

Foundations of Game-based Learning

Fall 2019

Course Notes

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Module 1: Defining Game-based Learning

Definitions

Gamification

Gamification is the idea that elements of game design can be applied to what were traditionally thought of as non-gaming situations (Deterding, Dixon, Khaled, & Nacke, 2011). Usually, this involves completing tasks as a competing individual (or working collaboratively with a team) to earn redeemable reward points, experience points (XP), various badges or trophies, and/or places on an overall leaderboard. Gamification is NOT "just playing games"...there is purpose to the game and the experience. The exploration and task completion experience is reinforced through completing goals and a safe and fun environment (Liebenson, 2018).

Paidia games

Video games are designed to measure a player's performance thus deciding whether the player can continue playing (Leino, 2010, p.128). This transforms video games into definers and executors of mechanisms within the game to define if the player wins or loses (Iversen, 2010). Some video games allow players to avoid the logic of winning and losing. Think of a player who decides not to follow the main storyline on an RPG game and decides to spend the entire time collecting herbs for potions as personal rewards (Gazzard, 2013). Other games, such as SimCity, may seem unloseable and, as a consequence, performance is not an intrinsic part of the game (Karhulahti, 2015). These games, where winning and losing are not part of the game experience, are coined by Frasca (1997) as "*paidia* games" (*paidia* from Ancient Greek, "play and amusement") and are rather considered as computerized playgrounds (Karhulahti 2015b). However, the winning and losing performance evaluation can still occur in these games. Players may not be subject to winning or losing conditions defined by the game but players can always think they won or lost based on what happened in the game. For example, growing a city in SimCity with 10 million people may leave the player with a sense of achievement. It is the videogame artifact which measures and considers the win, thus it becomes the performance evaluating judge.

Transfer of Learning

Transfer of learning refers to the potential for in-game learning to be applied in real world contexts (Plass, Horner, & Kinzer, 2015). In playing a game (or simulation), learners can practice specific actions to improve their performance on a task. This is similar to concepts such as transfer of training (TOT) and skill transfer. Burke and Hutchins (2007) define TOT as "*the*

use of trained knowledge and skill back on the job" (p.265). This supports work from Baldwin and Ford (1988) who suggest training knowledge should be applied towards a real world context. Meanwhile, skill transfer can be considered the process of learning (Smedslund, 1953; Barnett et al., 2002). The learning process can be classified into three levels which are surface, deep, and transfer (Hattie & Donoghue, 2016). For surface learning, students must establish foundational knowledge of material and how it is assessed (Clarke, 2007). Next, they can move on to more complicated problems to establish deep level learning. Then, they are able to apply what they have learned.

In flight simulator training, learners can be exposed to a plethora of situations (Bray, 1972; Hays, Jacobs, Prince & Salas, 1992). For pilots, the tasks of take off and landing can be practiced as well as interacting with in-flight systems. The experience is then applied to real world flight (Hays, 1992; Valverde, 1973). Similarly for Esports (motorsports) drivers, they are able to gain practice within simulations of realistic environments such as tracks and/or weather conditions without exposure to injury risks or the heavy financial burden (Britton, 2018; Carbonie, Guo, & Cahalane, 2018). From this practice, pilots and drivers can apply the techniques they have learned to real environments (Valverde, 1973; Carbonie et al., 2018).

Scaffolding

Scaffolding can be described as the process of a skill or strategy being introduced by an expert. While moving through the steps of scaffolding one becomes to acquire more knowledge on these skills. The teacher can gradually take away support from the learner. Wood, Bruner, and Ross (1976) proposed the concept of scaffolding to describe how children, with the help of someone more knowledgeable, share and support the problem solving process, can perform more complex tasks than they would otherwise be capable of performing on their own (Palincsar, 1998). Scaffolding can be seen in games when players begin with a tutorial level. That introductory experience provides learners with a walk-through of the aspects of the game and provides feedback to guide the player towards success. As players gain more knowledge, supports are removed and the player is eventually left on their own using what they learned through the tutorial levels (Plass, Homer, and Kinzer, 2015).

Adaptivity

Adaptivity is the way a game is customizable or personalized by the player, or personalized (Anderson, 2012; Leutner 1993; Plass, Chun, Mayer & Leutner, 1998; Turkay & Kinzer, 2013). It facilitates learner engagement in a game. A game that has adaptive design measures a variable of the game, such as prior knowledge or self-regulation skills. After measuring, the game modifies to provide the appropriate response for the learner (Plass, Homer, and Kinzer, 2015). Adaptivity has been used to overcome shortcomings and have games be more challenging and appealing to the player. These contribute toward making experiences in games or simulations more unpredictable, effective, and fun (Lopes & Bidarra, 2011).

Incentive System

Motivating elements in games are those that encourage the player to continue with their performance and strive harder in the games by giving points, trophies, badges, titles etc., throughout the game (Learning, 2015). Most games built today have a very strong motivational element to it. Some of the forms of reward systems used in these games include scores, which is extremely crucial for every game as it denotes the level or in some way ability and ranking of the player. Level up is a commonly used reward system that allows the player to keep increasing their levels based on their performance and the higher the level the better the player is considered. Item granting systems are also used as incentives which gives the player the ability to receive more power, skill, collection (depending on the game) to help them with the game. Additional rewards like unfolding the story, clearing a level to get ahead finishing, motivates the gamer to perform well and succeed in the game (Wang & Sun, 2012). Gamers can easily lose interest in the game if they are not given incentive.

Situatedness

Situated learning is a style of learning reinforced by socio-cultural origins of cognition (Zhang et al., 2017). In building a connection with a community, the learner begins as a peripheral participant, growing into a more fully participating role with time. This can occur with an inexperienced player learning from a more experienced player, or by empathizing with a character story featuring situated learning in a role-playing game (Zhang et al, 2017). Games provide this role-playing context for situated learning through immersion (Conrad, 2017, 3).

Interaction Design-Learning Mechanics

Learning mechanics is defined as “the design of the learning interactions within a game” (Plass, Homer, & Kinzer, p. 267). The process includes mapping the learning objectives with instructional strategies using learning theories. To be an effective game, the research has shown that it is important to match the mechanics with learning goals (Plass, Homer, & Kinzer, p. 267). The game designer often use this popular framework called Learning-Mechanics and Game Mechanics (LM-GM) model. According to Patino, Proulx, Romero (2016), this model allows the reflection of various pedagogical and game elements when we design games (p. 2). Some of the components of learning mechanics includes instructional, demonstration, generalisation, explore, hypothesis, simulation, motivation, and guidance.

Activity Theory

Activity theory is an abstract framework in which the foundation of the framework is “activity”. It is based on works by Leont’ev and Engestrom during the 1970 and 80s (Huang & Gartner, 2009). Activity itself is defined by being a unit of subject-object interaction where the object is positioned as a motive that intersects with the needs of the subject (Law & Sun, 2012).

Engestrom defined the activity system model which is broken into seven elements which include the following: subject, object, tool, rule community, division of labour, and outcome. The subject is the person performing the activity; the object is the motivation, or objective, the subject has for engaging in the activity; the tool is the mediating artifact between the subject-object interaction; rule is the statute of the different actions and interactions in the activity; community is other people who share the motivation with the subject; division of labour defines how tasks, influence, and position will be divided among the community; outcome is the state of the condition, or the feedback (Law & Sun, 2012). Activity Theory is comprehensively inferred to be purposeful, transformative, and developing interaction between subjects and objects. Activity theory offers analysis and design where there is a special interest in qualifications, work environment, division of work etc. It is applicable where there is a need to focus on complexities created from multi-user activities and development of expertise through user participation and use of an artifact (Law & Sun, 2012).

Game Mechanics

In games, there are rules to follow and challenges to overcome. To be able to navigate these challenges, players must make use of methods provided in the functionality of the game itself (Sicart, 2008). These are the activities repeated by the player through the duration of the game. These game mechanics are essential for making progress in the game's state. An example of a game mechanic would be *Gears of War* (Epic Games, 2006), where players could take cover in order to avoid taking damage and tactically make their way through the mission (Sicart, 2008). Game mechanics provide a crucial role in games that can allow the player to strategize their movements and decision-making to achieve higher rated performance. These mechanics contribute to the games design and incorporates a cognitive function.

Game mechanics can be a situational function within the game's state. This leads into "context mechanics". In the *Gears of War* example, the cover mechanic cannot be invoked by the input command of the player alone. The player's avatar must be in the proximity of certain objects the game has identified as suitable for using that mechanic (Sicart, 2008). Sicart defines context mechanics to be the mechanics that are triggered depending on the context of the player's presence in the game world (Sicart, 2008).

Intrinsic Motivation

Motivation is a concept that explains human's behavior. Humans find reasons to act and react through motivation. Based on Self-Determination Theory (Deci & Ryan, 1985), motivation could be intrinsic or extrinsic. Intrinsic motivation refers to those behavior where someone perform an activity or a set of activities from their own will (Eccles et al., 1998). Intrinsic motivation is an important aspect in an academic setting as this is a natural way of learning new things and achieving objectives (Ryan & Stiller, 1991). In contrast, extrinsic motivation is caused by

someone's desire for a reward or benefit (Eccles et al., 1998). As the source of motivation is external, an extrinsically motivated students can perform task with resentment or having no interest at all. This is how, extrinsic motivation differs with intrinsic motivation where satisfaction of activity is higher than its instrumental value, i.e. reward.

Emotional Design- Alex Ausenhus

Emotional design is the use of visual design elements in multimedia learning that can evoke positive emotions and therefore facilitate learning (Heidig et al., 2015). Elements that impact the learner are colors, shapes, and sounds (Um et al., 2012). Multimedia learning can be defined simply as learning from pictures and words (Um et al., 2012). Game mechanics and representation of information are two methods that have been used to induce emotions. Although these methods have shown the overall impact on learning, they lack the measure of learning outcomes. Homer, Kinzer, and Plass (2015) state that the design of the game environment impacts the learners' affective state and investigates to what extent players' affect impacts the learning outcomes. Furthermore, research has not been able to find design patterns that relate to learning the broad spectrum of games.

