Synthesis Paper: **Video Games and Education**

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"**Video Games: An Educational Exploration"**
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Abstract

Video games are an exciting, compelling, motivating, and interactive form of media. Their origins date back to the 1960's and are tied closely to many modern innovations with computers. They tell stories, they put players in simulations, they provide engaging exciting competitions, and more. From their engaging nature they have drawn the interest of educators and researchers. Research has focused in a variety of areas such as effects on the users of video games and how games can be used and designed to benefit learning. The purpose of this paper is to explore video games from an educational perspective by examining the history of video games, the effects of video games on their users, how video games relate to physical and digital learning environments, and what are some strategies that exist to address concerns and criticism related to video game use.

Video Games: An Educational Exploration

Since their beginnings in the 1960's video games have become a dominant force in popular culture for youth and adults. Stemming from their popularity, video games have become an area of focus for educators and researchers. The opinions on games vary greatly, as does their place in the field of education. Some argue that video game playing harms youth, others will say they can be a valuable educational tool that can motivate and benefit students in ways that will improve their learning. Although there are many topics to explore with video games in education, the purpose of this paper is to explore video games from an educational perspective by examining the history of video games, the effects of video games on their users, how video games relate to physical and digital learning environments, and what are some strategies that exist to address concerns and criticism related to video game use.

The History of Video Games

Video games are typically games played on a screen through input using a computer system in the form of a personal computer, gaming console, or mobile device. The history of video games stems back to the 1960's. Kent (2001) credits Steve Russell, Ralph Baer, and Nolan Bushnell as the fathers of video games. Although Bushnell often gets the majority of the credit in the creation of video games, the contributions of Baer and Russell predate Bushnell's by several years. Russell's contribution is creating the game *Space War* in 1962 while attending the Massachusetts Institute of Technology as part of the Model Railroad Club, and Baer's contribution is the invention of the first home console system conceived in the mid to late 1960's which was eventually released in 1972 and called the *Magnavox Odyssey* (Kent, 2001). Bushnell saw the financial potential in games like *Space War* and realized that people would pay money to play

these types of games (Egenfeldt-Nielsen, Smith, & Tosca, 2008, p.53). Bushnell cofounded the company Atari with Ted Dabney and designed the *Pong* arcade machine with Al Acorn in 1972 (Kent, 2001). *Pong* was a success, and later in 1975, Atari created a home version of *Pong* that was sold initially through the Sears Roebuck sporting goods department, and later in 1977 released the *Atari Video Computer System* also known as the *Atari 2600*, as a home console system that could connect to a television and play multiple games on cartridges (The Strong:National Museum of Play, 2017).

With Atari's success competition emerged, but the American video game industry started to see a decline in overall business which led to a crash 1983 (Kent, 2001). This allowed international companies such as Nintendo to make an impact in North America. In the mid to late 1980's, Nintendo rose to prominence in the American gaming market with the release of the *Nintendo Entertainment System*, the *Game Boy*, and landmark games such as the action adventure title *Super Mario Bros.*, the role playing fantasy game *The Legend of Zelda*, and the puzzle game *Tetris* licensed by Nintendo and designed by Russian mathematician Alexey Pajitnov (The Strong:National Museum of Play, 2017). Nintendo faced competition from other companies such as Sega and their consoles, and was criticized by educators for distracting children from their academic studies, and was also blamed for decreases in students' cardiovascular health (Kent, 2001).

As well as the growing popularity of gaming consoles, in the 1970's and 1980's educational game based software began to emerge, this included titles such as *Oregon Trail, Math Blaster,* and *Reader Rabbit*. These eventually progressed into commercial family designed learning games in the 1990's produced by the likes of Mattel and Cendant, which were then

distributed through stores such as CompUSA and ToysRus (Institute of Play, 2017). In Canada there were games such as *Cross Country Canada* that focused on Canadian Geography.

