Optimizing the Usage of Video Games in Youth Education

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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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In the summer of 2021, I worked as an instructor for Fairfax Collegiate – a Northern Virginia-based extracurricular program that taught 2 week classes to students grades 3-8. Fairfax Collegiate offered a variety of standard "summer school" classes, from math and programming to reading and writing, but I was a bit taken aback by one of the offered courses that went by the name of "Esports Arena." The course had students build PCs and then use them to play video games – and popular ones. League of Legends and Rocket League were two popular titles that were baked right into the class curriculum, and the students absolutely loved the class. What 13 year old wouldn't enjoy playing video games at summer school?

Now, this anecdote is exactly that – an anecdote. I don't anticipate that students next semester will be able to take Introduction to Starcraft II with Prof. Travis Elliot (although if I am wrong, and the stars align, I may be available as a TA) – rather, I share the story as an extreme case of a gradual shift in pedagogical practice. Technology – specifically in the form of technological games – has given teachers unprecedented new ways of engaging their students. In practice, student engagement is becoming the gold standard; this carries an implicit assumption that engaged students will learn the material indirectly, or as a side effect of being mentally stimulated.

The goal of this paper is to make an effort to delineate between "good games" and "bad games" for the purpose of classroom instruction. On the one hand, video games offer exciting new ways to engage previously tuned out students, and get them actively interested in their own learning. On the other hand, there becomes a point where the time a game wastes outweighs any time gained from active participation. This may be due to a number of factors – is the game related to course content? What skills does the game measure? How does the game treat its

winners and (inevitably) losers? If the game is only loosely relevant content-wise, is that okay? What classroom benefits can be derived from a purely recreational game, if any?

In order to refine our answers to these questions, we will look to answer them through the lens of Actor-Network Theory (ANT). ANT is a theory developed by French STS scholars Michel Callon and Bruno Latour, along with British sociologist John Law, and others. ANT posits that every entity in a closed system (whether human, technology, or otherwise) is an "actor" in some fashion. These actors interact with each other via networks, and an actor can be part of few or many separate networks. One of the most critical claims made by ANT is that every actor has some agency in his or her (or its) own network (Latour, 2005). Indeed, this is a criticism often levied against the theory by opponents, who claim it is nonsense to ascribe agency to an inanimate object, or an idea. ANT proponents respond by saying that agency is not necessarily an active trait, or one that requires conscious decision-making, rather it is simply the capacity for the actor to effect change in their own networks. I will expound on this idea later in my analysis, as allowing ourselves this freedom can lead to some interesting shifts in perspective (when compared to only allowing considering the agency of human actors).

It should be noted that ANT is not necessarily a "theory," in that it provides few to no prescriptions about any particular system. ANT does not allow us to predict with certainty the behavior of any particular actor – it instead provides a structured framework of questions we can ask to make these predictions ourselves. This framework quickly guides us beyond the narrow scope of the technology itself (a scope that a different framework, like Social Construction, might keep us bound to), and to explore the impact of technology on social relationships.

Indeed, the main reason why ANT is such a potent tool for this analysis is because of the humans involved, rather than the video games themselves. Pedagogical practices have impact far

beyond the student, as we will see – they affect teachers, parents, and administrators, but they also impact the students' *interactions* with these other actors – a sort of "meta-impact," if you will. As a brief example, consider a teacher who opts not to teach a lesson on a particular day, instead choosing to show a 20 minute video and then leaving the remaining hour for the students to do as they please. This decision obviously impacts the students' learning, but consider the conversation between one student and his parents at the end of the day. Say they ask what he learned in school that day. Is he necessarily going to be honest? As we will see, there are reasons why this may not be the case.