Graceful Failure

Failing gracefully in a game encourages or challenges the user to continue play. It is important that the challenges are not too difficult as this will discourage the user from continuing. It's equally important that the challenges are not overly easy. Good games aim for the "sweet spot," where players can succeed but only with some struggle, inducing what has been described as a state of "flow" (Csikszentmihalyi, 1990). As stated in the article *Foundations of Game-Based Learning* by Jan L. Plass "failure is by design an expected and some- times even necessary step in the learning process".

Module 2: The Transformative Potential of Games

Benefit	Supporting Articles (Full Citation)	Additional Notes or Comments
Social Interactions/Skills	Freeman, G., & Wohin, D. Y. (2019). Understanding eSports team formation and coordination. <i>Computer supported cooperative work (CSCW)</i> , 28(1-2), 95-126.	Teamwork or collaboration training in team games such as Overwatch, World of Warcraft and others allows students to develop prosocial (communication) skills through identifying and forming teams. Teams are

	<p>Prot, S., & Gentile, D. (2015). Turning Our Gaze to Prosocial Media Effects: What is and isn't Known. <i>Empirical Musicology Review</i>, 10(1-2), 75-79.</p>	<p>formed through identifying players based on ability and compatibility. Players may favor compatibility over skill, as having a positive experience may outweigh winning.</p> <p>Through gameplay players develop pro social habits (interaction) which can be transferred to real world environments. Positive behaviors or motivations in game play, such as helpfulness or empathy, in games or media can translate to those actions being taken in the real world.</p>
Cognitive - neural processing/ efficiency	<p>Ballesteros, Mayas, Prieto, Ruiz, Toril, Ponce de León, & Reales. (2017). TRAINING WITH VIDEO GAMES: EFFECTS ON COGNITIVE AND NEURAL MEASURES OF ATTENTION AND MEMORY. <i>Innovation in Aging</i>, 1(Suppl_1), 829.</p> <p>Clemenson, G., & Stark, C. (2015). Virtual Environmental Enrichment through Video Games Improves Hippocampal-Associated Memory. <i>The Journal of Neuroscience : The Official Journal of the Society for Neuroscience</i>, 35(49), 16116-16125.</p>	<p>A gaming study tested 55 participants to see if games could improve memory and other cognitive processes. Over 10-12 weeks, participants played their assigned games for 16 sessions of 40 minutes. Thirty of the subjects played 10 assigned <i>Lumosity</i> training games, while the other 25 played <i>The Sims</i>. Both groups showed memory improvement.</p> <p>Today's 3D video games provide enriching environments that stimulate the brain's hippocampus. Because of the importance of the hippocampus to memory, these games are thought to improve memory performance. However, it is thought that the best benefits come from games that draw on many cognitive processes (visual, spatial, emotional, motivational, attentional, critical thinking, problem solving, and working memory) due to the fact that these games are not narrowly focused on improving one process, but creating an immersive mirroring of our natural experiences.</p>
Vocabulary learning in Second Language Acquisition - Ezequiel Aleman	<p>Calvo Ferrer (2017). Educational games as stand-alone learning tools and their motivational effect on L2 vocabulary acquisition and perceived learning gains. <i>British Journal of Educational Technology</i>. Vol 48 p. 264-278.</p> <p>Derakhshan, A., & Khatir, E. D. (2015). The effects of using games on English vocabulary learning. <i>Journal of Applied Linguistics and Language Research</i>, 2(3), 39-47.</p>	<p>Educational games show a motivational effect when learners acquire L2 vocabulary. It also improves students' own perception of their learning gains.</p> <p>The cited studies also show that video games are more effective when they are complemented by other media types or instructional strategies. .</p>

Enhanced spatial skills	<p>Maillot, P., Perrot, A., Hartley, A., & Duberstein, P. (2012). Effects of Interactive Physical-Activity Video-Game Training on Physical and Cognitive Function in Older Adults. <i>Psychology and Aging, 27</i>(3), 589-600.</p> <p>Feng, J., Spence, I., & Pratt, J. (2007). Playing an Action Video Game Reduces Gender Differences in Spatial Cognition. <i>Psychological Science, 18</i>(10), 850-855.</p>	<p>Spatial ability transfer by the elderly from exergame training;</p> <p>Only 10 hours of action game playing results in an improvement in spatial attention and mental rotation; female undergraduate students showed more gain than male students.</p>
Emotional Benefits of Gaming	<p>Lafreniere, M. A. K., Vallerand, R. J., Donahue, E. G., & Lavigne, G. L. (2009). On the costs and benefits of gaming: The role of passion. <i>CyberPsychology & Behavior, 12</i>(3), 285-290.</p> <p>Jones, C., Scholes, L., Johnson, D., Katsikitis, M., & Carras, M. C. (2014). Gaming well: links between videogames and flourishing mental health. <i>Frontiers in psychology, 5</i>, 260.</p>	<p>Balanced passion is beneficial to people's psychological Improvement</p> <p>The authors proposed that video games are aligned with the well being of games by nature and can help mental help flourish. flourish-mental health.</p>
Motivational Benefit of Gaming	<p>Granic, I., Lobel, A., & Engels, R. C. M. E. (2014). The benefits of playing video games. <i>American Psychologist, 69</i>(1), 66–78. doi: 10.1037/a0034857</p> <p>Dichev, C., & Dicheva, D. (2017). Gamifying education: what is known, what is believed and what remains uncertain: a critical review. <i>International Journal of Educational Technology in Higher Education, 14</i>(1). doi: 10.1186/s41239-017-0042-5</p>	<p>Children who are praised for their effort (e.g. "You worked so hard on the puzzle!") develop an incremental theory of intelligence; they believe intelligence is malleable, something that can be cultivated through effort and time.</p> <p>The challenge of overcoming the game's obstacles and mastering them is what matters the most to players, regardless of the type of the games. gamified system designers should not be so concerned with rankings and online comparisons to encourage users to compete against each other, but with their use as a personal reference, creating, challenging, environments and guidances for users to achieve their mastery interests (p. 23).</p>

Increased Affective Engagement	<p>Hsieh, Y., Yi-Chun, L., Huei-Tse, H. (2015). Exploring elementary-school students' engagement patterns in a game-based learning environment. <i>Educational Technology & Society</i>, 18, 336.</p> <p>Eseryel, D., Law, V., Ifenthaler, D., Ge, X., Miller, R. (2014).. An investigation of the interrelationships between motivation, engagement, and complex problem solving in game-based learning. <i>Educational Technology & Society</i>, 17, 42.</p>	<p>According to Hsieh, Link and Tse, affective engagement refers to attitude; a sense of intention, interest, motivation to engage in a task (not to be confused with behavioral and cognitive engagement).</p> <p>Eseryel et al. (2014) shared that engagement can be fostered by intrinsic motivation and self-efficacy.</p> <p>Eseryel et al. (2014) used amount of time spent on a game and amount of completed tasks to measure engagement.</p>
Problem-Solving Skills	<p>Griffiths, M. (2002). The educational benefits of video games. <i>Education and Health</i>, 20(3), 47-51</p> <p>Adachi, P. J. C., & Willoughby, T. (2013). More than just fun and games: The longitudinal relationships between strategic video games, self-reported problem solving skills, and academic grades. <i>Journal of Youth and Adolescence</i>, 42(7), 1041–1052.</p>	<p>Video games provide a relatively safe environment to try various solutions and see the effects. This can transfer to real-world decisions in regards to problem-solving. Additionally, children who had vocal speech acquisition handicaps were shown to have growth in the use and problem-solving of their speech device and communication strategies after video game experiences.</p> <p>The results showed that higher self-reported problem solving skills occurred when there was more strategic video game play. This, in turn, predicted higher academic grades.</p>
Enhanced Creativity	<p>Checka-Romero, M., & Gomez, I. (2018). <i>Minecraft and machinima in action: development of creativity in the classroom</i>. <i>Technology, Pedagogy and Education</i>, 625-637.</p> <p>Hutton, E., & Sundar, S. (2010). <i>Can Video Games Enhance</i></p>	<p>The study conducted by Hutton & Sundar (2010) tested the effects of arousal on creative potential through a series of experiments using the game Dance Revolution. They discovered significant changes in creativity at different levels of arousal (high and low) and valence (positive or negative). The findings were that creativity was at its highest in two conditions. The first condition was when arousal was high and valence was positive</p>

	<p><i>Creativity? Effects of Emotion Generated by Dance Dance Revolution. Creativity Research Journal, 294-303.</i></p>	<p>and the second condition was when arousal was low and valence was negative. From these results, the researchers theorized that these combinations result in cognitive enhancement due to defocused attention and increased motivation.</p> <p>The study by Checka-Romero & Gomez (2018) used the game Minecraft to measure the ability of video games to enhance creativity. The results of the study were that unstructured game environments, like Minecraft where players can modify and create environments, yielded highly creative products based on the scale developed for the experiment.</p>
Mental Health Intervention	<p>Morris, G., & Forrest, R. (2013). Wham, sock, kapow! Can Batman defeat his biggest foe yet and combat mental health discrimination? An exploration of the video games industry and its potential for health promotion. <i>Journal of Psychiatric and Mental Health Nursing, 20</i>(8), 752-760.</p> <p>Morris, G., & Forrest, R. (2013). Wham, sock, kapow! Can Batman defeat his biggest foe yet and combat mental health discrimination? An exploration of the video games industry and its potential for health promotion. <i>Journal of Psychiatric and Mental Health Nursing, 20</i>(8), 752-760.</p>	<p>This article begins with examples of how video games can be problematic in their display of mental health issues and vilifying the sick, such as in the Batman: Arkham Asylum game. It then goes on to call for positive representation by drawing parallels to positive and empathetic examples in other comics, such as The Punisher, as well as in music and other mediums.</p> <p>The article then goes on to draw parallels to other shown benefits of games as evidence of the potential of video games to benefit people suffering from mental illness.</p> <p>This study focuses on the effectiveness of games explicitly labeled as being for mental health focus and games seeking to improve mental health while being distinguished as for entertainment. The same game was used for all individuals, but the two groups were shown trailers with different overlaying text to market the game as for entertainment or for mental health. They expected higher positive impact from games labeled as for entertainment rather than health, and for a greater reaction to both from subjects with symptoms of depression. While it was found that subjects with depression symptoms had greater benefit to mood after playing the game than participants without, there was no difference between them in each control group. In the group labeled as for mental health, however,</p>

