benefits emerge from the process of creating games rather than from interaction with finished products. Works by Gunnars and Palmquist (2026) and Khoo et al. (2025) indicate that such activities contribute to computational thinking, design thinking, systems thinking, creativity, collaboration, and communication skills.

2.3. Project-Based Learning (PBL) in game development education

Project-Based Learning (PBL) has become one of the most influential pedagogical approaches in contemporary game-development education. PBL positions learning within meaningful projects that require students to investigate problems, collaborate with peers, apply theoretical concepts, and produce tangible outcomes. Because professional game development is fundamentally organized around project work, PBL provides a natural alignment between educational practice and industry expectations (Huang Li & Shang, 2023; Gunnars & Palmquist, 2026). A review conducted by Huang and associates found that gamified project-based learning enhances both educational outcomes and learner satisfaction. Their research identified several strategies through which game elements can be integrated into project-based environments, including gamification of project structures, integration of educational games, and game creation activities themselves. Gunnars and Palmquist (2026) identified project-based learning as the internationally dominant educational model within game-development programs. Their findings suggest that projects provide opportunities not only for technical learning but also for professional socialization, interdisciplinary collaboration, and creative experimentation.

2.4. Community of Inquiry, mentorship, and teaching presence

As game-development education increasingly adopts project-based approaches, researchers have devoted greater attention to the role of mentorship and collaborative learning environments. One particularly influential framework is the Community of Inquiry (CoI) (Garrison, Anderson & Archer, 1999), which conceptualizes meaningful educational experiences through the interaction of teaching, social and cognitive presence (Banjanin et al., 2024).

Teaching presence refers to instructional design, facilitation, and guidance; social presence concerns interpersonal interaction and collaboration; and cognitive presence involves knowledge construction through reflection and discourse (Garrison, Anderson, & Archer, 1999). Game-development education provides a particularly suitable environment for the application of this framework because students work collaboratively, engage in continuous dialogue, and participate in iterative development processes (Banjanin et al., 2024). In the work of Banjanin et al. (2024), it was demonstrated that increasing opportunities for project discussions, mentorship, and collaborative work significantly improved educational outcomes. Their findings indicate that students benefit from educational models emphasizing consultation, guidance, and teamwork rather than relying exclusively on instructor demonstrations. Rather than functioning solely as lecturers, educators increasingly assume roles as facilitators, mentors, reviewers, and collaborators. Such developments align closely with both constructionist learning theory and professional practice within creative industries (Banjanin et al., 2024; Pierce et al., 2025).

2.5. Studio-Based Learning and industry simulation

A major development within contemporary game-development education is the adoption of studio-based learning (SBL). Studio pedagogy originates from architecture, industrial design, and fine-arts education and emphasizes learning through creation, critique, revision, and reflective practice throughout involvement in real-life projects (Al-Hammoud, Hussain & Araji, 2025). Unlike lecture-centred instruction, studio environments encourage students to engage directly with problems while receiving continual feedback from peers and instructors (Pierce et al., 2025; Gunnars and Palmquist, 2026).

One of the examples within game-development education is the Game Studio Simulator model developed by Pierce and colleagues (Pierce et al., 2025). Based on more than ten years of curriculum refinement, the model integrates software engineering and game design students into multidisciplinary teams operating within simulated production environments. Students participate in milestone reviews, collaborative planning, project presentations, and iterative development cycles that resemble professional studio workflows. Results suggest improvements in both student satisfaction and learning outcomes.

Studio pedagogy offers several advantages. First, it creates opportunities for authentic collaboration across disciplines. Second, it supports iterative learning through continuous revision and feedback. Third, it develops professional competencies related to communication, teamwork, and project management. Finally, it exposes students to production constraints and organizational structures commonly encountered in professional practice (Pierce et al., 2025; Gunnars & Palmquist, 2026).

Research within university game-development programs likewise demonstrates positive effects of studio-inspired approaches. Educational models allocating substantial time to project work and mentorship consistently produce stronger outcomes than those focused primarily on instructor-led demonstrations. These findings suggest that students benefit from environments where learning occurs through participation and creation rather than observation alone (Banjanin et al., 2024).

In the peer-review synthesis chapter, Güneş et al. (2026) examine international game design programs. They emphasized that successful programs balance technical, artistic, and theoretical competencies. It was also found that studio-based and project-based learning are the most dominant approaches to teaching game design.

In the perspective article, Fauilloux et al. (2025) synthesized evidence on student-led game design. They found that student-created games, which are a combination of game-based learning and design-based learning, promote systems thinking, collaboration, and engagement.

