

Using Nintendo's Game Builder Garage for Hands-On Learning in Graduate Game Design Education

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OVERVIEW

This activity is built around the hands-on use of Nintendo's (n.d.a) *Game Builder Garage* as a tool for teaching game design principles in an online, graduate-level course. Throughout the course, students use *Game Builder Garage* to design and create a fully functional game over four weeks, applying the course concepts to their projects, demonstrating their practical application of these principles, and receiving feedback. This activity details a four-week game jam implementation of game design theories and best practices using *Game Builder Garage*.

Topics: Educational Games, Game Builder Garage, Game Design

Time: Four weeks

MATERIALS

- Nintendo Switch console for each student
- Nintendo's (n.d.a) *Game Builder Garage* software for each student
- Internet access for instructor and students
- Computer with mic and webcam for each student
- Note-taking tools for students
- Audio/video conferencing tools (e.g. Zoom or Google Meet)
- External controller (optional)
- [Playtesting Rubric](#) (DOCX)
- [Final Game Rubric](#) (DOCX)
- [How to Develop Your Game](#) (DOCX)
- [Playtesting Discussion Prompt](#) (DOCX)

CONTEXT-AT-A-GLANCE

Setting

Online, graduate instructional design program at an urban university in the eastern United States.

Modality

Online, Asynchronous

Class Structure

The 3-credit, 15-week, asynchronous course was divided into eight modules focusing on different aspects of educational games, theory, practice, and applied design and development.

This lesson focuses on the final 4-week game jam module.

Learner Characteristics

Learners were primarily graduate students from diverse backgrounds with an interest in instructional game design. Prior knowledge of game design principles was helpful but not required. Learners typically worked in groups of 3-5. The instructor-student ratio was one to fifteen, which is recommended.

Instructor Characteristics

The course was developed by an instructor with comprehensive knowledge of game design and technical familiarity with the Nintendo Switch console and Nintendo (n.d.a) *Game Builder Garage* software.

Design Framework

The course was structured around the concept of "learning by doing," focusing on the practical application of game design principles.

SETUP

The course employed a Learning Management System (LMS; e.g., Blackboard or Canvas), set up in a structured and visually appealing manner. The LMS included elements such as a module banner, a brief module overview, module learning objectives, a module checklist for students, a link to the assignment details, and any pertinent due dates. A discussion board was also created for groups to post their game demos and receive playtesting feedback. The course followed a four-week module flow:

1. (W1) Conceptualize and begin designing your game,
2. (W2) Continue to prototype your game,
3. (W3) Post a game demo to the class discussion board for playtesting, and
4. (W4) Iterate upon feedback to prepare a final game demo.

Discussion forums were integral to the game creation process, providing a space for students to share progress, exchange ideas, ask questions, and receive feedback. The primary platform for practical application was the Nintendo Switch console, and students needed their own console to participate. Game Builder Garage, purchasable from the Nintendo (n.d.a) eShop, served as the main tool for game design. A stable internet connection with a minimum download speed of 3 Mbps was essential for software downloads, online discussions, and accessing course materials. Students also required a computer, preferably a Windows or Mac laptop or desktop, for accessing the LMS and participating in asynchronous forums. Note-taking tools, either physical or digital, were needed for jotting down ideas and keeping track of feedback. For any real-time, virtual meetings, students needed a webcam, microphone, headset, and software like Zoom or Google Meet. Some students preferred using an external controller for the Nintendo Switch for ease during game testing, but this was optional.

A step-by-step guide for setting up the Nintendo Switch and downloading Game Builder Garage, including creating a Nintendo account and accessing the eShop, was provided to students (see Game Builder Garage step-by-step guidance; Nintendo, n.d.c). A clear protocol for sharing game designs for peer review and instructor feedback was established, facilitated by the built-in game sharing feature (see Game Builder Garage FAQ; Nintendo, n.d.b). Real-time

meetings were a part of the course structure, so a reliable video conferencing tool was used, and meeting links were scheduled and shared in advance. The organizational goals were centered around cultivating educational game design skills, fostering creativity, and promoting active learning, supported by comprehensive resources and peer- and instructor-feedback mechanisms.

COURSE OBJECTIVES

This course included four overarching objectives with a focus on developing an understanding of theoretical and applied game design principles for learning and putting those principles into practice.