In this paper, we look at a few cases of video games (of various sorts) implemented in classrooms. We will use the framework provided by ANT to analyze the effects on the various relevant social groups, whether students, teachers, parents, or otherwise, and attempt to reason through the benefits yielded by their incorporation into the classroom, as well as the opportunity cost associated with deviating from more traditional instructional techniques. Using these case studies, we will attempt to reason through a "checklist" of sorts, pinpointing certain features of games as being a net positive, negative, or neutral. For the sake of a baseline, we will also analyze the effectiveness of more standard pedagogical practices alongside the experimental ones. Our goal is to provide guidance for any teachers or administrators shaping class curricula; specifically, guidance on the most effective ways to incorporate gaming into instruction, or whether any such endeavor will be fruitful at all. The usage of the terms "video games" and "gaming" throughout this discussion will be intentionally broad, so that our results can be as generalizable as possible. Video games may range from the commonplace live, point based "pop quiz" through popular internet apps, to the extreme scenario of orienting an entire lecture or even class solely around mastering some mechanically and intellectually stimulating game, despite it

failing to meet any explicit educational standards. As stated, the chief framework for analyzing this discussion will be Actor-Network Theory (ANT), one that emphasizes viewing relationships among actants from the ground up, and making very deliberate choices as to which actors are relevant to the analysis. Without using ANT, it becomes infeasible to "inspect the precise ingredients that are entering into the composition of the social domain (Latour, 2005)," and it is exactly these precise ingredients that will form the basis of the analysis. There will be a scrupulous focus on the primary classroom actors, namely students and their teachers, and secondary actors may be incorporated from the students' own immediate networks, including social relationships with peers and familial relationships with parents.

Historical Background

Catherine Beavis, a professor of education at Griffiths University in Queensland, Australia, comments on an English lesson at a Catholic school, centered around students guiding their teacher through a 1992 platformer called *Secret Agent*. Students would shout instructions to their teacher, who had the game projected at the front of the classroom. The activity was a precursor to students developing their own game, and centered around analysis of poor moral decisions made by the main character. Questions asked of the students afterwards included ones such as "What poor moral actions did the main character make?" and "Was it fun to be immoral? If so, why?"

Miguel De Aguilera and Alfonso Méndiz, two professors at the University of Malaga in Spain, present an interesting summary of various actors' views towards video games. On the one hand, the view of video games expressed by gamers tends to be incredibly positive, even

captivating, as an observer listens or watches a hobbyist share their interests to the fullest extent. Even in cases where the players aren't as intensely excited, the average view among players tends to be favorable, or one of "acceptance," as de Aguilera and Méndiz put it. They describe the irony of such a positive outlook contrasted with the connotations of video games in media, which range from concern, to disapproval, to outright rejection (de Aguilera & Méndiz, 2003). Video games are often used as a political scapegoat, weathering claims that they cause desensitization, which can lead to young students becoming increasingly violent in schools, just because they play a first-person-shooter game, for example.

The authors also outline early research into the same question being asked here, only from a time when video games were first beginning to emerge in popular culture. They reference G. H. Ball's 1978 work "Telegames Teach More Than You Think," in which Ball claims that video games both improve the spatial abilities of children, and their cognitive aptitude in mathematics and reading comprehension. Several other studies and works in the same field are referenced, with similar conclusions – that video games are capable of improving motor, spatial, and cognitive skills of children. De Aguilera and Mendíz make a comment in summary that will prove to be quite important in our analysis, namely that "the immediate feedback provided by video games, and the need for a continuous response during play, challenge and a stimulate children and adolescents and arouse curiosity, which can be extremely useful in learning." In other words, the "pull" that video games have on their players, if used correctly, can act as a valuable attention retainer in classes with easily distracted students!

In 2010, researchers in Scotland worked with 19 schools to identify the educational benefits of video games, using games on more traditional gaming platforms like the PlayStation, Xbox, and Wii. The researchers interviewed 3 groups: students, teachers, and school

leaders/administrators. All 3 tended to have positive reactions to the experiment. The students believed that gaming required them to collaborate and communicate with each other, the teachers indicated that students were engaged and motivated, and administrators noted that the endeavor made progress towards reducing the delta between students' home environments and school environments (Schaaf & Mohan, 2014). A possible effect of the latter point might be that students feel more comfortable at school, and that they might be encouraged to open up and engage with their peers and teachers.

