GAMIFYING EDUCATION THROUGH A TWO-PLAYER VIDEO GAME CONSOLE

KAHOOT! AND ITS EFFECTS ON STUDENT LEARNING

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction

The role of gamification is increasing rapidly in education, especially since the start of COVID-19 when instruction was held online for students during periods of isolation. However, as it is still early in its development stages, teachers have felt both positive and negative effects (Toda et al., 2018). Specifically, gamifying education has shown to increase negative competition among students, leading to an increase in test anxiety. In addition, there is a focus on surface-level learning, instead of deep learning, which many students benefit more from.

To address this issue, I propose a technical solution that involves making a two-player video game console inspired by the character "BMO" from the hit show Adventure Time. It will include an educational teamwork-based game that walks the two players through an engaging storyline, teaching them the value of plot progression. This game is specifically targeted towards 3rd-5th graders, as it will include Virginia Standards of Learning (SOL) type questions.

In terms of how my technical solution will improve on current designs, its mechanics will not be overly complex compared to those of mainstream video game consoles, adapting to a broader range of users. It will also include only multiplayer games, which are usually absent within mainstream counterparts, as they tend to focus on individual or competitive multiplayer games. The multiplayer game included will showcase obstacles that each player must help each other get through to get to the next obstacle.

Because my technical solution will require a diverse network of people, resources, etc. to keep track of, fully understanding the design and development of a successful network is critical. Therefore, I will draw on the Science, Technology, and Society (STS) framework of Actor Network Theory (ANT) to analyze the online game-based learning platform Kahoot!, and how it fails to recognize certain groups of students and even promotes an unhealthy learning

environment. I will also draw on Callon's concept of translation, which will showcase exactly how networks form and stabilize, and how they need to follow specific steps in order to change any aspect of them.

Neglecting to acknowledge the different roles of actors within a network and assuming some are somehow isolated from its socio-technical context runs the risk of creating a technical project that is inherently biased towards specific groups of people. Therefore, because the challenge of gamifying education is socio-technical within nature, it requires both its technical and social aspects to accomplish successfully. In what follows, I set out two related research proposals: a technical project for developing a two-player video game console with an educational teamwork-based game and an STS project proposal for examining Kahoot!'s network and its effects on student learning.

Technical

The growth in household video game consoles has been undeniable, shaping the identity of those born in the early 2000s and what they now find most nostalgic. Each video gaming company has had their own share of unexpected journeys in developing newer, shiner products, peaking people's interests at the latest software or hardware designs (Shilling, 2003). Although the impact of video game consoles has been great, the majority of mainstream video game consoles nowadays seem to be overly complex for children. Navigating a video game console's home screen can feel like navigating through an overcrowded airport. There are a hundred different options to choose from, and it does not help how game controllers can also have an overwhelming number of buttons, which basically go half unused by the average player. These aspects clearly take away from the original product, discouraging children from using it in a way that facilitates a fun and meaningful experience.

To address this issue, video game consoles such as the Nintendo Switch have been developed to target a larger age range than the typical XBox or PlayStation. The Switch has been successful in appealing to a wide range of users due to its family-friendly focus (Zhangshao, 2023). Nintendo the company itself is known for creating games that are appropriate for all ages, and the Switch is no exception. Its home screen is clean and simple, consisting of only seven buttons to choose from outside of the games the user owns. Children are able to navigate it without failure, and parents are even able to add parental controls that ease age-appropriate restrictions. In addition to the Switch's overly simplistic software design, if one person uses one controller, they would only have 9 buttons to choose from, making it more accessible than the average controller, which can include up to 12. Clearly, the Switch is a better choice than other

mainstream video game consoles, promoting a welcoming environment for children and users of all ages.

However, there is an undeniable flaw in the Switch's design that cannot be ignored. The Switch, while offering some multiplayer games, primarily focuses on individual or competitive multiplayer experiences. Many of its most popular games such as "Mario Kart" and "Super Smash Bros" do not require its users to adopt and foster teamwork skills that people must apply in everyday situations. This is obviously a huge disadvantage to having children interact with a majority of the games on the Switch, and clearly shows how there is a lack of focus on children's development when it comes to these kinds of games. This is especially true when we are in the midst of facing a decline in children's social skills due to the COVID-19 pandemic (Breaux et al., 2023). Because the market for competitive games for children is at its highest, studies have shown that children who interact with these kinds of games display aggressive behaviors overtime (Verheijen et al., 2019). This is an issue that clearly needs to be addressed to ensure that children's development is not compromised in the pursuit of creating "entertaining" or "successful" games.