1. **Theoretical Understanding:** Develop a comprehensive understanding of the relevant theories that elucidate the use, design, and effectiveness of instructional games, with a particular focus on digital games.
2. **Game Analysis:** Develop the ability to critically analyze existing games, assessing their potential for adaptation to instructional use.
3. **Research Application:** Critically evaluate foundational and current digital game-based learning research through discussion of its implications for instructional gaming.
4. **Game Development:** Create functional game prototypes in a digital game environment to gain practical skills in designing and developing games that incorporate instructional content.

The focus of this activity is on objective four, Game Development.

CONTEXT AND SETTING

This activity is part of a 15-week online, graduate-level game design course which integrates within the broader university ecology of instructional design courses and curricula. What sets this course apart from the rest of the program is the focus on equipping instructional designers with specialized skills needed to evaluate, design, and develop educational games. The course covers a diverse array of topics, from an introduction to games and simulations to in-depth explorations of off-the-shelf games, Minecraft Education Edition, serious games, empathy games, and gamification strategies.

Throughout the course, students engaged in a variety of activities, from academic discussions based on course readings to hands-on projects like creating Minecraft learning environments. Class activities included playing a range of video games, learning to evaluate them using rubrics, discerning the difference between games and other immersive media, and collaborating to create game environments. The course also included a LinkedIn Learning component on gamification (Gamification of Learning, 2014) where students earn a completion certificate and critique their classmates' gamification ideas. Throughout the semester, guest speakers recorded lectures which were posted to the class for students to engage with.

The overall class structure was as follows, with a one-week break built in for students. Modules are presented as levels (Lvl):

- Lvl 1-Tutorial Mission (one week: course introduction)
- Lvl 2-Games and Simulations (one week)
- Lvl 3-Integrating common off the shelf games (one week)
- Lvl 4-Exploring Minecraft Education Edition (one week)
- Lvl 5-Serious games (one week)
- Lvl 6-Gamification (one week)
- Lvl 7-Designing in Minecraft (two weeks)
- Lvl 8-Representation in Games (one week)
- Lvl 9-Developing your own game (four weeks)*
- Lvl 10-Credits (one week)

**The focus of this manuscript.*

The course was meticulously designed to meet its objectives in a balanced and comprehensive manner. The theoretical understanding was fostered through academic readings and discussions that delve into the relevant theories behind the use, design, and effectiveness of instructional games, particularly digital ones. Game analysis was a recurring theme, as students are encouraged to critically assess off-the-shelf games and their potential for educational adaptation. The objective of research application was met through in-depth discussions that evaluated foundational and current research in digital game-based learning, allowing students to understand its implications for instructional gaming. Finally, the game development objective was realized through hands-on projects, such as creating Minecraft learning environments, where students gain practical skills in designing and developing games with

instructional content. Lastly, the course culminates in a capstone project that allowed students to showcase their acquired skills in educational game design. This is focus of this four-week activity.

A structured game development framework enriched this transition by prioritizing key components such as player experience and playtesting. This game development framework was adapted from the game jam format (Hrehovcsik et al., 2016; Zook & Riedl, 2013). A game jam is a time-limited event where individuals or teams work intensively to design and develop a video game from concept to prototype and typically lasts over a short period of time (Locke et al., 2015). This approach was adapted for the course to take place over four weeks.

This framework guided students through the iterative process of game development, from initial concept to final prototype, through four assignments:

1. Developing the Game Idea Assignment
2. Game Jam Activity
3. Playtesting and Redevelopment
4. Preparing Final Demo Assignment

Player experience was emphasized early to ensure the game is engaging and meets educational objectives. Playtesting was integrated throughout the course, but especially during the 4-week game jam phase, where students worked in groups of 3-5 to rapidly prototype, gather feedback, and revise a game using Nintendo's (n.d.a) Game Builder Garage.

About half the learners in the course were regular video game players, but most had little to no experience with playing or developing educational video games. The course was designed to be accessible, and no prior knowledge was assumed. The course design was deeply rooted in constructivist theories, specifically Vygotsky's (1978) work, which emphasized the social context of learning and the importance of hands-on experience. This is complemented by Kolb's (1984) experiential learning theories that advocated for active engagement in the learning process. Game Builder Garage served as an ideal platform for this pedagogical approach, being user-friendly, affordable, and devoid of a steep learning curve. Specifically, its user-friendly interface aligned well with Vygotsky's emphasis on scaffolding, providing learners with the tools they needed to build upon their existing knowledge. Additionally, its affordances for rapid prototyping and iteration resonated with Kolb's cycle

of experiential learning, allowing students to learn by doing, reflecting, and revising.