Analysis

The collection of these studies seems to indicate a rather cheery view of gaming in schools. It should be noted that many of the derived results in this field (both here and in other studies) are stricken by the curses of self-reporting and, to an extent, selection bias. It is much easier to conduct several interviews with willing participants, than to run an experiment on schools who did not consent to the study, or to hold a several-month long randomized controlled trial to determine quantitatively the effectiveness of these games. Many of these participants, by nature of being willing to partake in these novel studies, likely already harbored some internal favorability to the idea of using games in the classroom.

Even still, it is clear that video games do have some potential to be effective teaching strategies. What can they teach? I would divide the results gathered above into four categories: motor skills, cognitive skills, and social skills, and curriculum-based achievement. Motor skills concern students' hand-eye coordination and ability to physically use the technology (and in turn gain aptitude for using future physical systems). Cognitive skills include things like spatial

reasoning, plan formation, and logical reasoning. Social skills are by necessity derived from multiplayer games, and can include effective and efficient communication, teambuilding, and confidence when in public situations. Lastly, curriculum-based achievement might be what most people think of when they hear "instructional strategy;" that is, achievement by the benchmark of standards of learning, or course objectives. I would caution, however, that we should not restrict ourselves to having such a narrow view. Even without video games, students do not *only* learn history in history class, nor do they *only* learn chemistry in chemistry class. Every day spent in the classroom presents a vast multitude of lessons to be taught and learned, most of which have no curricular basis at all. Students already interact with each other and with teachers socially; they learn how to be courteous; they learn how to be empathetic. It is an unfair double standard to expect video games to exclusively teach course content in nothing else when this was never the purpose of even the most traditional of classes, especially for young students. It is not an unreasonable argument, I would claim, to say that even a video game that teaches no course material should not be immediately discarded as useless. There are plenty of other skills to learn.

Let us hone in our analysis on a particular real-world example, and use our historical data and Actor-Network framework to draw some conclusions. Consider the popular internet app Kahoot. Kahoot is, for those unfamiliar with it, essentially a gamified, twenty-first century quiz engine. Teachers create a quiz, project it to the front of the classroom, and students use their personal laptops or smartphones to connect to the quiz session and answer questions themselves. Students who answer correctly earn points, and after every question a leaderboard is projected, giving the current winners some recognition for their achievement. The application has loud noises, cute graphics, and fancy colors, but behind the smoke and mirrors it is functionally identical to the Scantron exams that students a decade ago abhorred taking. And yet somehow (in

my experience), when the quiz was dressed up with bells and whistles, students had no objection to participating, and even thoroughly enjoyed it, in most cases. My anecdote is not an outlier; Kahoot, in 2019 Kahoot had over 70 million monthly active users, with 50% of all US K-12 students using the app (Wang & Tahir, 2020). So what is the difference between Kahoot and a bubble quiz? Students are presented with immediate feedback, and are publicly recognized when they score well. Importantly, the leaderboard only shows the top 5 places, so students are never publicly shamed for doing poorly. The atmosphere is (typically) made to be much more casual than a quiz. Students are not barred from speaking, nor scrutinized to make sure their eyes stay on their own paper.

What actors can we identify in this example? Recall that an actor is effectively any entity that impacts the system; in this case the classroom. The students are undoubtedly actors, as is the instructor. The Kahoot game platform is an actor, as are the devices the students use to connect to it. The quiz itself can be seen as an actor; after all, students taking a paper and pencil quiz would definitely view the quiz as an actor, and most likely a malicious one! How do the actors interact with each other? The instructor invests some effort into writing the quiz (or using a quiz published to the Kahoot library), and in turn is able to teach more passively for a time, letting the game do most of the work. The students invest their energy and attention into the quiz, and are rewarded by the game for doing well. Additionally, regardless of their performance, students are given critical feedback regarding how well they understand the course material. How do students interact with each other? If curated well, the atmosphere can be one of friendly competition. Obviously, students are competing against each other for high scores, but the platform does not tally up scores and store them in a database to help determine class grades. The quiz is transient – students play, cheer if they win, and then move on with their days.