In the late 1980's and throughout the 1990's, computer games that can be played through networked computers and eventually on the internet, started to become popular, these included multi user dungeons which are type of role-playing game with multiple users, first person shooters that can be played with multiple users on different computers, such as *Doom* or *Quake*, and real time strategy games such as Warcraft and Starcraft (Lifewire, 2016). In 2002, most home consoles began adding online services such as Xbox live, where players could play console games with and against each other through the internet (Spohn, 2016). A game that was released at this time was *Halo 2* which was a console game that featured an online matchmaking service allowing players to connect with each other around the world through their Xbox consoles.

Throughout the 90's and into the 2000's, console and computer games began to feature longer and more detailed narratives, examples would include games such as *Final Fantasy VI* and *Baldur's Gate*, that feature a variety of different characters and scenarios, and a story that takes several dozens of hours to complete. In the twenty-first century, games have progressed to be more immersive and cinematic featuring voice acting, edited rendered cinematic sequences, and motion capture acting, examples would include *Mass Effect*, *The Last of Us,* and *Final Fantasy XV*. Some of these games explore complex themes in relationships, politics, and moral choices.

At the same time another new type of game emerged known as massive multiplayer games, which feature thousands of players interacting in different environments sometimes with role playing elements or player versus player combat. Initially these took the form of Multi User Dungeons (MUDS), which eventually lead into Massive Multiplayer Online Role Playing Games

(MMORPG) including *Ultima Online*, *Everquest*, and *World of Warcraft*. These online games were a whole different experience compared to local multiplayer games, The new massive multiplayer games featured interactions with thousands of individuals rather than a small handful. These games feature their own in game economies where players can bid on items with in game currencies.

In the 1990's and 2000's games emerged that focused on tinkering, authoring, and construction, with titles such as *SimCity* and *Droidworks*, some of which were influenced by the theory of constructionism and Seymour Papert (Institute of Play, 2017). These games allow users to build and develop models and creations while depending on the game feature challenges or puzzles to complete. A more recent world building game *Minecraft* could also be considered part of this, and similarly many games today come with the ability to edit or modify content in ways that allow users to create their own experiences.

Many games today depict realistic violence, as the games feature real looking firearms which are then fired at accurate looking models of people. These games have also evolved in the sense that there is competitive multiplayer game play where players enter a type of "deathmatch" where they are trying to kill each other's characters. These multiplayer matches are usually very fast paced and require high degrees of speed and accuracy as commands are inputted. Games that fall into this category would be the *Call of Duty* and *Grand Theft Auto* series, among others.

Currently the revenue of the global video game industry is estimated to be over one hundred billion dollars, with the average household spending about sixty dollars on video games every year (Statista, 2016). The top selling games of 2016, include mostly first person shooter games such as *Call of Duty:Infinite Warfare*, *Battlefield 1*, and *Overwatch* (Tassi, 2017). We are

also seeing new trends emerging, such as E-Sports and virtual reality (Entertainment Software Association, 2016).

Categories of Video Games

Games can be divided into a multitude of categories based on genre, content, playstyle, publisher size, educational style, and more. This paper will examine three broad categories: Entertainment games, Edutainment games, and Serious Games.

Entertainment Video Games

Entertainment video games are as the name suggests, are games that are primarily played for entertainment. Learning typically happens in a secondary manner, as these games could be seen as the equivalent of entertainment films. Current examples of these games would include *Final Fantasy XV* , *Overwatch* , and *Super Mario Maker*. Currently entertainment games would include console games such as games for the Xbox One or Playstation 4, computer games played on a desktop or laptop, tablet and mobile phone games, and handheld console games. These games can furthermore be broken down into a variety of genres including first person shooters, role playing games, strategy games, puzzle games, and more. It is worth noting that over time the genres are become more integrative and combined, as games such as the *Mass Effect* series use the action components of action games, while also using character progression systems and decision making scenarios typically found in role playing games. Although these games are not specifically designed for education, later in this paper we will discuss secondary educational, cognitive, social, and developmental effects of entertainment games.