By incorporating these theoretical and design frameworks, game development sequences, and key components, the course aimed to guide students through a comprehensive learning journey. This journey led to the creation of fully functional digital games, designed for a variety of potential environments, from K-12 classrooms to professional training settings.

GAME BUILDER GARAGE GAME JAM ACTIVITY

While the following activity structure is presented within the context of a 15-week graduate-level course, it's worth noting that the framework is highly adaptable and could be effectively implemented in an undergraduate setting as well. Minor modifications, such as simplifying some of the more advanced game design concepts or reducing the scope of the projects, could make the course more accessible for undergraduate students. In the sections that follow, a 4-week activity structure is outlined, along with the required materials. Each of the activities have been designed to take approximately one week. For successful replication of this lesson in different educational settings, it is recommended to adjust the following lesson stages to fit your specific time frame and teaching modality. During this lesson, italic text identifies instructions, questions, or prompts provided to the learners.

ACTIVITY STRUCTURE

Week 1: Developing the Game Idea

- Activity: Brainstorm Game Ideas
- Assignment: Develop the Game Idea
- Grading: Open Evaluation and Feedback

Week 2: Game Jam Activity

- Activity: Rapid Prototyping and Iteration
- Assignment: Create the Initial Game Demo

Week 3: Playtesting and Redevelopment

- Activity: Iterative Feedback and Revision
- Assignment: Refine the Game Prototype based on Feedback
- Grading Rubric: See Support Materials

Week 4: Preparing Final Demo

- Activity: Prepare the Final Game Demo
- Assignment: Finalize the Game Demo
- Rubric: See Support Materials

DEVELOPING THE GAME IDEA ASSIGNMENT

Objective: The objective of this assignment was to develop a game idea that was both doable within the scope of the course and aligned with the learning goal of creating an educational game.

INSTRUCTIONS

Reflect on the learning goals and objectives of the course, focusing on the educational aspect. Consider the key concepts, skills, or knowledge that the game prototype should convey to the players.

Brainstorm game ideas that are feasible to develop within the given timeframe and resources. Keep in mind the scope of the course and the technical limitations of the Game Builder Garage software.

Examine "How to Develop Your Game" (DOCX) to gain additional tips for managing the scope and direction of the game.

Prepare a brief presentation of your game idea, including the following details:

- **Game Concept:** Provide an overview of the game's main concept and mechanics.
- **Learning Goals Alignment:** Explain how the game aligns with the learning goals of the course. How does it support the educational objectives?
- **Player Experience:** Describe the intended player experience and how the game engages learners in the educational content. This includes the game mechanics, asset design, character design, audio, game theme, etc.
- **Feasibility:** Explain why the game idea is doable within the constraints of the course, considering the scope and technical limitations.
- **Potential Challenges:** Identify any potential challenges or limitations that may arise during the development process and propose possible solutions.

INSTRUCTOR FEEDBACK

The instructor reviewed the submitted game ideas with a focus on feasibility and alignment with the course's educational objectives. Feedback was

provided to help students refine their concepts into a manageable scope that can be realistically developed, using the Game Builder Garage software, within the course timeframe. Suggestions were offered to streamline game mechanics, simplify asset and character design, or modify game themes, all while ensuring that the educational goals were effectively met. The aim was to guide students in honing their game ideas to be both achievable and educationally impactful.

INSTRUCTOR SETUP AND NOTES

The focus of this activity was for students to propose ideas for a feasible game that can be created during their game jam. While the written instructions provided were the primary guidance, the instructor had the option to create a supplementary video for students who may need additional clarification. There were no mandatory readings or discussion threads, although the latter can be included for students interested in going beyond the assignment's basic requirements. For example, an instructor could choose to provide a discussion board assignment around managing the game's scope where students discuss strategies for keeping the game project within a manageable boundary.

Feedback for this assignment was provided through the institution's LMS assignment grading tool and was given at the end of the week. The assignment was set up in the LMS, where all resources and submissions were centralized. The grading approach for this assignment was largely pass/fail, with the feedback aimed at helping students refine their game ideas to make them more manageable and aligned with the course's scope. The primary focus was on signposting students to prepare them for the upcoming game jam.

GAME JAM ACTIVITY

Objective: The objective of this game jam was to foster creativity and collaboration by challenging students to design, develop, and prototype a functional digital game within a specified time frame.

Utilizing an iterative approach, teams focused on rapid prototyping, testing, and iteration, aiming to produce a game that is both innovative and polished. The game jam served as a practical, hands-on experience to apply the principles of game design, encouraging risk-taking and learning from failure.