The aim of this technical project is to avoid this flaw by creating a two-player video game console with a simple interface navigated using two controllers, each equipped with only 6 buttons. It will also include an educational teamwork-based game targeted towards 3rd-5th graders. The video game console can only be played with two players at the exact same time, promoting a deep sense of teamwork between them. In addition to this feature, the game will only include obstacles that each player must help each other pass through to get to the next obstacle, following an engaging storyline that teaches them the value of plot progression.

This project will be divided into 3 main components: software development, hardware development, and the integration of the two. The software development portion includes making the game with LUA on a coding platform called PICO-8 within an agile environment so that all components are created and tested throughout each development cycle. The hardware development portion includes making the printed circuit board (PCB) to connect the power supply to the Raspberry Pi microcontroller, which will interface the controllers with the screen, allowing smooth data transferring. After completion of the two, the two portions will then be integrated with one another, and encapsulated in one aesthetically pleasing video game console made from laser cut wood and 3D printed buttons, arms, and legs.

Once the project is completed and ready for deployment, it will be demonstrated at multiple different elementary schools within the Charlottesville area, allowing students to interact with it while we monitor progress in their behaviors. This progress will then be documented to prove that it accomplishes its goal of addressing the problem of overly complex video game consoles for children, while also promoting teamwork skills that are often ignored in game development. We have already gone ahead and contacted different teachers, and even the education school at the University of Virginia.

STS

Throughout the history of education, people have found ways to incorporate technology as a way to make processes easier for not only students but for teachers as well. The two are inseparable, and not only does the use of technology increase the effectiveness of teaching, but it pushes students' motivation to learn at heights that have never been achieved before. Kahoot! is an online game-based learning platform for teachers to test their students on specific learning areas through timed multiple choice questions. Students are able to play through their phone or laptop, and are ranked based on how well and fast they perform relative to their peers. It is among one of the most highly rated game-based learning platforms, and is used by 50% of US K-12 students (Wang et al., 2020).

Current discourse around Kahoot! includes positive impact on student learning outcomes, sometimes improving student performance on tests by an entire letter grade. Studies have also reported that most teachers felt positive about using Kahoot! within classroom settings. Specifically, Kahoot! has been credited with automating teachers' instructional processes through its user-friendly platform, and even reducing teachers' workload (Wang et al., 2020).

However, what is inadequate about this perspective is that it fails to acknowledge the negative impacts it has on students who do not excel in surface-level learning and/or memorization. Kahoot!'s mechanics clearly promote an unhealthy competition-based learning environment, as it includes timed multiple choice questions, and even shows the ranking of each student on the board for everyone else to see. Rather than focusing on deep learning, or even teamwork-based learning, students are only concerned with winning or appearing on the leaderboard, leading to surface-level engagement that pits students against each other (Ebadi, 2021). This kind of learning style can increase test anxiety in students, making them less eager to

learn or grow from their mistakes (Buhana, 2022). In addition, according to a research study conducted by Hanoi University in Vietnam, teachers rarely ever did any review after playing Kahoot!, leading to a lack of discussion that could potentially help their students further learn the material they were given (Truong et al., 2024).

Focusing on this new perspective can show how important it is to keep in mind every type of student, and how some do not mainly learn from timed multiple choice questions. When it comes to gamifying education, there are a multitude of different factors to consider, and it is up to the engineers and teachers to notice them. For this reason, I argue that although Kahoot! is a fully functional game-based learning platform that does not reveal any obvious faults, it is unintentionally biased towards certain students, and only rewards those who excel in surface-level learning.

To further frame my argument on Kahoot!, I will draw on the Science, Technology, and Society (STS) framework of Actor Network Theory (ANT). Developed by STS leaders Michel Callon, Bruno Latour and John Law, ANT emphasizes how all technical projects can be viewed as a network of human and non-human actors assembled by network builders to achieve a greater goal (Cressman, 2009). It also can provide an overall purpose for research that looks into the complexities of a technical project that are too often overlooked. In addition, I will also draw on Callon's concept of translation, which refers to the process of how networks form and stabilize, and how it is needed for Kahoot! to reconfigure its network towards deep learning outcomes, instead of surface-level ones (Callon, 1984). The evidence I will use to fully support my argument will be primarily taken from research studies, as well as overall comments from teachers and students on Kahoot! from neighboring schools.

Conclusion

In conclusion, I will be proposing a technical solution that involves making a two-player video game console that will include an educational teamwork-based game geared towards 3rd-5th graders. The game will walk the two players through an engaging storyline, teaching them the value of plot progression. It will include a simple interface, and its controllers will only include 6 buttons, making it simpler than mainstream video game consoles such as the XBox or Playstation. To fully hone in on the ethics of this technical solution, and how it requires a network of human and non-human components, I will draw from the Science, Technology, and Society (STS) framework of Actor Network Theory (ANT). I will do this by analyzing the network built around Kahoot!, an online game-based learning platform, and how it fails to recognize certain groups of students and even promotes an unhealthy learning environment.

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