2.6. Limitations

2.6.1. Assessment and collaborative learning

Assessment represents one of the most persistent and complex challenges within contemporary game-development education (Pierce et al., 2025; Gunnars and Palmquist, 2026). While project-based learning and studio pedagogy have become widely accepted as effective educational approaches, institutions continue to face difficulties when evaluating individual student achievement within collaborative production environments.

In their experience, the authors of this paper also experienced this limitation during the implementation of PBL in a university course in game development. Students work in teams of three or two. The main issue arises in determining a quantity of work done by individual members of a team (for example in the case of absence from class during milestone's presentations and during some of the development process in the classroom). So, in some cases, an unequal distribution of the work between team members is noticed, which later appeared as a problem during the assessment.

Students working within multidisciplinary teams contribute in different ways and at different times throughout the production cycle. Students that took a programmer role may produce substantial amounts of code while students with designer role focus on documentation, gameplay systems, and balancing. Students with artistic roles contribute visual assets, user-interface elements, and animations, while students with producer role coordinate schedules, tasks, and communication among team members. These roles were distributed so that one member took various roles in the development process. Because contributions differ in form rather than quantity alone, evaluating individual assessment becomes challenging.

In the work of Hughes and Kavanagh (2025), an innovative solution known as the Trunk and Branch assessment model was proposed. In this approach, students first develop a shared collaborative foundation referred to as the "trunk." Subsequently, each student expands the project through individual work known as a "branch." This structure allows educators to evaluate both collaborative competence and individual achievement while maintaining authenticity within the learning environment. Approximately 72% of participants reported that the approach contributed to their professional development.

2.6.2. Selection of representative research papers

The present study employs a narrative synthesis rather than a formal systematic review or meta-analysis. While the selected corpus includes influential and recent publications, the methodology does not follow strict inclusion and exclusion protocols such as those associated with PRISMA-based review studies (Huang, Li & Shang, 2023; Gunnars & Palmquist, 2026). Consequently, the findings should be interpreted as conceptual and integrative rather than exhaustive representations of the field.

2.6.3. Lack of longitudinal evidence regarding professional outcomes after graduation

Many studies rely heavily on qualitative methodologies, participant feedback, educator observations, and case-study approaches. Although these methods provide valuable insight into educational

practice, they frequently lack longitudinal evidence regarding professional outcomes after graduation. Additional research examining employability, career progression, long-term skill retention, and professional success would strengthen understanding of the effectiveness of different educational models.

3. Results

3.1. Evolution of Educational Thinking in Game Development Education

Analysis of the reviewed literature reveals a progressive evolution of educational thinking regarding video game development. This evolution can be described through four interconnected stages:

1. Stage 1: Games as Educational Tools
2. Stage 2: Learning Through Game Creation
3. Stage 3: Studio-Based Learning
4. Stage 4: Ecosystem-Based Professional Formation

Stage 1: Games as Educational Tools

The earliest educational approaches treated games primarily as instructional media. Educational researchers focused on how serious games and simulations could improve motivation, engagement, and retention of knowledge across diverse academic disciplines. During this period, games were viewed principally as mechanisms for teaching content rather than as objects of study or development (Banjanin et al., 2022; Brandl & Schrader, 2024).

A key contribution of this stage was the demonstration that interactive systems could support experiential learning more effectively than passive instructional methods. Serious games established the legitimacy of interactive learning environments within higher education and contributed significantly to the later development of game-oriented pedagogical approaches (Banjanin et al., 2022; Brandl & Schrader, 2024).

Stage 2: Learning Through Game Creation

The second stage emerged from constructionist theories of learning. Instead of consuming educational games, students were encouraged to create them. Learning occurred through the design and development process itself. Researchers observed that game creation required learners to integrate technical, creative, and organizational knowledge across multiple domains.

As students designed mechanics, built systems, created assets, and evaluated user experiences, they acquired skills extending beyond traditional disciplinary boundaries (Gunnars & Palmquist, 2026; Khoo et al., 2025).

This stage marked a fundamental transition in educational thinking. Educational value no longer originated solely from interaction with finished products but from participation in creation processes.

Stage 3: Studio-Based Learning

The third stage introduced educational models inspired by professional production environments. Programs increasingly adopted multidisciplinary teams, long-term projects, milestone reviews, sprint planning, and collaborative workflows.

Within these environments, students assumed specialized roles resembling industry practice. Learning became situated within authentic contexts, and educational activities mirrored real production pipelines more closely than traditional coursework. Studio pedagogy began replacing isolated assignments with sustained development experiences (Pierce et al., 2025; Banjanin et al., 2024).