THE ASSIGNMENT

To master game design, the most effective approach is to create rapid prototypes, test them, embrace failure, analyze what worked and what did not, and iterate. As your instructor, I encourage you to trust that it is okay to fail and take risks, even if your final game ends up as a rudimentary collection of assets. To ensure your success in this course, grading will be de-emphasized, focusing instead on the learning process.

Now, let's explore the concept of a game jam.

Game jams showcase the incredible potential of achieving remarkable outcomes within a short time frame when you apply yourself. In a traditional game jam, small teams design and develop functional game prototypes over the course of a day or two. Given our constraints, this course will feature an extended game jam, spanning the remaining duration of the course. During this time, you are expected to collaborate with your team to bring your game design concept to life as a functional digital game prototype.

To set realistic development goals, it is beneficial to examine examples of games created during previous game jams (e.g., Global Game Jam, n.d.). These games will serve as a source of inspiration and provide insights into the level of development you should aim for with your game prototype. By playing and discussing these games with your team, you can gather cool ideas for game mechanics, feedback loops, and more. Additionally, analyzing these examples will help you gain a sense of the level of polish and functionality you should strive to achieve.

INSTRUCTIONS

This week, you will begin the functional digital game prototype by following these steps:

- **Start Small:** Begin by focusing on a single, core game mechanic. Your aim should be to do this one thing exceptionally well. This will be the foundation upon which your game is built.

- **Create a Basic Build:** Using Game Builder Garage, create a basic build that showcases this core mechanic. At this stage, don't worry about additional features, levels, or polish.
- **Collaborative Review:** Share this basic build of your collaborative game with your team members for a quick review. Gather initial thoughts on the functionality and potential of the core mechanic.
- **Refinement After Review:** Based on the feedback from your team, refine your prototype. Make necessary adjustments to the core mechanic to enhance its functionality and engagement.
- **Documentation:** Keep a record of your development process, noting any challenges, successes, or insights. This will be useful for future iterations and for understanding your design choices.
- **Submission:** Upload your basic build and any accompanying documentation to the LMS assignment grading tool. Feedback will be provided at the end of the week, primarily focusing on whether the core mechanic is strong enough to build upon.

THE EXPECTATIONS

In the context of this game jam, it is crucial to understand that the goal is not to produce a fully finished game within this short time frame. Instead, the emphasis is on the iterative process of game development. Your primary objective should be to establish the core mechanics of your game. These are the foundational elements that make your game unique and engaging. Once these are in place, you'll have the opportunity to iterate internally within your team, troubleshooting issues and refining the gameplay.

Next week offers a valuable opportunity for playtesting, where others will interact with your game. Therefore, your focus should be on creating a prototype that effectively communicates your game idea to others, even if it's not fully polished. The aim is to have something playable that allows others to grasp your vision, providing you with valuable feedback for further iterations. Remember, game jams are all about rapid development, learning, and improvement, not perfection.

INSTRUCTOR SETUP AND NOTES

During this week the game demo is not due, so there is no need to have any discussion board or area to share the demo codes. This will be covered in the next activity.

PLAYTESTING AND REDEVELOPMENT

Objective: The objective of this asynchronous activity was to prepare a game demo that effectively showcased the key elements and features of the students' game prototype, incorporating playtesting as a valuable feedback-gathering process.

MODULE FLOW

- Game demo submitted to discussion board on Monday.
- Peer feedback given by Wednesday.
- Revisions continue through week.
- Instructor gives feedback by end of the week.

INSTRUCTIONS

This week, you will continue the functional digital game prototype by following these steps:

- **Identify Key Elements:** Review your game design and identify the essential elements that you want to highlight in your game demo. These could include unique mechanics, engaging gameplay, captivating visuals, or immersive storytelling. Consider what aspects of your game best demonstrate its educational value and align with the learning goals.
- **Plan the Demo Flow:** Outline the structure and flow of your game demo. Determine the sequence of events, levels, or sections you want to showcase to create a cohesive and engaging experience for the players. Ensure that the demo effectively communicates the core concepts and gameplay features of your game.
- **Create a Demo Script:** Develop a written script that guides the gameplay demonstration. The script should include instructions for the presenter, highlighting important elements, explaining mechanics, and providing context to the audience. Consider how you can effectively communicate the educational aspects of your game during the demo.

- **Prepare Visual Assets:** Gather or create visual assets that accurately represent the visuals and aesthetics of your game. This may include screenshots, concept art, or promotional graphics. Ensure that the visual assets effectively convey the unique qualities of your game and generate interest among viewers.