Edutainment

Edutainment is a term that can be applied to a variety of fields, but in this paper we will examine it in the context of video games. Edutainment is a type of video game used for education, typically to teach specific content. Addis (2005) defines edutainment as "the convergence of education and entertainment" (p. 729). Similarly, Buckingham and Scanlon (2005) define "edutainment" as "education and entertainment that relies heavily on visual material, on narrative or game-like formats, and on more informal, less didactic styles of address" (p. 47) with an "insistence that learning is inevitably 'fun'." (p.48). Edutainment games use learning theories such as behaviourism, cognitivism, and constructivism, in their designs, although commercially behaviourism based titles have been more dominant (Egenfeldt-Nielsen, 2006, pg. 187). The qualities and purpose of Edutainment is to promote learning of materials through interaction and entertainment with the thought that the excitement of the learners will be increased and that subjects will be more enjoyable (Aksakal, 2014, p.1233). Edutainment titles are usually defined by characteristics such as reliance on extrinsic motivation, drill and practice learning experience, simple gameplay, and no required teacher presence (Egenfeldt-Nielsen, Smith, & Tosca, 2008, p.212-213). These games typically take course subject matter and place it in an interactive game like format. Many of the games that use a behaviourist approach have the player repeating a specific skill and then receiving rewards, the cognitivist approach has players discovering through an experience that uses learning and play, and the constructivist approach would simulate part of a micro-world allowing players to explore as an integral part of their learning experience (Egenfeldt-Nielsen, 2006). Examples of games that would fit into the Edutainment category include *Math Blaster*, *Brain Age* , and *The Oregon Trail*.

Educational games have garnered praise as they tend to emotionally engage students in a positive manner by making the learning process more motivating and appealing (Annetta, 2003, p. 233). There is also evidence that suggests that they can be used to supplement traditional instruction for more effective learning such as a 2010 study by Miller and Robertson which examined school children aged ten and eleven playing *Dr. Kawashima's Brain Training* which is a puzzle like game used to develop skills related to numeracy and vocabulary ; the students played the game on a Nintendo DS handheld system for twenty minutes a day, showed that students who played the game for twenty minutes a day showed mathematical skill gains in accuracy and speed of calculations at a faster rate than students who only took part in a traditional classroom.

It is worth noting that Edutainment is not without criticism. Because the games themselves put educational content before gameplay, they may not have the same motivational impact and appeal or entertainment based titles. Buckingham and Scanlon (2005) argue that some games that fall under edutainment " are not real games, the children see through the pretence, they do not engage with them as games, and so the attempt to harness the intrinsic motivation of achievable challenges central to games by building these around the learning objectives required, and associating these objectives and challenges in turn with the representational systems of the game, ends in failure" (p.137).

Serious Games

Although they are similar to Edutainment, Serious Games have a different purpose and definition. "Most agree on a core meaning that serious games are (digital) games used for purposes other than mere entertainment" (Susi, Johannesson, & Backlund, 2007, pg.1). This is different from Edutainment as serious games would use simulations to design or solve a problem,

rather than placing content learning in a game like setting, they teach through the playing of the game itself. Serious games are often used in fields such as the military, healthcare, government, business, and education and often use simulations or other gameplay to promote awareness, understanding of specific experiences and developing attitudes (Dörner, Göbel, Effelsberg, & Wiemeyer, Chapter 5, 2016). Sometimes Serious Games are designed to solve a problem by using a model or simulation, an example being military simulations that use game technology that cost less than traditional simulations, such as the first person game *America's Army* published by the U.S Arrny (Susi et al., 2007). Serious games still entertain players, but the gameplay would be used to train other skills and functions, such as playing a first person shooter game to train fine motor skills and reaction times (Dörner et al., 2016, p. 3-4).