		<p>participants did state that they felt like they experienced less autonomy, meaning they felt like they had less options or ability to choose than participants in the group labeled for entertainment. The overall level autonomy of both groups remained high in spite of this.</p>
Developing greater perseverance with challenging problems	<p>Graesser, A., Goldberg, B., Sottilare, R. A., & Hu, X. (2014). <i>Design Recommendations for Intelligent Tutoring Systems: Volume 2</i>. Orlando, FL: U.S. Army Research Laboratory, 93-101.</p> <p>Deubel, P. (2006). Game On!. T.H.E. Journal, 33(6), Retrieved September 9, 2019 from https://www.learntechlib.org/p/7186/.</p>	<p>Through motivation and appropriate Game Design Patterns, games can provide challenging problems for users to solve and work through. When users continue to spend more time on these challenging problems, they are developing perseverance, which is the aim for developing a growth mindset.</p> <p>Similar to motivation, but more specific towards perseverance on its own. Persistence can be measured by the amount of time spent not on solved problems, but on unsolved problems. Addition of a 'hint' system to guide users without giving too much away to solve the problem. The hints allow the users to stay in the Zone of Proximal Development.</p>

Health/Serious Games - Alex Ausenhus	<p>Halton, J. (2008). Virtual rehabilitation with video games: A new frontier for occupational therapy. <i>Occupational therapy now</i>, 9(6), 12-14.</p> <p>McCallum, S. (2012, January). Gamification and serious games for personalized health. In <i>pHealth</i> (pp. 85-96).</p>	<p>Utilizing games into rehabilitation therapy allows the user to have fun while recovering. Instead of feeling like a normal doctor's appointment, the patient can work range of motion while trying to be competitive in a bowling or tennis match on the wii. The article stated that patients tended to stay in therapy sessions longer, engaged in social interaction, and didn't focus on the pain of their limbs.</p> <p>Although this is an old article about the Wii, many new systems or devices have been introduced that could be manipulated to have a more impactful recovery and statistical factor for therapists to analyze.</p> <p>The article goes over the activities within a game (physical health, cognitive health, and social/emotional health). The game they focus on most is a game designed for dementia patients and the trend to live longer and to be able to maintain mental health for the elderly.</p> <p>The game created was a simple quiz game. The tablet would announce to the patient to pick up the tablet and begin playing. The patient would have unlimited attempts at getting the answer correct. The results were not used to analyze the user's and their answers, but of the independence while playing. The study was wanting to see if their user's were independent enough to play a game on their own with virtually no help from a caregiver. The results showed a little more than half of dementia patients had the ability to pick up the tablet and begin playing.</p>
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Module 3: Gamers

Brain-Training Games

Pelmanism was a brain-training technique that swept across the United Kingdom in the early part of the twentieth century (Makin, 2016). It is a game based on memorizing cards or other objects placed before the players. This concept has been adapted to the 21st century as game developers are now focusing on creating games that improve cognitive functioning called brain-training games (Cubero & Billingsley, 2018).

Brain-training games are games that have been developed to help people remember items, to respond to items in the world more quickly, and to do logical reasoning tasks (Markman and Duke, 2016). Developers use the following characteristics to develop effective brain-training games: targeting, adaptivity, novelty, engagement and completeness (Hardy and Scanlon, 2009). According to McCallum (2012), *Gamification and Serious Games for Personalized Health*, good computer games provide challenges that match the skills of the player. The state of being deeply engaged, or reaching optimal enjoyment, in a game based on the difficulty matching your current ability has been termed “Flow” (McCallum, 2012). The idea of “Flow” is now being applied to the workplace where employees can be happier, more creative, and more productive. Lumosity, a brain-training game, is proven to release dopamine into the brain. This chemical makes a person feel happier and engaged by a reward-motivated behavior.

These 21st century brain-training games, such as Lumosity and Elevate, are focused on reshaping the mind to be more efficient and effective. Brain training games are being highly researched. Results from brain-training has shown improved abilities in core cognitive skills such as attention and memory to fluid intelligence (Hardy and Scanlon, 2009). According to Hardy and Scanlon (2009), these improved abilities can help people to do better in school, perform more effectively at work, and live a more productive life. The transfer effect is “the ability to extend what has been learned in one context to new contexts” (Bradsford, 2004). For example, Lumosity is designed to target brain areas such as memory, attention, and processing speed to make the individual, irrespective of age, smarter and better fit, mentally (Kpolovie, 2012, p. 188). A study, completed by Hardy (2001), concluded that “97% of people who train with Lumosity for at least 10 hours see increases in their Brain Performance Indexes (BPIs). These BPIs measure improvement in brain areas such as memory, attention, and problem-solving, and more generally a person’s ability to recall process information.”

Retro Gamers

Technology is making it possible for gamers to play older arcade, console and computer games using current devices. Players can get access to these older games by using old consoles or by installing PC emulators to play games from companies which discontinued their products a long time ago. In general, retrogaming refers to video games released in the 1980s and 1990s (Gee, D, 2019).

One of the reasons why retro gamers may be attracted to this new genre has to do with the emotions past games bring to the players. Gamers find a relationship to old characters and decide to continue playing with them even when technology may have left those characters behind (Wulf & Rieger, 2017). However, there are gamers who prefer enjoying the game in the

original hardware. In fact, companies like Nintendo have relaunched older hardware such as the Nintendo Mini Classic (Byford, 2018). One explanation for this behavior is that consoles can also represent part of someone's identity. Feelings of nostalgia arise from having these objects at home. (Wulf et al, 2018)

Some independent companies are now designing video games with a retro look (8-bit, 2D platformers) incorporating new gameplay mechanics. *Knight Shovel* (Yacht Club Games, 2014), a blockbuster success among gamers, was designed by a small company thanks to a crowdfunding campaign and is a clear example of this retro-modern game design. Gee (2019) describes three ways in which retro-modern games have been designed. First, games in which developers design new games using the same gameplay mechanics and aesthetics of 1980s games trying to depict the experience as faithfully as possible to the original games. Secondly, there are older games which have been fully re-designed to add new more attractive features while eliminating the more outdated ones. These so-called remakes can be attractive for some gamers with a strong emotional connection with an older game. Finally, some games incorporate older games features within modern games seeking to connect players with those nostalgic experiences. A clear example of this type of game is *Super Mario Odyssey* (Nintendo, 2017) which combines 3D gameplay with 2D sequences.

Developers, either by re-launching older game consoles and video games or remixing modern and old formulas to design retro-modern video games are seeking to satisfy the needs of a growing number of gamers who have a strong emotional connection with older games.

esports Gamers

The area of Electronic Sports (or esports) is organized competitive video game play between players as individuals or part of a team (Shaw, 2010; Burk, 2013; Lee, 2017). This can depend on the type of game and the genre which the game and/or specific competition takes place. As gaming has grown in popularity, it has given rise to esports and several new opportunities such as esport scholarships, live esport events on major networks, and consideration for inclusion in the 2020 Olympics (Holden, Kaburakis, & Rodenberg, 2018). Specifically, the rise of high speed internet has allowed the practice of competitive gameplay to move from a co-located experience to an online experience where players can compete with contemporaries around the world to determine who really is the best (Jenny, Manning, Keiper & Olrich, 2017).

For gamers, they can participate at different levels. Lower tiers range from casual competitions based on enjoyment to amateur competitions where players can earn as much as \$50,000 in cash prizes (per day) from companies such as Gfinity (Jenny, et al., 2017; Jenny et al., 2018). To win, gamers need to develop their skills similar to sports such as hockey or soccer. The better the players are, the more likely they are to gain an audience, or the notice of top tier esports players/teams for recruitment (Jenny et al., 2018).

According to Wagner (2006), an interesting interpretation of some esports team games is that they demonstrate aspects of “virtual high-performance teams” (p. 442). Teams compete against other teams in multiplayer games such as Overwatch, Fortnite, League of Legends, and the Defense Against the Ancients series (DOTA) (Riot Games, 2009; Valve Corporation 2013; Blizzard Entertainment, 2019; Epic Games, 2019). With these multiplayer games, they perform interdependent tasks, and develop expert communication techniques in order to succeed. Team members have defined roles, and are responsible for specific actions. Through effective communication they execute strategies which have been rehearsed. The skills these gamers possess are similar to important characteristics of successful distributed teams such as team skills and task skills (Bonner et al., 2015; Gilbert et al., 2018).

Social Gamers

Social Gamers or socializers are gamers who enjoy gaming in the presence of company. They will continue to play till they are surrounded by people or have someone to socially engage with during the gameplay. They don't prefer gaming individually. They are enjoying playing games, but their prime goal is social interaction. These types of gamers prefer multiplayer games, board games or sports games. Many researchers explore social interactions and relationships in gaming. In a research study conducted by McLean and Griffiths (2019), it was determined that there was a positive impact of gaming in terms of social support as well as progress of social ties online and offline including social capital, social identity and civil engagement (McLean & Griffiths, 2019).