Playtesting: Asynchronously playtest other groups' game prototypes and provide constructive feedback. Engage in discussions or use provided evaluation questions to share your impressions, suggestions for improvement, and insights on the educational value of their games (see Playtesting).

- Discussion Prompt for evaluation questions). Take note of their comments and engage in thoughtful discussions about the strengths and areas for improvement of their game demos.
- **Share the Demo and Receive Feedback:** Share the game demo to the discussion board, where it can be easily accessed by your instructor and peers. Provide a brief description or summary of the demo, highlighting the educational aspects and key features you focused on. Encourage your peers to play your demo and provide constructive feedback, based on their own playtesting experiences and observations.
- **Peer Feedback and Discussion:** Engage in asynchronous discussion forums or communication channels provided by your instructor to share and receive feedback on the game demos. Encourage your peers to watch your demo and provide constructive feedback, impressions, and suggestions for improvement based on their own playtesting experiences. Take note of their comments and engage in thoughtful discussions about the educational value and effectiveness of your game.
- **Reflection and Iteration:** Reflect on the feedback received from playtesting and peer discussions, considering how it can inform the further development of your game. Use the feedback to iterate and improve your game prototype, ensuring that it aligns more effectively with the learning goals and provides an engaging and meaningful experience for players.
- **Note:** This asynchronous activity allows you to showcase the progress of your game development, gather valuable feedback through playtesting, and refine your game prototype. The recorded demo serves as a snapshot of your game's potential and acts as a steppingstone towards its further

enhancement and refinement. Engaging in discussions with peers and providing constructive feedback on their game demos fosters a collaborative learning experience and provides insights from different perspectives.

Rubric: This activity can be assessed by the instructor. See Playtesting Rubric for a rubric that can be used. Students find it helpful to have access to the rubric in advance to know the criteria on which their output will be evaluated.

INSTRUCTOR SETUP AND NOTES

The instructor's role was pivotal in guiding students through this complex, multi-step process. The activity was fully integrated into the LMS where a dedicated assignment tab was created specifically for this phase of the game jam. Instructors may optionally upload supplementary materials, such as example demo scripts or feedback forms, to aid students in their preparations (see Playtesting Discussion Prompt).

Feedback remained a cornerstone of this activity and was facilitated through the LMS assignment grading tool. Instructors should focus on the quality of the game demo, the effectiveness of the playtesting process, and the depth of the peer feedback provided. The aim was to guide students in refining their game prototypes and enhancing their educational value. Given the asynchronous nature of the course, instructors should also create and monitor discussion boards to ensure that constructive and meaningful feedback is being exchanged among peers.

The grading rubric, which outlines the criteria for assessment, should be made available to students in advance (see Playtesting Rubric). This allows students to understand what is expected in terms of demo quality, playtesting feedback, and peer engagement. The instructor's feedback should be constructive and aimed at facilitating iterative improvement, aligning with the activity's focus on redevelopment and refinement.

PREPARING FINAL DEMO

Objective: The objective of this final assignment was to evaluate the final game demo based on the

revisions, functionality, alignment with learning outcomes, and educational nature.

INSTRUCTIONS

This week, you will finish the functional digital game prototype and submit your final game demo by following these steps:

Documentation of Revisions: Provide clear documentation that outlines the revisions made to the game based on the feedback received during the development process. Describe how the feedback influenced the changes and

- **improvements made to the game mechanics, gameplay elements, and overall design.** Explain how the revisions align with the learning outcomes and enhance the educational value of the game.
- **Functionality and Playability:** Evaluate the functionality of the final game demo to ensure that it is playable without any game-breaking bugs or technical issues. Test the game thoroughly to ensure that all features and mechanics work as intended. Verify that the controls are intuitive, the game progression is smooth, and the overall user experience is enjoyable.
- **Cohesive Game Mechanics:** Assess the coherence of the game mechanics within the final demo. Determine if the mechanics work together seamlessly and create a consistent gameplay experience. Consider the clarity of instructions and the ease of understanding the mechanics.
- **Alignment with Learning Outcomes:** Evaluate the extent to which the game demo aligns with the intended learning outcomes. Assess how the gameplay elements and mechanics directly contribute to the achievement of these outcomes. Analyze how the game engages players in active learning experiences and promotes the acquisition of knowledge or skills in the targeted educational domain.
- **Educational Nature:** Examine the educational nature of the game demo. Determine if the game effectively presents educational content, concepts, or challenges to the players. Assess the extent to which the game encourages critical thinking, problem-solving, collaboration, or other educational goals. Evaluate how the game engages players in meaningful learning experiences.
- **Evaluation Criteria:** Develop a set of evaluation criteria or a rubric that reflects the elements mentioned above. Use this rubric to objectively

assess the final game demo in terms of documentation, functionality, cohesive game mechanics, alignment with learning outcomes, and educational nature. Provide clear descriptions and scoring guidelines for each criterion.