Stage 4: Ecosystem-Based Professional Formation

The most recent stage extends beyond project work itself and conceptualizes game-development education as a professional ecosystem. Educational success is no longer measured solely through technical competence but through the development of professional identities, collaborative capabilities, reflective practice, and participation in communities of practice.

Students are viewed as emerging professionals who gradually transition into the industry through mentorship, industry engagement, portfolio development, and authentic production experiences. This ecosystem perspective forms the conceptual foundation of contemporary educational frameworks (Pierce et al., 2025; Gunnars & Palmquist, 2026).

3.2. Proposed game development education framework

The proposed framework synthesizes key findings identified throughout the reviewed literature in the hope of further developing the game education development narrative. This framework can be presented in terms of the six most important aspects (pillars) of contemporary game education approaches (Table 1).

Together, these pillars establish a comprehensive framework for contemporary curriculum development that integrates educational theory, professional practice, and industry requirements and aligns with the reviewed literature.

Table 1
Proposed game development education framework

	Name	Short description
Pillar 1	Project-based learning	Projects function as the primary vehicle for knowledge construction and skill development. Students learn through solving meaningful problems and producing authentic outcomes.
Pillar 2	Multidisciplinary collaboration	Students collaborate across disciplinary boundaries in ways that mirror professional game-production environments.
Pillar 3	Teaching presence and mentorship	Educators guide learning through mentorship, consultation, feedback, and reflective discussion.
Pillar 4	Authentic industry simulation	Educational environments incorporate workflows, methodologies, tools, and practices commonly found within professional studios.
Pillar 5	Hybrid assessment	Assessment balances collaborative achievement with individual accountability through multidimensional evaluation systems.
Pillar 6	Professional identity development	Curricula support the transition from student identity toward professional participation within game-development communities.

3.3. Future research directions

The reviewed literature suggests that future research should move beyond evaluating isolated pedagogical interventions and instead focus on understanding game-development education as a dynamic educational ecosystem (Pierce et al., 2025; Gunnars & Palmquist, 2026).

One of the most significant research priorities concerns longitudinal evaluation of educational outcomes. Most existing studies examine learning outcomes at the conclusion of individual courses, semesters, or academic programs. These investigations frequently report improvements in engagement, project quality, collaboration, and student satisfaction. More research is needed to understand how different educational approaches influence employability, career progression, industry retention, and long-term professional development.

Assessment innovation represents another important area requiring additional investigation. While recent contributions, such as the Trunk and Branch model, provide promising solutions for balancing collaborative and individual evaluation, challenges remain. Future research should explore assessment systems capable of measuring technical competence, creativity, communication skills, leadership, collaboration, and professional development simultaneously.

Generative artificial intelligence is likely to become one of the most influential factors affecting game-development education in the coming years. Tools based on large language models, procedural content generation, machine learning, and AI-assisted programming are already altering professional workflows. The authors of this paper identified, through their work with university students and students across different courses, extensive use of generative AI, primarily Anthropic's Claude and Google Gemini for code generation, issues with workflow, and challenges in finding certain technical solutions during game development. Future studies should investigate the pedagogical implications, ethical considerations, and assessment challenges associated with AI-supported development practices.

4. Discussion and conclusion

The reviewed literature demonstrates a clear transition from content-centred educational models toward ecosystem-oriented professional formation. This transformation reflects broader developments in higher education as well as changing expectations within the game industry.

One of the most significant findings concerns the evolving role of educators. Traditional models positioned instructors as primary knowledge providers. Contemporary approaches increasingly emphasize mentorship, facilitation, consultation, and reflective guidance. Students acquire knowledge through participation in meaningful activities rather than through passive reception of information (Banjanin et al., 2024; Pierce et al., 2025). The convergence between educational theory and professional practice represents another notable trend. Concepts such as project-based learning, constructionism, experiential learning, and reflective practice increasingly align with professional development methodologies including agile production, milestone reviews, iterative design, and collaborative problem-solving (Huang et al., 2023; Pierce et al., 2025; Gunnars & Palmquist, 2026).

Game-development education has evolved substantially beyond its origins in technical instruction. Contemporary programs increasingly emphasize project ownership, multidisciplinary collaboration, mentorship, industry simulation, reflective practice, and professional identity development.

The literature reviewed in this study suggests that four major stages characterize this evolution: games as educational tools, learning through game creation, studio-based learning, and ecosystem-based professional formation. Each stage represents a deeper integration of educational theory and professional practice.

The proposed framework synthesizes these developments into a unified conceptual model. By emphasizing project-based learning, mentorship, collaboration, authentic production, hybrid assessment, and professional identity formation, the framework provides guidance for future curriculum design and educational innovation.

Ultimately, successful game-development education extends beyond teaching students how to build games. It creates ecosystems through which students become game developers.

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