Mobile Gamers

Due to the emergence of smartphones and tablets people can access mobile games anywhere and anytime. The interesting thing about mobile games is that they are somewhat not ideally situated for typical game play. This is in the context of screen size being small, computing power fairly low, and battery life limited (Kim & Lee, 2017). Analyzing the current market for mobile gamers and comparing the genders of this market it has been discovered that mobile gamers have similarity with male and female gamers having commonality in device usage and play (Balakrishnan & Griffiths, 2018). A majority of mobile games have a lifespan of less than six months due to their failure to keep consistent play with their gamers and or the lack of success in attracting new players (Kim & Lee, 2017). It has been reported by google that more than 90 percent of Google Play's revenue is from mobile games. Some of the research has proposed that the increase in popularity from mobile games is due to the convenience, transportability, and low price (Balakrishnan & Griffiths, 2018).

MOBA Gamers

Multiplayer Online Battle Arena (MOBA), is a game genre that uses ideas from First-Person Shooter (FPS), Role-playing games (RPGs), and Real Time Strategy (RTS) games. MOBAs are games that match two teams of five to compete against each other and destroy their enemy's core/nexus (base). Common current MOBAs are *League of Legends* (Riot Games), *Dota 2*

(Valve Corporation), Smite (Hi-Rez Studios), and Heroes of the Storm (Blizzard Entertainment). There also exist mobile MOBAs, but with less popularity to their PC and Console counterpart. Roles are assigned to players and players can select from a wide range of characters, all wielding their own abilities and strengths that play a specific role in the game. In the match there are small objectives that help progress teams to victory (Tyack, Wyeth, & Johnson, 2016). Players use their game knowledge and game mechanics to select characters to construct team composition, strategize and coordinate the team's decisions that will lead to their victory. Themes presented by MOBA players are competition, mastery, and teamwork as essential aspects (Tyack, Wyeth, & Johnson, 2016).

In the survey conducted, Tyack, Wyeth, and Johnson (2016) asked MOBA players questions regarding their experience with the game genre. There were 760 participants, 89% were male and an average age of 21. Tyack, A., Wyeth, P., & Johnson, D. (2016) asked what drew these players to play a MOBA game, and 65.22% responded that it was because their friends played. Other reasons were because the game was free, had nothing else to do or it was part of a LAN party. No other common themes were found.

As for reasons why players stop playing MOBA, 48.74% responded had quit for at least three months mainly because they did not have the time to play (26.94%). Other reasons were to play other games (23.99%), they no longer considered it fun (23.62%), or because of unsportsmanlike players (12.18%) (Tyack, A., Wyeth, P., & Johnson, D., 2016).

In one study by Johnson, D., Necke, L., & Wyeth, P. (2015), understanding player experience (PX) and game genres are a main focus. When looking at the MOBA genre, there is a disconnect from this particular genre and components of PX that have motivated players to engage with other genres of games. In comparison to other genres, MOBAs offer less autonomy and are more frustrating and challenging (Johnson, D., Necke, L., & Wyeth, P., 2015). Because MOBAs are very team reliant, there tend to be greater levels of frustration experienced by players. The genre involves fairly focused competition with a steep learning curve. Johnson, D., Necke, L., & Wyeth, P., state, "With less focus on the immersive qualities of the game and greater focus on competing and cooperating with others, there is more potential for frustration with the performance of others." (2015, p. 7). In conclusion, performance from a player can be affected by familiarity of a character or role a player plays, the difficulty of a character, the matchup of a character against another, higher game mechanics or knowledge of a player vs player, or even connectivity issues.

Console Gamers

Consoles gamers prefer to play and experience their games on dedicated interactive consoles like the Microsoft Xbox, Sony PlayStation, or Nintendo Switch. As of 2018, 49% of gamers preferred some type of gaming console over mobile and PC gaming, and even overall awareness of popular platforms is very high with the PlayStation 4 being a widely known console (Nielsen, 2018).

Recently, game companies have started to focus on cross-platform gaming to also include mobile versions of games or supplement the main console game. Sony has begun to work on cross-platform development in order to draw in hard-core console gamers at the same time as they draw in casual mobile gamers (Marek, 2005). Since mobile gamers currently make up 30% of the gaming market preference (Nielsen, 2018), cross-platform gaming will only serve to make console gaming more popular.

Adolescent Gamers

Adolescent gamers are an increasing part of the esports gaming community. According to the Games 360 Report, 15% of esports fans are between the ages of 13-17 years old (Nielsen, 2018). There are significantly more male than female adolescent gamers. In their play they are less likely to select for their character to swap gender. Additionally, in this study, there was a significant amount more of adolescents than adults who reports that violence was their favorite aspect of playing video games. Looking at ages, in general, the younger the player, the more time was spent playing each week (Griffiths & Davies, 2004). In addition to preferences in games, there are some adverse effects for adolescent gamers. In a study of Dutch schoolchildren between the ages of 13-16, there was confirmation of a small amount of addicted online gamers, 3%. This represents about 1.5% of all children in this age range in the Netherlands. This study found addiction-like problems present, but the decreased psychosocial health effects were less evident (Van Rooji, Schoenmakers, Vermulst, Van Den Eijnden, Van De Mheen, 2011).

VR Gamer

According to the Games 360 Report, only 13% of gamers in the age range 13+ showed that they are satisfied with VR experience and 63% of gamers have no opinion on Virtual Reality for video games (Nielson, 2018). Shelstad, Smith, & Chaparro (2017) investigated how using VR technology will affect the user satisfaction. The results indicated that VR created more satisfying experience and did contribute more immersive gaming as compared to traditional games which used only a computer or TV monitor (p.4). For example, engineering education is considered to be one of places using VR widely known as 3D Virtual Laboratories (Vergara, Rubio, and Lorenzo, 2017). It helps the engineers to solve lots of difficult problems such as “the danger of using products or machines, overcrowded classes, timetable schedule availability of the lab.” (Vergara, Rubio, & Lorenzo, 2017, p. 3) Sherstyuk, Vincent, & Treskunov (n.d) suggested that there are still problematic when we use VR to play game because it challenges the traditional business practices of game production (p. 2). They suggested the proposal design including VR Game pockets where the player can select the portion where they want to play VR.

Table-Top Role-Playing Gamer

“TRPGs are not board games, card games nor board wargames. They are fantasy role-playing games, a kind of leisure activity” (Chung, 2013, p. 56). In these games, a gamemaster, who also

functions much like a director, provides information to a group of players to create fictional personas within the guidelines of the rule book. Together, they create a form of collaborative storytelling fueled by the player's imagination, often in conjunction with dice (Chung, 2013). TRPGs can last a matter of ours, or can span over any length of time with as many sessions as the players may require to complete their adventure (Chung, 2013). In Chung's research, it is found that TRPG players essentially undergo creative training, and so are better able to exhibit divergent thinking, which is considered a sign of creativity, than non players or Electronic RPG players. It also has been found to improve empathy, collaboration, and have a positive impact on psychological and social development (Coe, 2017).

In recent years, TRPG play has been on the rise (Coe, 2017). Among the motives for playing TRPGs that are discovered by Coe are "Imaginative Creativity" (creative concepts such as building characters and applying roleplaying), "Exploring and Knowing Self" (taking part in personal and group identity work), "Belonging and Interacting" (social inclusion), "Relief and Safety" (a form of escapism from social pressures), "Learning" (practicing social interaction), and "Becoming" (a single theoretical concept the author introduces as the summation of the prior motivations).

Module 4: Designing Games for Learning

Design Methods and Theories

Constructionist game design

Constructionist learning design seeks to provide learners with opportunities to construct artifacts which are personally meaningful and that can be publicly shared (Weintrop, Holbert, Wilensky and Horn, 2012). As video games gained popularity, constructionist learning and constructing through videogames became widespread.

In order to design a constructionist game, giving the players the ability to construct in-game artifacts is central for the gameplay. These artifacts must be meaningful, identifiable, and useful for the players. Weintrop et al. (2012) suggest two basic principles for constructionist game design. The first one requires the built artifact to have a personal meaning for the players who created it by providing them with materials and tools which can be arranged in different ways to produce valid constructions. Designers can alter the range of the expressiveness of the representations in the game by adjusting the granularity of the building blocks. Larger blocks can make the experience easier while smaller blocks will make the challenge harder. Finding the right balance in terms of block size for the construction is essential for effective constructionist game design.

The second principle suggested by Weintrop et al. (2012) is based on the concept of microworlds discussed by Seymour Papert (1980) who stated that while materials may bring constraints, the exploration of combinations has none of them. Thus, learners can self-direct their learning by exploring through constructed artifacts. Papert's concept of exploration and self-directed learning is especially difficult for game designers. On the one hand, the game should offer learners the opportunity to explore and discover, but, on the other hand, it must require some specific outcomes. Thus, Weintrop et al. (2012) suggest designing games which can measure players' outcomes through a wider variety of discovered or invented ideas. Rather than rewarding players for reaching one specific solution, the game will reward any approach which accomplishes the objective.

Constructionist game design can be challenging for developers as they may struggle to create engaging and commercial games while providing players with free exploration and construction of artifacts.

Play-Centric Design

The main focus of play-centric design is the player experience which utilizes greater involvement from the audience and in return enhances characters, storylines, and interactions (Fullerton, 2006). The design method is basically a more detailed version of interactive design methodology (Dormans, 2012). How the design methodology works is that there are two distinct layers in the game development. The first is the formal core which consists of the underlining game structure; this is where the game rules, procedures, objectives reside. The second is the dramatic shell which surrounds the formal core with characters, interactive experiences, and story. The idea is that combining these two layers deliver the foundation of play and adjusting or tuning these properties of game play can create specific experiences aimed at the target audience (Dormans, 2012). The designer of the game works with the development team and ultimately creates the game rules, experience, storyline, etc, but neither have the ability to judge whether a game is going to perform well with the public (Fullerton, 2006). Play-centric design's primary focus is on continuous player testing using paper prototypes, storyboards, and mock-ups and constant improvement and iterations (Fullerton, 2006).