- **Reflection and Conclusion:** Reflect on the evaluation process and the strengths and weaknesses identified in your own game demo and those of your peers. Discuss the effectiveness of the revisions made, the overall functionality and playability, the cohesiveness of game mechanics, and the alignment with learning outcomes. Consider how the evaluation process informs future iterations or improvements in the game design.

Rubric: The Final Demo should be assessed by the instructor. See Final Game Rubric for a rubric that can be used. Students find it helpful to have access to the rubric in advance to know the criteria on which their output will be evaluated.

CRITICAL REFLECTION

The following reflection aims to provide a comprehensive overview of the experiences, challenges, and opportunities encountered during the 15-week online, graduate-level game design course. This course was designed with the dual objectives of equipping instructional designers with specialized skills in educational game development and providing a hands-on learning environment. The reflection is organized into key thematic areas, each addressing specific aspects of the course, with two main themes: student growth and game design courses.

STUDENT GROWTH

The 15-week online, graduate-level game design course has been a journey marked by both rewarding milestones and challenging obstacles. A significant highlight was the observable growth among students, particularly those who started with minimal experience in educational video games (Gee, 2003).

BRIDGING THEORY AND PRACTICE

Initially, the course was designed with a "tabula rasa" approach, aiming to be accessible to beginners

(Prensky, 2001). This raised concerns about students' ability to navigate game development tools effectively. However, the incorporation of Game Builder Garage, known for its user-friendly interface (Guerrero-Serrano et al., 2023), successfully bridged the gap between theoretical understanding and hands-on application. To build on this success, the course could introduce "mini-challenges" throughout the term, further preparing students for the more open-ended game jam project (Squire, 2006). Examples of mini-challenges could be based around core game mechanics such as a) getting a character to move successfully, b) setting up game goals and win/fail states, and c) creating non-playable characters that can be interacted with. Breaking the complex task of game design into these micro-

challenges could further the success and feasibility of the approach.

THE INTERPLAY OF LEARNING THEORY AND GAME DESIGN

The course's design was deeply rooted in constructivist (Vygotsky, 1978) and experiential learning theories (Kolb, 1984), emphasizing hands-on, active learning through Game Builder Garage (Nintendo, n.d.a). This approach could be further improved by incorporating more explicit scaffolding (Jantan & Aljunid, 2013) and elements of social learning (Bandura, & Walters, 1977). By doing so, the course could offer a more nuanced and supportive learning environment, catering to both novice and experienced students.

To make the learning process more accessible and effective, the course could benefit from the integration of explicit scaffolding techniques, as highlighted in research by Jantan and Aljunid (2013). Scaffolding in this context refers to a variety of instructional techniques designed to move students progressively toward stronger understanding and greater independence in the learning process. For example, the course could introduce step-by-step tutorials or guided exercises that break down complex game development tasks into smaller, manageable components. These could be paired with "hint" systems or interactive frequently asked questions (FAQs) that provide just-in-time support, allowing students to overcome challenges without getting stuck. This approach would not only help students build foundational skills but also empower them to tackle more advanced challenges as they

progress through the course. In addition to scaffolding, the course could also incorporate elements of social learning theory, inspired by the work of Bandura and Walters (1977). Social learning theory posits that people learn from one another through observation, imitation, and modeling. To put this into practice, the course could introduce structured peer reviews where students evaluate each other's game projects based on predefined criteria. This would offer multiple perspectives on their work, fostering a richer understanding of game design principles.

Furthermore, group discussions could be facilitated to encourage the sharing of ideas, challenges, and solutions, thereby creating a collaborative learning environment. Mentorship programs could also be considered, pairing less experienced students with those who are more advanced, to provide personalized guidance and support. By implementing these enhancements, explicit scaffolding and elements of social learning, the course could offer a more nuanced and supportive learning environment. This would cater to a diverse student body, ranging from novices who are just getting started with game development to those who have more experience but are looking to refine their skills.