There is evidence that suggests that Serious Games can be an effective means of instruction. Research indicates that standard learning objectives such as systems thinking, immigration, geology, and global warming can be taught effectively through the use of simulations (Halverson, 2005). Belotti et al. (2013) suggest that serious games appear effective in teaching in specific fields such as healthcare, yet indicated that serious games are not necessarily a more effective means of instruction when compared to other methods, but are a promising means for safely and cost effectively teaching skills and attitudes through simulations (p. 2). The true benefit of serious games, is that they may provide an way of teaching certain skills, ways of thinking, and content, at a more cost effective rate.

Effects of Video Games on Players

Concerns Regarding Negative Effects of Video Game Playing

Over the years video games have received criticism in relation to negative effects they may have on the player. In the 1990's some educators expressed concerns that video games could lead to violent behaviour, unhealthy attitudes, and lack of creative play (Squire. 2003). Concerns have also been raised over possible negative impacts of video games which have included health related issues such as headaches, fatigue, mood problems, as well as psycho-social issues including aggression, depression, negative societal behaviour, and more (Susi, Johannesson, & Backlund, 2007). One example is Eugene Provenzo (1992) who criticizes video games for their use of violence, gender bias, and stereotyping; and their social and educational impact. Another example is Tracy Dietz (1998) who writes that video games often do not portray female characters or portray them as sex objects or victims of ruthless men and suggests that video games may negatively influence the attitudes of children towards women, relationships, and expectations (p.439).

Aggression and Video Games

Anderson et al. (2003) write that research indicates that violence in media such as video games, movies, and television, increases aggression in individuals in the short term and the long term because of factors such as priming aggressive thoughts, increasing physiological arousal, triggering a tendency to imitate observed behaviours, and by creating long-lasting aggressive scripts and interpretational schemas(p.67). Anderson et al. continue that research on randomized experiments indicates that violent video games increases aggression in both youth and adults (2003, p.34). Anderson and Bushman (2001) found that " exposure to violent video games poses a public-health threat to children and youths, including college-age individuals"(p.358). Similarly, Anderson and Dill (2000) suggest based on their data, that violent video games promote aggressive

solutions to conflicts and that violent video games prime aggressive thoughts (p. 788). This is echoed by Greitemeyer in his 2013 study where he states "that violent video games increase the likelihood of aggressive behavior" (p.55). Bushman and Huesmann (2006) found that there was a positive correlation between child exposure to media violence and aggressive thoughts and behaviour, they suggest that "parents particularly need to be urged to protect their children against the kinds of repeated exposures that heavy play with violent video games or immersion in violent TV programs is likely to produce" (p.351).

However it is worth noting that not all are in agreement about the relationship between video games and negative social behaviour. The studies listed above would fall under what Egenfeldt-Nielsen, Smith, and Tosca call the "Active Media Perspective", this perspective focuses on behaviourism and experimental psychology through controlled studies (2008, p. 225-226). Egenfeldt-Nielsen et al., write that when other factors are considered in these studies such as gender and parental involvement, the results in the active media studies are radically different (2008, p.231). Annetta (2008) writes that the idea that video games lead to antisocial behaviour and unhealthy children has been proven false, where now games are looked at as a motivating power that can encourage students to cooperate and develop into independent and social people (p.233. Similarly, Squire (2003) writes that the research regarding video games has failed to show a relationship to aggression, violence, and antisocial behaviour (p. 8). Furthermore, in his meta analysis of video game studies, Ferguson (2007) found that playing violent games " does not appear to be associated with negative effects in relation to aggressive behavior" (p. 314). Egenfeldt-Nielsen et al., (2008) write that the majority of active media researchers favour a more cautious approach due to a small body of research, noting that the effect of video games is smaller

than that of violent television and because of an apparent lack of evidence for firm conclusions (p. 232).

The contradictory findings regarding video games and negative social behaviour, may indicate that there are more factors to consider including type of game, social context of playing, feedback received in game, and game content. Another perspective of video games and behaviour is "Active User Studies", which examine the social context and interactions of children who play games and how it relates to behaviour noting the differences of individual experiences playing games, yet the amount of studies in this area is limited (Egenfeldt-Nielsen et al., 2008).