User-Generated Game Design - Caitlin Rice

User-generated game design is defined as the instance wherein players may create, edit and release their own content into the game world, thus influencing the game's evolution as well as the experience of other players (Kasapakis, Vlasios & Gavalas, Damianos, 2017). One of the most pervasive user-generated games is Minecraft. In user-generated games such as Minecraft, users become content creators. For instance, Minecraft game players "interact with the game world by placing various types of blocks in a three-dimensional environment, players can build creative structures, creations, and artwork on multiplayer servers and singleplayer worlds across multiple game modes" (Minecraft Wiki). They are in charge of the potential of the

game. Evidence exists that user-generated content related to specific areas may be of high quality, as it benefits from the knowledge of the local contributors, while also consolidating inclusivity, sociability, and engagement (Kasapakis & Gavalas, n.d.). User-generated game designers look closely at three motives: 1) self-marketing motive, 2) learning-motive, 3) fun-motive in their game designs. UGC games typically include gamification idea of rewards to generate extra motivation. These extra rewards “motivate users to engage with an application or service, usually by making it more ‘fun’ to use (Deterding, 2011). The main focus of user-generated games is to provide a fun, social, and creative environment for users to be in charge of the outcome of the game and be self-motivated.

Nine events of instruction in games

There are several events in the game and in the article “Preparing Instructional Designers for Game-Based Learning: Part 1” the authors Hirumi, Appelman, Rieber, and Eck mentioned about nine events that generally occurred in the game. They are as follows:

Gain attention: There are motions, cut scenes, noise, music, character speech, health meters, attacks, death in the gameplay and these are often used to draw the attention of the gamer.

Inform of Objective: This is often found in packaging the game box, documentation for the game, introductory movies, cut scenes, character speech in and between the game, and sometimes obstacles that limit movement or interaction of players.

Recall Prior Knowledge: Sometimes skilled learned in previous stage or even in previous version of a game is being used in a new one.

Present Instruction: Characters, environment, objects, puzzles and obstacles, conversation are arranged as per games objective. Instant instruction guides gamers throughout the gameplay.

Provide Guidance: Cut scenes, non-player character or player character speech, friends, partial solution of puzzles...all may provide guidance to the gamer to move forward to proceed to the next stage.

Provide Practice: While playing, players not only move forward, but also practice the game and learn techniques to play more skillfully.

Provide Feedback: Gameplay provide constant feedback to gamers. Characters speech, motion, action, challenges, cut piece almost everything in the game provide feedback to the gamers.

Assess Performance: Advancement throughout the game, graceful failure is a part of assessment.

Enhance Retention & Transfer: The more the gamer play more they retain information of game such as storyline and playing skills. Players also aware of the fact that what they learned through previous gameplay is relevant in gameplay for both the short and long term.

Video Game Design with Storytelling

Book series such as Harry Potter and the Lord of the Rings follow the flow of Joseph Campbell's description of the hero's journey (Robbins, 2005; Campbell, 2008). This is a long used story structure describes the process of a normal person (protagonist) thrust into difficult circumstances (by an antagonist), making a choice to pursue a challenge, and ultimately achieving a goal (Campbell, 2008). Many entertainment focused video games utilize aspects this narrative structure (Campbell, 2008; Paltz-Spindler, 2008; Rogers, 2010; Seager, 2018). Beyond entertainment games, story can be a useful asset in educational games as it has the ability to draw in the user. With an interesting narrative, users may be more likely to engage in game play, and return to that game. This is described in work to determine the use of storytelling in educational games (Kelleher & Pausch, 2007). The researchers compared time spent using an educational environment with a story element to one without it finding learners spent more time with the former. While Storytelling and narrative can aid in engaging learners, the story of a game is not necessarily the focus of the design. In game design the use of a game document describes the game, its goals, and how it is played. It also contains a guide for developers to refer to (Rodgers, 2010). While the story of the game guides the development, the designers also are responsible for creating the game's world with multiple interactions (Jenkins, 2004). For example narrative is used to determine long term events such as player goals or short term interactions such as achieving an ability, solving puzzles, or retrieving an item (Jenkins, 2004).

Persuasive Game Design method

Persuasive Game Design is based on three central concepts including user experience, gamification design, and transfer effects. Game designers want to create a game where players can transfer the knowledge from the game world to real life (Visch et al., 2013). According to Siriaraya et al. (2018), it is important for game designers to direct the player's motivation in their experience of the game world. The purpose is to transfer of knowledge. For example, player can change their attitude about a specific issue such as environmental care toward the change to their behavirol lifestyles as living a healthy lifestule. (Siriaraya et al., 2018) However, the transfer design is often being forgotten. Here are the three methods that could help to the progress of transferring including sudden change, gradual change, and adaptive change. (p. 3) Another important area is the game-elements which consist of "challenge, phantasy, competition, and exploration." (Visch et al., 2013, p.4) It is nescessary to keep in mind that persuasive games is restricted to the game-elements on gamifying the real-world context and the effort to transfer the knowledge. (Visch et al., 2014)

Entity-Component Systems

Entity-Component Systems (ECS) is a software development pattern designed to aid in the development of Real-Time Interactive Systems, such as games. Embracing an ECS approach to the software end of game development can diminish problems caused by coupling (Fischbach, 2017). Coupling refers to the dependence of code on external segments of code. Low coupling is considered highly desirable from a programming perspective, as high coupling means that there is a greater chance of interfering with other sections of code when you make changes to one (Jha, Bali, Narula, & Kalra, 2014). In simplified terms, ECS is about taking all the components that make up an entity and applying them to that entity (Fischbach, 2017). Because these components can be used on any entity that happens to require this component, code is highly reusable and is less likely to suffer issues regarding maintainability when a change has to be made.

ECS is especially useful to know now, as it is supported by some of the major game engines such as Unity, which even includes information on the design and use of this pattern and how it impacts Unity in its documentation (ECS Concepts, 2019).

Iterative Game Design Method

An iterative or incremental model is based on developing a software application one step at a time with the goal of expansion. In this model there is a testing phase at every step and based on the response received it is altered and extended further. This process is repeated until the application becomes fully functional and achieve all its goals (DESPA, 2014). Iteration is widely accepted as one of the core methodologies of game design and development. According to author Tracy Fullerton in her book, *Game Design Workshop: A Playcentric Approach to Creating Innovative Games*, the development of a game is cyclic in nature and repetition of phases like idea generation, conceptualization, testing and evaluation is crucial for the designer (Fullerton, 2008). This paper discusses a few frames of iteration, such as, Iteration as Elaboration, in this iteration, the game goes from small scale to a full version consisting of a variety of details with addition of characters, features, and gaming environment. The second kind of iteration discussed is Iteration as Simplification where during the iteration process the design is simplified and unnecessary features and concepts are cleared away from the game. Opportunistic Iteration helps with exploration of various concepts that may not be in line with the initial concept of the game. It allows adding exciting elements that may create an interesting change in the game. Omissive Iteration frame of iteration allows the developer to omit a major idea from the game in order to focus on the rest of the game design more efficiently. This concept is known as “creativity occluders” which was initially discussed by game developer, Dylan Cuthbert in Game Developers Conference in the year 2013 (Cuthbert, 2013). This concept revolves around the idea that sometimes the main concept of the game takes too much attention leaving the rest of the game to seem less worthy. Hence getting rid of the strongest candidate forces the developer

to enjoy a different perspective of the game without having the core idea overshadowing the rest of the game design (Kultima, 2015).

Modding Design

Modding is a method of game design where users/designers take an existing game and make changes to the original game. There can be different approaches to modding a game as well. Modding can be broken down into four different types; user interface customization; game conversions; machinima; and hacking closed game systems (Scacchi, 2011).

The user interface mod can customize three different components of the interface. One customization is the change to the in-game character's attire or accessories. A second customization is a change to the games color palette and framing borders of the game display. Lastly, add-ons to the interface dashboard that can provide the user with more in-game information. This mod type does not change play-rules or function of the game (Scacchi, 2011).

Game conversion is changes to in-game appearance or capabilities, changes to non-player characters (NPCs), in-game items or objects, or in-game maps or landscapes. This can keep the original goal of the game, but with added rules, behaviors, or challenges to the game (Scacchi, 2011). In some cases, if a modder takes a game, changes its behavior, creating an entirely new world and even goal or function to create a new game (El-Nasr, & Smith, 2006), then it is modding to create an entirely new game using the original game as a baseline idea or as a starting framework. This method can be used by beginning game designers to help start them off or even experienced designers who like the idea and wish to modify it to create something of their own.

Machinima is when a modder will take the visual of a game into a new media for other purposes such as, story telling, moving making or even for game play experience. This can create an interactive art exhibition or even an online cinema (Scacchi, 2011).

Lastly, hacking closed game systems is a mod that is mainly focused for the purpose of reverse engineering (deconstructing a product to its parts or core) and for understanding and create computing innovations. However, this can breach intellectual property and be illegal. In some cases this is done to create an unfair advantage for players or for game piracy (Scacchi, 2011).

In conclusion, modding can be a great method for game design, especially for beginners, to help them start out and design a game that best fits their needs for the content they want to implement. It can even change the player experience to meet the needs of a range of players or make it feel more personal to the modder or player themselves. One does need to be careful on certain modding and making sure that it does not affect intellectual property.