SKILL ASSESSMENT AND PREREQUISITES

To ensure that the course remains accessible while still challenging enough for more experienced students, a "skills checklist" could be introduced at the start of each new unit or module (Mishra & Koehler, 2006). This would assist students in identifying the prerequisite skills and knowledge they need to acquire.

THE VALUE OF TARGETED FEEDBACK

While peer feedback was invaluable for refining the game prototypes, there's an untapped opportunity for more specialized insights. For instance, a short survey involving instructors or students could offer invaluable perspectives, ensuring closer alignment with educational goals (Schmidt et al., 2020). This is an area ripe for future exploration.

GAME DESIGN COURSES

Another observation after implementing this activity and course was the challenges that mirror broader, long-standing issues in the field of educational game design (Barab et al., 2005). Issues such as superficial integration of education into games and students' lack of technical skills emerged.

ADDRESSING EDUCATIONAL INTEGRATION

The superficial integration of educational components into the games is not isolated to this course but is a pervasive problem seen even in 'edutainment' products and professional game development (Egenfeldt-Nielsen, 2007). The challenge is exacerbated by the multifaceted complexities of game development, which demands a diverse skill set that includes music composition, graphic design, logic, computational thinking, and programming (see Glaser et al., 2021 which highlights some of this complexity).

Moreover, the majority of educators, while experts in pedagogy, often lack the technical skills to effectively navigate these complexities (Hirumi et al., 2010). Even when they do, they are confronted with the limitations and challenges of game design engines, which can be both technically demanding and inflexible for educational integrations. Given these layers of challenges, it's not surprising that the integration of educational components into games often remains at a superficial level.

To address this, a dedicated module focusing on the complexities of intertwining educational objectives with game mechanics could be introduced (Shaffer, 2006). This proposed module would aim to provide students with the theoretical understanding and practical skills needed to create games that are both engaging and educationally effective, thereby tackling the long-standing challenges that have been identified.

TECHNOLOGY CHOICES AND THEIR IMPLICATIONS

Future iterations of the course could explore the use of platforms like Unity in conjunction with simpler tools like Scratch. Unity offers a robust set of features for more experienced students, allowing for

the development of complex and polished games. However, it comes with higher computing requirements, which could be a barrier for some students. On the other hand, the drag-and-drop interface in Scratch is more approachable for beginners and has lower computing requirements, but the development of complex games is limited compared to Unity. Both platforms do have extensive online communities and resources, which can aid in the learning process. Additionally, Unity offers a free version, and Scratch is entirely free, addressing some of the affordability concerns associated with proprietary software like Nintendo's (n.d.a) Game Builder Garage.

Considering the challenges and trade-offs associated with current game development platforms, questions persist about the most effective ways to leverage these tools for educational purposes, especially in complex design contexts like game jams. A significant shift is likely to occur when one of two conditions are met: (a) either game development software becomes exponentially easier to use and support, or (b) educators find opportunities to collaborate with specialized software development studios to create educational tools that are both user-friendly and versatile.

Regarding the prospect of easier-to-use software, computing laws such as Moore's Law (Moore, 1965/2006) predict ongoing improvements in the power and user-friendliness of computing systems. These laws suggest that computing capabilities will double approximately every 1.5 years, leading to even more rapid advancements in technology. Extrapolating from this, the limitations of current game development platforms may be temporary hurdles. As technology advances, these platforms could become more accessible and more powerful, making them increasingly suitable for educational settings (Schmidt et al., 2023).

REFERENCES

- Bandura, A., & Walters, R. H. (1977). *Social learning theory*. Prentice Hall.
- Barab, S. A., Thomas, M., Dodge, T., Carteaux, R., & Tuzun, H. (2005). Making learning fun: Quest Atlantis, a game without guns. *Educational Technology Research and Development*, 53(1), 86-107. <https://doi.org/10.1007/bf02504859>