Effects on School Learning

Criticism of video games is sometimes leveled at their effect on school learning. Gentile (2009) suggests that pathological video game playing of approximately twenty four hours a week was a significant predictor of poor school performance (p.600). Although there have been concerns raised about children becoming addicted to video games, King, Delfabbro, and Griffiths (2013) write "it's difficult to establish empirically whether excessive video game use represents a stable problem behavior that is maintained on a long-term basis" (p.824).

Another consideration is that the American Psychiatric Association has now listed Internet Gaming Disorder as a condition for further study in the DSM V, although they note symptoms that involve excessive game playing and its effects on relationships and personal activities. Although the APA only lists it as a condition for further study, "growing evidence of clinically significant harms derived from excessive game playing suggests that this is an important condition from a public health perspective" (Petry, Rehbein, Ko, & O'Brien, 2015, p.7).

Despite the concerns regarding game playing on academic performance and health, there are those who dispute the claims. Fletcher and Wind (2014) argue that the negative relationship between learning at school and video games is just a statistical finding and that it has not been determined that playing video games causes a reduction in school performance, noting that there may actually be a positive effect on school learning from playing games (p.496). Ferguson (2015) suggests that the potential influence of video games on youth continues to be debated throughout the general public, academic, and clinical communities, and that among researchers and clinicians there is no consensus, one way or the other. Video games themselves may not be the factor that affects school learning, it may be that excessive playing is the true issue.

Screentime

Another area that is closely related to video game play is the amount of time in front of a screen that children spend throughout an average day, due to health and perceptual factors. Concerns about the amount of time children spend in front of screens has made headlines in Canadian newspapers and websites such as *The National Post.* Busch, Manders, and de Leeuw looked at screentime in regards to Dutch high school students, and found associations between excessive screen time and health and behavioural factors, these included associations between excessive internet use and alcohol use as well as excessive video game playing and school conduct (2013). Sigman (2012) writes that screen time of over two hours a day is associated with health risks in children such as type 2 diabetes, cardiovascular disease, increase in diastolic blood pressure, unhealthy dietary behaviours, attention problems, self esteem issues, and more. Again it may not be the games themselves that contribute to these risks, but rather the amount of time spent playing them, and not finding a balance between gameplay and other activities.

Entertainment Video Games and Cognitive Skills

As well as research into the negative effects of video games, there have also been studies examining how they benefit the learning and cognitive skills of an individual. Video games develop a variety of skills in its players, this includes cognitive skills through first person shooter games, problem solving skills through strategy games, and prosocial skills through games that require teamwork, cooperation, and social interactions (Granic, Lobel, & Engels, 2014). In their 2012 literature review Connolly, E.A. Boyle, MacArthur, Hainey, and J.M. Boyle, suggest that playing entertainment video games can lead to improvements in attention and visual perceptual skills, while supporting competencies in curricular areas such as science, technology, engineering, and mathematics. In the following section I will examine some areas where skills are developed by playing game genres such as violent action games, strategy games, and massive multiplayer games..

Violent action games. Action video games typically feature game play from a first or third person perspective, utilization of weapons such as guns and knives, and frequently contain a significant amount of violence. Examples of action video games fitting this description would include the *Call of Duty* series, *Grand Theft Auto* series, and the *Halo* series. Despite concerns already raised about the negative effects of violent games, there are indications that they improve perceptual and attentive skills. Ferguson's meta analysis (2008) of violent video game exposure suggests that it appears that violent video game exposure appears connected with increased visual-spatial cognition. People who play action video games frequently, score higher on cognitive and perceptual measures and performance, while game training has the potential for transfer beyond the specific task being trained for (Boot, Blakely, and Simons, 2011, p. 1).

Strategy games. There are many type of strategy video games, ranging from adaptations of popular turn based board games such as *Risk* or *Carcassonne*, to faster paced real time strategy games such as *Rise of Nations* or *Starcraft* that involve manipulating soldiers and other units in a battlefield scenario. In their 2013 study, Adachi and Willoughby found that there was a relationship between strategic slower paced video game play and self-reported problem solving skills, as well as an indirect relationship between strategic video game play and academic grades. Basak, Boot, Voss, and Kramer (2008), found that by playing the real time strategy game *Rise of Nations*, older adults showed benefits to executive control functions, mental rotations, and task switching.