Game Object Model

The Game Object Model, or GOM, is a combination of game design and educational theory. This is the basis for the growth of the Persona Outlining Model (POM) as well as the Game Achievement Model (GAM). GOM has concrete interfaces that appear in GAM. These provide a way to both develop and document games of an educational nature (Amory & Seagram, 2003). More recently, a newer and more detailed model has built on previous concepts. Computer games should be emotive, relevant, engaging, having complex challenges. Additionally, they should be explorative and support learning activities that are authentic. They should also be inclusive of gender, have appropriate role-models, have challenges of puzzles or quests. These will be the primary learning process where the knowledge and reflection results can be shared. The second version of GOM supports the development of educational computer games and is a provided mechanism to evaluate how computer games are used in the classroom (Amory, 2007). By incorporating all of these aspects into game development, a designer can be assured it is suitable for educational needs and use in the classroom.

Resonant Game Design

At the heart of every game, there are still main principles of learning upon which design must be focused: scaffolding, metacognition, and conceptual change (Kloster, 2018). Resonant games also focus on learning through the game while sharing in the game experience with others, adding a social aspect to the learning. In this, resonant game design pulls from many aspects of sociocultural learning theory and this design also prepares the learner for more learning in the future, all while providing for peer interaction and instructor support (Kloster, 2018).

User Centered Game Design- Alex Ausenhus

It is crucial that game designers understand the interactions associated with the game tasks and their impact on players prior to game development (Rankin et al. 2008). Rankin et. al. implemented the framework and methodology of interaction design in the creation of a serious game (Massive Multiplayer Online Role Playing Game). User centered design consists of three stages: conceptualization, prototyping and playtesting (Fullerton et al. 2004). Conceptualization stage is primarily the brainstorming. This can but is not limited to: rules, the game controls, background story...etc. Prototyping is the stage in the cycle when designers create the first functioning model before release. The playtesting stage is most crucial of the three. This stage allows for feedback from the gamers and will contribute to any changes in the game. In conclusion, user centred game design identifies learning opportunities in the initial stage of game development (Rankin et al. 2008).

Module 6: Assessment

In Review

Time of Assessment	Assessment	Potential indicator
Before Gameplay	Eye tracking	Calibration for game play, attention pre-test
	Facial electromyography (EMG)	assess positive and negative emotional valence through muscle contractions
	Cardiovascular	Measure heart rate for stress and excitement levels.
	Galvanic skin response	Measure moisture (sweat) as an indication of psychological or physiological arousal.
	Pre-test / interview / questionnaire	<ul style="list-style-type: none"> • Testing knowledge • Testing feeling toward games • Assessing past experience with games. • Teacher's stance on games in the classroom, teacher's instructional strategies
	Artifacts	Common prior lessons,
During Gameplay	Eye tracking	Location of attention, reactivity, concentration, focus, interest, cognitive load, use of peripheral vision, gaze, visual search strategies
	Score/Rank	player progression during gameplay, comparing to other players' levels
	Biometrics Heart rate, respiratory rate, brain waves (stimulation in both amount and location)	Level of immersion, investment in the gameplay, level of stimulation
	Reaction (Facial expressions, body language, verbal response)	Emotional engagement

	Annotation (note taking); Audio recording	Explain and track thought processes, metacognition in the moment
	Observation	Observe player status during the game (frustrations, successes, failures)
After Gameplay	Eye tracking	attention post test, eye fatigue
	Score (Points, Rank, Letter Grade)	performance - relative skill
	Improvement	Immediate feedback, mastery progression
	Duration	The time it took to meet a goal or time used.
	Consequences	Outcome: Branch or story outcomes experienced Actions taken
	Observation	Social values learned, expressed empathy, group interactions
	Completion	Status update, message confirmation
	Post-test / interview / questionnaire	<ul style="list-style-type: none"> ● Testing gained knowledge ● Testing feeling toward games ● Assessing game experience

Definitions

Formative Assessment

According to Sadler (1989), the adjective formative is associated with forming or molding something, usually to achieve a desired end. He goes on to state that formative assessment is concerned with how judgements about the quality of student responses (performances, pieces,

or works) can be used to shape and improve the student's competence by short-circuiting the randomness and inefficiency of trial-and-error learning. Formative assessment is implemented and present throughout the entire learning process and continuously monitors progress and failures (Bellotti, Kapralos, Lee, Moreno-Ger, Berta, 2013). Hattie and Timperley (2007) state that formative assessment guided by effective feedback is critical for effective learning.

Ranking System

A ranking system is a form of assessment of player skill utilized in matchmaking to place players according to skill level. This can take many forms, but in games such as League of Legends, rank is split into several tiers known as a "ladder". After each game, players either climb up or fall down the ladder based on whether they win or lose, along with some hidden metrics regarding performance (Mora-Cantallops, Sicilia, 2018). These systems give players a chance to compete to show off their rank, both for social credit, and for end of season rewards. By having these ranking systems, the game can matchmake people within a range of rank so that, in theory, players are against and with players of equivalent skill level. This can save on frustration, by keeping the player from facing off against a far more skilled opponent, as well as avoid tedium in the game that can be caused by mundane, easy matches where only less skillful players are fought.

Also used by League of Legends as one of its hidden metrics is an Elo system that is affected by both ranked and unranked play (Mora-Cantallops, Sicilia, 2018). Elo was a rating system created for measuring chess players, but has since become affiliated with a variety of online games (Pelanek, 2016). Elo works by storing a rating for a player. On completion of a match, the players Elo goes up or down accordingly. If a strong player beats a weak player, they only go up in Elo slightly, but if they lose to a weak player, they go down significantly. The same applies in reverse to a weak player winning or losing to a strong one (Pelanek, 2016).

Game

Multiple definitions of *game* were shared in the articles. Some have overlapping components, and there are unique components to others. When talking about assessment within a game, knowing what qualifies as a game is important. A class discussion on September 10, 2019 involved many components of a game, some leading toward a "good" game rather than just a game. What was decided was that a game has rules, goals, and outcomes. It was also shared that there is no agreed upon definition of a game.

In the Shute and Ke article, there are multiple mentions of what constitutes a game. One is that games are structured or organized play (Klopfer, Osterweil, and Salen, 2009). Play is voluntary, it is intrinsically motivating, and it has an active component - either physically or mentally. There is a freedom to fail that is supported by opportunities to recover. Also mentioned in Shute and Ke is Suits' take on a game. Bernard Suits has a succinct summary of a game in his book titled *The Grasshopper: Games, Life, and Utopia*: "playing a game is the voluntary attempt to overcome unnecessary obstacles" (p xiii, 2014).

Epistemic Games

Epistemic games are focused on enhancing subject knowledge and understanding of the material similar to most games in that they have rules and goals with variation in game play (Bielaczyc & Ow, 2014). An epistemic game allows players to work through it and learn as professionals would in the workplace. They are designed for deep learning as well as being a fun way to learn work (Nodoushan, 2009). In workplace-specific epistemic games, many aspects are produced such as goals, constraints, tools etc. Shaffer (2006) describes the concept of an epistemic frame for epistemic games as a means for students to experience and solve outside problems through video games, computer games or other interactive learning. He describes epistemic games as games that manipulate epistemic forms which are distilled forms of knowledge applicable towards a certain discipline (Shaffer, 2006).

Epistemic games have the ability to teach students to think outside the box. Students can learn to think like a professional such as: doctors, engineers, architects and many other professionals. Some epistemic games can teach students intuitive decision making, for example the military uses a Tactical Decision Game (TDG) to teach this to soldiers (Nodoushan, 2009). Many epistemic games on the market today fall under many categories like simulation and strategic games (Nodoushan, 2009). These games are not only used for fun or pleasure, but also for teaching real life facts and problems which allow students to solve problems through innovative thinking and working (Nodoushan, 2009). Examples of epistemic games include Age of Empires, Microsoft Flight Simulator X, and SimCity 4 (Nodoushan, 2009).

In-Game Assessment

According to Belotti, Kapralos, Lee, Moreno-Ger, and Berta (2013) “The player should be able to learn simply by trying to overcome the game’s challenges” (p. 7). In this way, games can serve as a way to assess student learning by keeping track of choices made in an effort to show their cognitive processing in a much more complex way than any standardized test could show. Games that are well-designed for both learning and assessment will serve to help students retain important information that meets learning goals, but in the context of using this information to make decisions and reach important milestones within the game. These in-game assessments allow for a more authentic experience, as well as providing information about the player’s/learner’s thought process that a simple test cannot show.

Stealth Assessment

Stealth assessment is one of the components of evidence-centered design where assessment is integrated with the learning in such a way that the participants wouldn’t notice it (Shute & Ke, 2012). In a video game, players use their creative thinking, problem solving skills, and other competencies to finish a level or achieve the goal of the game. While doing so, players receive constant feedback in terms of score and progress in the game play which made actions and assessment simultaneous. Similar to the video game, students perform actions and activities

which ranges from scientific enquiry to problem solving and while doing so they are being assessed. While the players play the game, game assesses players competencies although the player is unaware of this fact. As a result, stress related to assessment which is common in the traditional testing system is absent here (Wang, Shute & Moore, 2015). In addition to these, scholars argued that students develop problem solving skills and other valuable life skills that is crucial to make them competent for 21st century (Gee, 2008). As the video game is gaining its popularity in increasing rate and a significant number of students play video games at home due to its engaging nature and as a source of enjoyment (Lenhart, Kahne, Middaugh, Macgill, Evans & Vitak, 2008), if the characteristics of game can be incorporated in the learning, student learning will be enhanced. Realizing the benefits of video games, for the last few years, game based learning experts have been using games as a preferred medium for assessment.

Discussion Topics

Game Completion and Achievement as Assessment

The immediate feedback provided by games can let the student know whether they meet the requirements to acquire certain achievements or not. These achievements can range in difficulty and be used to challenge the students. This achievement progress can be used for the teacher to see where the student is in their learning process.