- Egenfeldt-Nielsen, S. (2007). Third generation educational use of computer games. *Journal of Educational Multimedia and Hypermedia*, 16(3), 263-281. <https://www.learntechlib.org/p/24375/>
- Gamification of Learning. (2014, October 9). LinkedIn. Retrieved October 3, 2023, from <https://www.linkedin.com/learning/gamification-of-learning>
- Gee, J. P. (2003). What video games have to teach us about learning and literacy. *Computers in Entertainment*, 1(1), 1-4. <https://doi.org/10.1145/950566.950595>
- Glaser, N., Schmidt, M., Schmidt, C., Palmer, H., & Beck, D. (2021). The centrality of interdisciplinarity for overcoming design and development constraints of a multi-user virtual reality intervention for adults with autism: A design case. In B. Hokanson, M. Exter, A. Grincewicz, M. Schmidt, & A. A. Tawfik (Eds.), *Intersections across disciplines: Interdisciplinarity and learning* (pp. 157-171). Springer. https://doi.org/10.1007/978-3-030-53875-0_13
- Global Game Jam. (n.d.). Retrieved October 3, 2023, from <https://v3.globalgamejam.org/2023/games>
- Guerrero-Serrano, A., Elizondo-Noriega, A., Tiruvengadam, N., Félix-Herrán, L. C., Forte-Celaya, M. R., Ruiz-Mendez, F. Güemes-Castorena, D., Lozano-Taba, D., Castillo-Paz, A., & Ramirez-Montoya, M. S. (2023). Protocol for using Nintendo Switch in an engineering class: A literature review. *2023 Portland International Conference on Management of Engineering and Technology* (pp. 1-7). IEEE. <https://www.doi.org/10.23919/PICMET59654.2023.10216896>
- Hirumi, A., Appelman, B., Rieber, L., & Van Eck, R. (2010). Preparing instructional designers for game-based learning: Part 1. *TechTrends*, 54, 27-37. <https://doi.org/10.1007/s11528-010-0400-9>
- Hrehovcsik, M., Warmelink, H., & Valente, M. (2016). The game jam as a format for formal applied game design and development education. In R. Bottino, J. Jeuring, & R. C. Veltkamp (Eds.), *Games and Learning Alliance: 5th International Conference, GALA 2016, Utrecht, The Netherlands, December 5-7, 2016, Proceedings* (pp. 257-267). Springer. https://doi.org/10.1007/978-3-319-50182-6_23
- Jantan, S. R., & Aljunid, S. A. (2013). An experimental evaluation of scaffolded educational games design for programming. In *2012 IEEE conference on open systems* (pp. 1-6). IEEE. <https://doi.org/10.1109/ICOS.2012.6417631>
- Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.
- Locke, R., Parker, L., Galloway, D., & Sloan, R. J. (2015, June). The game jam movement: disruption, performance and artwork. In *2015 workshop on game jams, hackathons and game creation events (co-located with FDG-2015)*.
- Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record: The Voice of Scholarship in Education*, 108(6), 1017-1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>
- Moore, G. (2006). Cramming more components onto integrated circuits. *IEEE Solid-State Circuits Society Newsletter*, 11(3), 33-35. <https://doi.org/10.1109/N-SSC.2006.4785860> (Original work published in 1965)
- Nintendo. (n.d.-a). Game Builder Garage™. Retrieved December 22, 2023, from <https://www.nintendo.com/store/products/game-builder-garage-switch/>
- Nintendo. (n.d.-b). Game Builder Garage FAQ. Retrieved December 22, 2023, from [https://en-americas-support.nintendo.com/app/answers/detail/a_id/55524/~game-builder-garage-faq#s3q1](https://en-americas-support.nintendo.com/app/answers/detail/a_id/55524/~/game-builder-garage-faq#s3q1)
- Nintendo. (n.d.-c). Game Builder Garage™ step-by-step guidance. Retrieved December 22, 2023, from <https://www.nintendo.co.uk/Games/Nintendo-Switch-download-software/Game-Builder-Garage-1964648.html>
- Prensky, M. (2001). *Digital game-based learning*. McGraw-Hill.
- Schmidt, M., Glaser, N., Schmidt, C., Kaplan, R., Palmer, H., & Cobb, S. (2023). Programming for generalization: Confronting known challenges in the design of virtual reality interventions for autistic users. *Computers & Education: X Reality*,

2, Article 100013.

<https://doi.org/10.1016/j.cexr.2023.100013>

Schmidt, M., Tawfik, A. A., Jahnke, I., & Earnshaw, Y. (2020). *Learner and user experience research: An introduction for the field of learning design & technology*. EdTech Books.

<https://doi.org/10.59668/36>

Shaffer, D. W. (2006). *How computer games help children learn*. Palgrave Macmillan.

Squire, K. (2006). From content to context: Videogames as designed experience. *Educational Researcher*, 35(8), 19-29.

<https://doi.org/10.3102/0013189x035008019>

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Zook, A., & Riedl, M. O. (2013). Game conceptualization and development processes in the global game jam. In *Workshop proceedings of the 8th International Conference on the Foundations of Digital Games*, 5. Retrieved December 22, 2023, from http://www.fdg2013.org/program/workshops/papers/GGJ2013/ggj13_submission_4.pdf



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