Consider what would need to be done to achieve the same results without a platform like Kahoot. Students would need to take a quiz via pencil and paper which would likely be much slower (due to a lack of automation). Grading would be manual as well, and by the time any grades were calculated, any allure of the moment would have vanished. Students would either need to wait for the teacher to tally up top class scores, and sit idly by in the meantime, or compare grades with each other to determine peak performance, which would introduce the cost of poor performers feeling called out for inadequacy. Seeing these options side by side, it is no wonder why the app is as popular as it is.

Let us take another example – the hivemind activity described by Professor Beavis, where students worked together with their teacher to complete a simple platformer video game. Once again, the students were individual actors, and I would also argue that the collective student body was one actor – the teacher did not listen to any one particular student, rather he listened to the collective wisdom of the crowd. The students in turn fed into this collective wisdom, reducing the burden on any one student to shoulder the entire challenge. Of course, the video game itself acted as a visual medium, informing the students and the teacher when they were (and were not) successful. Students had to work with each other to streamline communication, and not stifle each other's contributions. Students had to work through the delay between coming up with a plan, and seeing it enacted on screen, due to their teacher acting as a middleman. I would argue that this delay is actually a benefit, forcing students to think on their feet and distill only the most important directions to the teacher!

It is clear that there are a number of benefits to be gained from classroom gaming, across a variety of categories. It is, however, important to consider the ethical ramifications of these conclusions. An immediate question arises – if games are so effective, should we compel

teachers to incorporate them into their curricula? I would argue most certainly not; the most we can ever do is encourage teachers to experiment with new teaching strategies, but to compel a certain lesson plan is to take away any teacher autonomy, likely worsening the quality of any content delivered. Teachers need to feel comfortable teaching, and after all they know their own students' learning habits far better than any generalized conclusions made by a researcher aggregating thousands of data points. Additionally, we must be sure that any opportunities extended to students are done so equally, without preference for some based on outside circumstances. Kahoot, as engaging of a tool as it is, would be a poor choice in a classroom where only 30% of students had cell phones, due to young age, living in a low-income household, or any other reason. Schools can of course remedy this by providing communal technology in the form of classroom laptops, but this requires an investment in itself. Likewise, in the introduction I spoke of a summer class where students built computers and used them to play games. Importantly, all class materials were loaned to the students for the two-week period free of charge (aside from the fees to register in the summer class). Once in the classroom, no preference was given to any one student over another.

Opponents to the gamification of the classroom are, in some cases, simply misinformed. Policymakers and political pundits are on average much older than the typical student (or even the typical gamer), and grew up in a time where such technologies were non-existent. We readily see clips of a Congressperson or prominent public figure showing their ignorance when it comes to regulating modern technology. However, it is not fair to prescribe ignorance to all opponents, as there are legitimate criticisms to be made about this change. For example, playing video games has been shown to activate "similar brain regions as drugs of abuse, including the mesolimbic reward system and amygdala" (Mathews et al., 2019). Video games are addictive,

and the minute that students begin to withdraw from learning and interacting healthily with others is the minute that we have gone too far in our endeavors. Additionally, as mentioned previously, the universal incorporation of such technology requires a hefty investment of resources. This may involve school funds being allocated to purchase hardware, or in some cases the purchase of educational licenses for applications. And, though indirect, it would be dishonest not to mention that many of these computer parts come from child labor in foreign countries Lachney et al. (2018).

It is because of these entirely reasonable objections that we cannot use broad brush strokes to replace the entirety of K-12 education with a Dave and Buster's arcade. At the end of the day, school is still school. If video games become the normative mode of delivering content, then we run the risk of that becoming the baseline, for which even more drastic attention-grabbers must be introduced. An effective classroom game is one that encourages student communication, rather than stifles it. It is one that, even if its goal is not necessarily content-based, has *some* goal in mind, and is not just used to keep students occupied so that the teacher can put less effort into the class. It is one where students feel proud and excited to have learned what they did, rather than sheepishly feeling that they somehow "got away with" wasting class time. And even if a game does meet these goals, it is important to constantly monitor its active use to ensure that it continues to follow them.

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