As Hamari and Eranti (2011) state, “Achievements are goals in an achievement/reward system (different system than the core game) whose fulfilment is defined through activities and events in other systems (commonly in the core game). With this initial definition of an achievement in mind, we proceed to the empirical part of the paper that analyses achievements with an aim to break them down into analytical components.” (p. 4).

Components of an achievement are signifiers that breaks down into the name of the achievement, a visual of it (usually an icon), and a description of the achievement (Hamari & Eranti, 2011).

Completion logic is another element of achievement. Completion logic breaks down into trigger, pre-requirements, conditional requirements, and a multiplier (Hamari & Eranti, 2011).

These different types of components of achievement and completion allow students to work towards different goals. These goals can motivate students in numerous ways but are a way that can be used to assess students if implemented properly. This is because students are already use to how most games already include these achievements. Some students even want to beat their previous scores or go for a higher completion in a game. By having games require extra steps of understanding to acquire an achievement, students can be assessed without realizing it. This ties in well with “stealth assessment” (Shute & Ke, 2012).

Difference between Gamification and Game based Learning

In the past decade, gaming has evolved in nature to an extent where it is being used as a learning medium to educate students in various disciplines (Karagiorgas & Niemann, 2017). With the growth rate of technology and advancement of learning methodologies we often tend to incorporate new structures of learning in classrooms. Gamification and game-based learning (GBL) have become a recent trend in enhancing classroom learning, however people often tend to get confused between the two concepts. Gamification uses game design elements, game mechanics and game thinking in a non-game context to motivate participants (Khaleel, Sahari, Wook, & Ismail, 2016). The benefits of gamification include higher motivation levels, increased interaction and great loyalty. The concept of gamification is used in workplaces and in other domains like marketing, customer loyalty programs etc. GBL on the other hand is applied in enhancing the learning experience of students by encouraging their participation in learning while playing resulting in making the learning process more interesting and enjoyable. This type of learning process has a positive effect on the cognitive development. In short, gamification converts the entire learning process into a game whereas GBL uses game as a part of the learning process (Al-Azawi, Al-Faliti, & Al-Blushi, 2016).

Game Reviews

Assessments in iRacing

The racing simulation game iRacing (2016), assesses players to determine their license level. This is determined by how player performs regarding the license requirements and their safety rating. The safety rating is based on the combination or a drivers consistency in performance such as staying on track and avoiding causing accidents. Each license class has its own qualification merits as a player must achieve a standard lap time and/or compete in a number of official races where their performance is evaluated. Through meeting these prerequisites, players are promoted to new license classes and series.

This assessment process is similar to literature on serious games which suggests “knowledge acquisition and/or skill development” in serious games (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013, p.1). The use of the license classification system also can serve as an in-game assessment as players game-play informs their skill level as the action of driving a race car (the academic content) is directly linked to the player. The use of pedagogical target of decreased lap times, effective cornering, and use of in-race strategy is practiced and applied within the game environment (Bellotti et al., 2013; Sturm, 2019).

Concentration: a core element of good games

Concentration prescribes that games should provide stimuli from different sources to grab and maintain players' attention, but not burden players with trivial

tasks or overload them beyond their cognitive, perceptual, and memory limits (Shute, V. J., & Ke, F. (2012). Games, learning, and assessment. In Assessment in game-based learning (pp. 45). Springer New York)

3D Role-Playing Games as Language Learning Tools

In this study, EverQuest is used as a learning tool to help English as a second language (ESL) learners. Massive multiplayer online role-playing games (MMORPGs) and second language methodology had applied to create a digital learning environment. According to Rankin, Gold, & Gooch (2006), students who learn foreign languages found that virtual chat rooms and online discussions are less threatening as compared to traditional learning environment. In addition, students with a variety of language levels and personality differences (including introverts and extroverts) found that “online chat rooms promote a democratic learning environment” (Rankin, Gold, & Gooch, p. 2). MMORPGs provide authentic environments for learners where native and non-native language speakers can have an authentic conversation and can evaluate each other through the role-playing characters (Rankin, Gold, & Gooch, p.2). The research showed that as a results of game play interactions, ESL students increased their English vocabulary to 40%. EverQuest 2 created a rich environments that helped ESL learners to build up their vocabulary. It could potentially increase their conversational skills (Ranking, Gold, & Gooch, p. 5).

Module 7: Immersion

Definitions

Immersion

According to Brown and Caine (2004), “immersion is a powerful experience of gaming, and has been mentioned by gamers, designers, and game researchers alike as an important experience of interaction” (p. 1297). Immersion is described into three level of involvement (i.e., engagement, engrossment, total immersion) (Brown & Cain, 2004). Lack of awareness of time and awareness of the real world can be considered a sign of immersion (Jennett, Cox, Cairns, et al, 2008). Jennett, Cox, Cairns (2008) also stated that “immersion is the result of a good gaming experience” (p. 32).

Jennett, Cox, Cairns, et al. (2008) researched the relationship between immersion and talk completion time. The results predicted that the more the person immersed into the game, their focus ability to complete the task in real life was lower. Another study was about the relationship between immersion and the changes in the number of eye fixations. They found that the eye movements of the participants in the immersive condition decreased since they became too

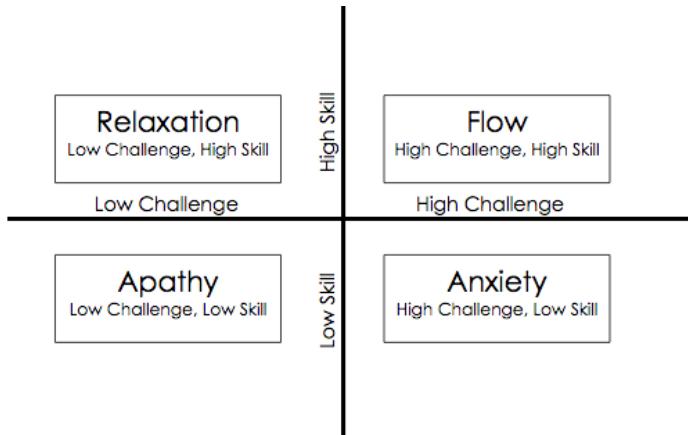
focused on visual components. Overall, the study concluded that immersion could bring positive and negative experiences such as anxiety to the players. (Jennett, Cox, Cairns, et al, 2008)

Flow Theory

"Flow refers to a state of mind characterized by focused concentration and elevated enjoyment during intrinsically interesting activities (Hamari, Shernoff, Row, Coller, Asbell-Clarke, Edwards, 2016). Flow is a state of mind where your body feels completely immersed in what you are doing. Flow can occur in many different forms and many different ways. Some may experience flow while playing sports, a musical instrument, drawing or writing, even when playing video games. Csíkszentmihályi, an American-Hungarian psychologist who recognized and named 'flow', states that there are certain characteristics for a flow experience. The factors are as follows: 1) concentration, 2) time distortion, 3) rewarding experience and 4) loss of self-consciousness (Kiili, Freitas, Arnab, Lainema, 2012). According to Kiili et al. (2012) one is in a state of flow when "a person is in a psychological state where he or she is so involved with the goal-driven activity that nothing else seems to matter." This flow experience has been highly talked about in regards to game-play and immersion. Brown and Cairns (2004) argue state that "flow has some parallels with immersion in the fact that attention is needed, sense of time is altered, and sense of self is lost." Flow seems to be truly achieved when there is challenge and engagement. Killi et al. (2012), states that "educational games should stretch a player's mind to its limits in his effort to overcome worthwhile challenges." According to this idea, the flow experience can be thought of as a design approach to designing educational games.

Flow Theory

According to Csikszentmihalyi (1990), flow is enhanced by certain properties of the task or experimental conditions. A goal is reachable when the chance of success is reasonable and can be met with a sincere effort. There are various combinations of high or low challenges and skills that can predict psychological states: "(a) apathy, resulting from low challenge and low skill; (b) relaxation, resulting from high skill but low challenge; (c) anxiety, resulting from high challenge but low skill; and (d) flow, resulting from high challenge combined with high skill" (Hamari, Shernoff, Rowe, Coller, Asbell-Clarke, & Edwards, p. 171).



Flow Theory adapted from Hamari, Shernoff, Rowe, Coller, Asbell-Clarke, & Edwards, p. 171

Discussion Topics

Benefits of immersive games for people with autism spectrum disorder (ASD)

According to Politis, et al., 2017, people with ASD may experience social deficiencies which can make it difficult for them to pass job interviews and function in the workplace. Currently there is a project called Hao2 which uses online immersive games to teach various life skills to people with ASD. Most prefer to learn in an online environment as they feel more comfortable with the virtual interactions. The design of these courses are to stretch the comfort zone of people with autism in a safe virtual environment. Learners have a majority control over their learning environment and engage in peer mentoring through customized 3D environments and partnered organizations (Politis, et al., 2017).

In a research article by Mazurek, Engelhardt, & Clark (2015), they investigate what motivates people with ASD to play video games. Many were motivated by challenges in the game, but some became frustrated with excessive difficulty. There was a negative perception towards violent and sexual content and very few of the participants listed first-person shooter games as their top game genres. 38% of the participants reported being motivated by a means to reduce stress. The distraction from problems through video games was very appealing to them. The fantasy/immersion characteristic was popular by over a third of the participants and they expressed the desire to take on characters who can do things that were not possible for them in the real world. As many studies have shown with the positive adoption of social media among adults with ASD, there was a similar acceptance towards multiplayer online games as they allowed them to share and connect with others (Mazurek, Engelhardt, & Clark, 2015).

Immersion and Flow, do they mean the same thing?