Puzzle games. Although sometimes blurring the lines of strategy games and edutainment, puzzle games are another genre that has been shown to develop cognitive benefits in players. Games in this genre would include classic titles such as *Tetris* or more recently mobile titles such as *The Room*. These games are usually played by using various cognitive skills such as executive functions, visual and spatial processing, and attention, in order to complete tasks. Oei and Patterson (2014) found that undergraduate students showed improved higher order executive function skills through playing twenty hours of the puzzle game *Cut The Rope*, possibly due to the game demanding the use of higher order cognitive functions to play. Similarly, Yuda (2011) found that there was a positive effect on elementary school students spatial thinking skills, who played a map based puzzle game once a week for a three week period.

Massive multiplayer games. Massive Multiplayer Online (MMO) games, are games where players interact in an interactive world full of thousands of other players. In these games players perform tasks like entering a dungeon in groups to slay monsters, building collaborative

housing, and participating in large scale game events that include resource collection and player interactions. Gee (2003) suggests that massive multiplayer games allow players to collaborate using different skills while sharing values and knowledge, which may be better locations for preparation for the modern workplace when compared to traditional schools. Also, Gee (2011) argues that massive multiplayer games such as *World of Warcraft* build mind simulations, distributed intelligence, cross functional collaborations, and problem solving strategies. These games have a variety of player interactions, collaborative goals, and group based gameplay. Due to the multifaceted nature of these games, a thorough study of specific skills may be difficult, yet the effect on players may be different from user to user depending on game and life experiences.

Video Games in School and Other Learning Environments

Learning can happen anywhere, even in and through video games. Video games can serve as a supplement, but can also serve as a learning environment themselves. Yet, game use in schools is not widespread. In the following section discussion will centre around attitudes towards games in schools, gaming in the classroom, and video games serving as their own learning environment.

Attitudes Towards Games In Schools

Video games are not typically part of traditional classroom instruction, but it has been suggested that video games can help engage students in a learning activity, as engagement characterized by heightened interest, excitement, and enjoyment, as well as perceived challenge can have a positive effect on learning (Hamari et. al, 2016). There are not many examples of entertainment based video games being used explicitly in the classroom due to difficulty meeting curricular outcomes, yet game-based approaches are being used in areas such as health, business, and social issues, which players seem to enjoy and be motivated by (Connolly et al., 2012, p.

671). Kenny and McDaniel (2011) suggest that many teachers do not implement video games in their classes, which is likely due to their unfamiliarity with them for reasons such as pre-service teachers playing video games less frequently than post-secondary students in other majors, lack of time, and perceived difficulty of games. It is also possible that video games are not being used frequently in schools, as the decisions to use them may not fall to teachers. Halverson (2005) suggests that ultimately reshaping teaching practices to use video games falls on the hands of school administrators, curriculum and technology coordinators, superintendents, and other school leaders. This being said, if given sufficient autonomy, teachers can implement games as part of instruction or learning opportunities for student.

Gaming In The Classroom

Despite entertainment based video games not being prevalent in traditional classrooms, there are examples of them being used to benefit students within a classroom environment. In his book *Teaching with Games: Learning Through Play* (2011), Kurt Squire suggests that entertainment games can be implemented in classrooms as long as features are leveraged such as commitment to interest driven learning, teachers acting as advisors and producers/participants in games, and dedication to design of game content and culture (p. 59).

Squire's suggestions are rooted in his experience of using a modified version of the game *Civilization III* to teach disengaged high school students history and geography. Squire reports that students who played *Civilization III* learned geography features, paid attention to details and engaged in deeper thinking, learned background information about technologies and civilizations, produced understandings of ordinal relations of historical events, and learned how geography affected civilizations. While the biggest gains made by the students were interests in history and

geography, that eventually led students to subject matter questions and one inquiry project (2011, p.127-128).

As video games can feature a heavy text based narrative, there is also the possibility that they could be used to teach reading. Megan Glover Adams argues that video games can help reluctant and unsuccessful readers through tutoring programs using role playing games such as *Neverwinter Nights* to improve confidence, visual literacy, vocabulary acquisition, reading comprehension, and reading for information (2009).

There has also been success using video games with students with disabilities. Marino et al. (2014) argue that video games can promote achievement and engagement in students with high-incidence disabilities by aligning selected game based materials with universal design for learning. This could benefit students through increased motivation , repetition of game based learning, and game performance assessment instead of paper pencil problem solving tasks.

Squire (2011) suggests strategies for teachers using games in the classroom such as knowing the game, game play driving the learning, just-in time lectures, creating a supporting game community, and facilitating inquiry and knowledge sharing (p. 139). New entertainment based games are released every year, and although content changes, many of the gameplay mechanics remain the same. An area that could be researched further are general guidelines for implementing games in classrooms, regardless of specific titles.

Video Games As A Learning Environment

Video games themselves can also serve as a type of virtual classroom where learning and development can take place. Malone and Lepper (1987) suggest that learning environments and games can be intrinsically motivating due to the aspect of challenge, their use of perspective,

image, interaction to stimulate sensory curiosity, factors related to cognitive curiosity, sense of control, use of a fantasy environment, and provision of choice. In these spaces users can create individualized characters, interact with objects, and engage in text or voice chats with other people and non player characters. In games such as *Minecraft* the focus is more on construction and creation, while in others the focus is on interaction, manipulation, teamwork, and/or narrative. These environments can vary depending on the design and/or purpose of the game. In a construction based game like *Minecraft* there are many ways that learning can happen, examples would include the building of complex structures, models, or settings, by teachers or students to be used in areas such as math, science, social studies, or language arts (Ellison & Evans, 2016).

There are also examples of game based virtual environments being used to allow students to learn in ways that may not be possible depending on their location and resources available. Hamalainen (2008) studied vocational students in a 2D/3D virtual learning environment that used scripts to guide players to work together to solve puzzles related to the vocational design process for four custom hotel rooms. Hamalainen reports that students felt that the benefits of the virtual environment were, that they were able to use visual outlining in the design process related to solving problems, that they were able quickly experiment with new materials, and that the game was fun (2008). The virtual game like environment *Wolf Den* from North Carolina State University, functions in a similar fashion, as students can conduct science experiments in a virtual environment (Annetta, 2008, p. 234). This type of manipulation in the environment could allow users to learn in a simulated lab like setting that could break down distance boundaries and let learners experience situations they might not experience otherwise.

Another aspect of virtual environments is the ability to individualize avatars and characters which ties into the idea of social presence. "Social presence is described as the ability to project one's self and establish personal and purposeful relationships" (Garrison, 2007, p.63). Players are able to create new and alternate identities through social experimentation in environments contributing to adolescent development, while allowing players to participate in simulated virtual communities such as *Revolution* and *Eyewitness*, which allow players to interact in a virtual recreation of real events (Halverson, 2005). This notion is supported by Annetta's (2008) example of the game environment *Wolf Den,* where education students individualized their in game avatars and reported more satisfaction with their learning experiences, and felt that they had stronger relationships with their classmates and instructors (Annetta, 2008, p.35).

Considerations Regarding Game Use

Choosing Effective Games

There are multiple factors that contribute to well designed video games which make them more enjoyable, more motivating, and more beneficial to learning. If games are to be used for teaching and learning, it is important to use games that contain factors identified within games that are supported by research relating to cognitive science and motivation which could be utilized by teachers or instructional designers for choosing, implementing, or designing video games for learning.

Well designed (good) video games use learning principles that are supported by cognitive science research, as they give information on demand, remain challenging and doable, allow players to be producers and decision makers, they use progressively more difficult problems, and

are highly motivating (Gee, 2003). Tobias, Fletcher, and Wind suggest recommendations for game design for instruction such as: using human not synthetic voices, pictorial not textual instruction support, using the first person in dialogue, maximizing user involvement, reducing cognitive load, increasing pro social content, reducing aggressive content, and more. These elements can be considered when choosing games to ensure that engaging games that benefit instruction are chosen.

It is also important that games chosen are engaging and motivating. Malone and Lepper identify factors that influence game preference, such as whether the game keeps score, whether there are audio effects, whether there are random elements to the game, and whether the speed of response makes a difference (Malone & Lepper, 1987, p. 225). Other factors that could be used to evaluate games for instruction could include narrative, interactions in game design, player/avatar positioning/perspective actions and feedback, action and resource hooks, focused goals, character roles, and more (Dickey, 2005). Malone and Lepper (1987) also suggest that instructional environments can be improved by utilizing multiple individual intrinsic motivations which are: challenge, explicit and emergent goals, uncertain outcome, performance feedback, and engagement of the learner's sense of self esteem and personal relevance.

Appropriateness for audience is another factor regarding game choice, as there are different factors that affect intrinsic interest for specific audiences, for example with a darts game, boys seemed to like the effect of arrows popping balloons, where girls did not, yet girls appeared to have an increase in intrinsic interest with the addition of musical rewards when boys did not (Malone & Lepper, 1987, p.227).

Digital Citizenship and Appropriate Use

There are potential negative factors that can affect users of video games. Because of the powerful learning potential of games, addressing these factors is important. Strategies for limiting the negative effects of games can be looked at through the perspectives of appropriate use and digital citizenship.

Mike Ribble (2017) defines digital citizenship as " the norms of appropriate, responsible behavior with regard to technology use" and he later writes that" users need to be taught that there are inherent dangers of technology". Although the concerns noted above in other sections of this paper are debatable, they can still be addressed by educational and parental means through suggestions and strategies for parents and educators to help students learn with and use video games in a healthy manner. These suggestions ultimately concern the social and family contexts of where and how games are played so that the benefits of playing games can be maintained while limiting the potential dangers.

There are a variety of strategies that parents and caregivers employ to address concerns related to game playing. These can include a ban on games, supervised and collaborative use, and no restrictions or supervision at all. Durkin and Conti-Ramsden (2014) suggest that there are four broad strategies of advice for caregivers in regards to gaming, in their order of most recommended to least recommended these are: constructive use, restriction, laissez faire, and prohibition. Their recommendation of using constructive use includes strategies of accommodating, supporting, and building on young people's activities with media, which would help reflect the child's developmental needs and interests, while promoting social interactions between children and caregivers (Durkin & Conti-Ramsden, 2014).

Similarly, Media Smarts, a Canadian not for profit organization makes several recommendations for parents about their children playing video games, these include thinking about children's interests, seeking advice from other parents, finding games that have appropriate age ratings, looking for games that are still challenging but are not violent, looking for games that have strong non sexualized female characters, choosing games that require strategy and problem solving skills, and encouraging cooperative play (2012). These considerations are not difficult to apply, yet they do require the attention and decision making by parents and educators. This is also echoed by Anderson et al. who suggest that parents and educators might be able reduce the harmful effects of media exposure through guidance and discussions of interpretations of media, while interventions that reduce a child's exposure to violent media could also be an effective option (2003, p.64-65).

Conclusion

The world of video games is large and multifaceted and it is out of scope the of this paper to encompass many of the topics related to games. This paper has explored the history of video games, how video games can affect an individual, and strategies for effectively using games for education. It is apparent that there are multiple perspectives in the research involving the effects of video games and there is a lack of consensus either way. However, it is clear that there are a number of concerns related to video game use, yet there are also strategies that can be used by parents and educators to explore the positive potential of playing video games to increase engagement, to benefit learning, as well as various cognitive and attention skills. The key to harnessing this potential is the involved and constructive role that parents and educators need to play.

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