Immersion and Flow theories are often mixed up and perceived to mean the same thing. According to a study by Örtqvist and Liljedahl in 2010 on the topic “Immersion and Gameplay Experience: A contingency framework”, it is concluded that immersion is a separate but related construct to gameplay experience where individual characteristics influences the extent by which immersion impacts gameplay (Örtqvist & Liljedahl, 2010). Many researchers debate that Immersion is more popular than flow however, more than the importance of the right usage of the term it is about the sensory, cognitive and emotional response of an immersive experience. Researchers have considered flow to be an optimal experience when nothing else matters, which has led to the perception that it is a particularly extreme and intense experience, however Immersion, on the other hand, has been concluded to be sub-optimal which is considered more suitable for video games where there are various levels of immersions like engagement, engrossment and total immersion in which the latter is rarely existent. Immersion and flow don't appear as theoretically different nor are the differences compelling enough to categorise immersion as a different mental state. Hence the terms “Flow and Immersion” can be used interchangeably until further convincing differences can be discovered (Michailidis, Balaguer-Ballester, & He, 2018).

Virtual and Augmented Reality for Training

Virtual reality and similar technology has been utilized for training in real world environments. Work from MacAllister et al. (2017) describes the use of augmented reality (AR) to train Boeing workers for airplane assembly. “Augmented reality is a technology that adds digitally generated visual cues like 3D models, static images, or textual based information onto a view of the physical world” (MacAllister et al., 2017, p. 2). The purpose being to help orientate workers to efficiently perform tasks without errors or the need of extraneous supervision. This AR immersion allowed for workers to be able to identify parts, understand where they would be placed, and the method of installation.

Beyond job training, the use of AR/VR (or mixed reality) in work has been used to help patients. Molin, Graneheim, and Lindgren (2016) suggested that socialization can help alleviate some aspects of patients conditions as previously described in flow theory. Other medical conditions which can benefit from socialization are those suffering from Amblyopia (or Lazy Eye) as it can impact interactions with others. Visual therapy through VR can allow a patient to become immersed in a VR environment where they can undergo vision therapy. Work from Amir et al. (2016) describes a FPS game DUKE which allows players to not only train their vision, but their spatial awareness. Players use gesturing technology such as a magic leap to control movements. The HUD (Oculus, HTC Vive, etc) forces the players eyes to work together as in games such as by Nowak, Wozniak, Pieprzowski, and Romanowski (2018). In their work they

utilize mixed reality (similar to the Boeing work) to perform therapy. This requires the use of a Microsoft HoloLens which provides primary field images to the dominant eye and background (or secondary and tertiary) images to the recessive eye. As patient players improve, they are not as susceptible to negative associations with the condition (Chen et al., 2016). Due to the lack of symmetric features, this can cause interactions to be stressful and more difficult in multiple areas of their lives (Perrett et al., 1999). This can be from forming relationships, interviewing for jobs, or holding conversations as eye contact is valued in many western cultures.

Challenge and skills in game-based learning

It has been found that the relationship between challenge vs skill is not only extends players capacity of playing games but also it increases player motivation (Fullagar, Knight, & Sovern, 2013). Unlike confronting or solving superficial topic when students are invited to engage themselves in complex problems, they show more interest and attention in solving problem. This is happening as the players or students feel themselves more connected with the issue they are addressing. On the other hand, lack of challenging component on the way of achievement demotivated learners. This factor is supported by National studies where it has been found over and over that the lack of challenge is a common cause for student disengagement (Shernoff, 2010; 2013; Yazzie-Mintz, 2007). In addition to this, it has been found that the students experience higher motivation when they perceive them as competent for the task they are given (Covington, 1985). And students feel competent when they upgrade their skills through overcoming challenges. According to Nicholls & White, this perception of skill and competence has been considered primary indicator of achievement, motivation, and behavior (Nicholls, 1979; White, 1959). This phenomenon caused as success is valued positively, and the failure is a negative term in learners mind. These factors create an urgency among students to generate a sense of competency to avoid the pain of failure. The urge for achieving sense of competence help students to achieve a high level of focus which again help them to achieve higher skill set and as a result to fulfill their goal. This integrated relationship between challenge and skill introduce growth principal which is also connected to learning. Continuous challenges and overcoming them through learning cause an upward growth. Same phenomenon happened in the video game where the player adapts to the increased level of difficulties with their advancement which help them in building increased competencies (Fullagar et al., 2013).

Game Transfer Phenomena

Game Transfer Phenomena, or GTP, is the occurrence of game-related distortions of perceptions, be they visual, auditory, mental processes, or involuntary behaviors (Gortari, Griffiths, 2015). "An analysis of more than 1600 gamers self-reports have shown that videogame playing can lead to (i) perceptual distortions of physical objects, environments, and/or sounds, (ii) misperceptions of objects and sounds that are similar to those in the videogame, (iii) interpretation of events in real life contexts that utilize the logic of the

videogame, (iv) ghost perceptions and sensations of images, sounds, and tactile experiences, and (v) involuntary actions and behaviors based on experiences from the videogame (Gortari, Griffiths, 2015)." While Gortari and Griffiths find that many gamers have positive experiences with GTP, 1/5th of them report distress at the experience, and as many as 96.6% of gamers experienced it (2015). While the majority of instances of GTP are not considered bad, but were sometimes even desirable, it can be construed that this may sometimes apply to learned behavior, as physical actions and mental associations result. The negative effects are still certainly worthy of caution.

Effects of background music on memory

Music has long been one of the most effective avenues of immersion in television, movies, and video games. It has the ability to convey emotion and feeling quickly, transporting the viewer or player to another place, time, and state of mind. As many games have started to become more focused on learning and education, background music has followed as a typical game design element. However, its impact in the realm of learning is not well known. Research by Fassbender, Richards, Bilgin, Thompson, and Heiden (2012) yielded interesting results in memorization of history facts while utilizing two different delivery systems of instruction. While their results were far from conclusive, music will continue to be a point of interest for game designers as they look to design the most immersive and effective learning games.

Can competitive and cooperative gaming change the behavior and relationship between existing friends?

In the article "The influence of competitive and cooperative video games on behavior during play and friendship quality in adolescence" the question was asked "can competitive and cooperative gaming change the behavior and relationship between existing friends (Geert P. et al., 2018, p .298)". They ask this question in comparison of the theory of Bounded Generalized Reciprocity (BGR; Yamagishi, Jin, & Kiyonari, 1999), which studied the effects of gaming between strangers, but not friends. Their study showed that the relationship between friends can be affected by both the way the game is played and the behavior that is displayed during the game sessions (Geert P. et al., 2018, p.303). It would be interesting to see how the behavior of a team of employees in the workplace would be affected by competitive and cooperative video game play.

Game Reviews

What Remains of Edith Finch.

What remains of Edith Finch (Giant Sparrow, 2017) is a story of fantasy and mystery which portrays a young woman who decides to return to her old family home after several years. Returning home will bring back memories about her loved ones and uncover secrets about the reasons why they are gone. While this description may make us think this is a bleak or depressing game, Ian Dallas, writer of this game, exceptionally managed to turn every story, regardless how sad the final outcome, into a fantastic experience full of magic and wonder. These are stories of death, but they are also stories which make us fall in love with each character.

Barbara will teach us how hard it was for her to become a movie star at a young age just to lose everything a few years later. Lewis, who had a miserable job in a cannery, will show us how he found a way out of his despair. Calvin will take us on a trip with his rocket ships. Their stories matter, not because they are dead but because their lives are more than just sad photographs on a wall.

The game is shown from a first person perspective and the controls are very simple. You can move around, perform some basic movements like jumps, and interact with different objects. There isn't a focus on speed and you will not be chased by enemies lurking in the shadows. Instead, the game will immerse you in a series of stories which portray fantastic worlds. The main character is also the narrator of the story and her words appear on the screen in different parts of the house making the storytelling even more vibrant. Everything in this game will encourage you to keep exploring, to check every corner, to look at every photograph, to listen to every story.

One of the greatest qualities of What remains of Edith Finch (Giant Sparrow, 2017) is its ability to allow the player to actively follow the storyline by performing simple actions. There is no frustration or interruptions in this game. The story will drive you forward seamlessly. A player may wonder if the lack of action may not make this game a dull experience. On the contrary, the story is so rich and compelling that the player will just continue searching to get more answers.

The game can be finished in less than four hours making it an immersive but short experience for any casual player looking for an engaging experience without committing long periods of time. What remains of Edith Finch is a clear example of how immersive games can result in satisfying, deep experiences for more mature players who may never have gamed before. For those who play more often, this is a refreshing take and a new genre that may be, hopefully, developing.

Module 8: Interaction

Definitions

Prosocial Behavior

Prosocial behavior refers to any action completed to the benefit of another individual or group of people. In the context of gaming, effects on prosocial behavior has been studied and tested in a myriad of ways. According to research by Greitemeyer and Osswald (2010), “participants who had played a prosocial video game were more likely to help after a mishap, were more willing (and devoted more time) to assist in further experiments, and intervened more often in a harassment situation” (p. 211). Tear and Nielsen (2014) also arrived at the same conclusion as many other studies that violent video games do not affect prosocial behaviors, though they admit that this may only be due to the short duration of studies that cannot show the long term effects.

Discussion Topics

Building a Growth Mindset Through Game Play

According to Ricci (2017), a mindset is “a set of personal beliefs and is a way of thinking that influences your behavior and attitude toward yourself and others”. Dr. Carol Dweck, a professor of psychology at Stanford University, believes that abilities are developed through dedication and hard work. She also states that “students who embrace growth-mindsets--the belief that they can learn more and become smarter if they work hard and persevere--may learn more, learn it more quickly, and view challenges and failures as opportunities to improve their learning and skills.” (p.#). Games often promote a sense of struggle. This productive struggle allows students to develop their own growth mindsets (Henry, 2017). For example, while in game play students might do everything they need to do and still not win. At this point, a growth mindset will allow a student to say, “I haven’t won yet!” and try again. Wissinger (2019) believes that “by incorporating games and using the language of games in the classroom, we can shift students thinking so the resilient behavior demonstrated while playing a game transfers to the process of learning.”(p.#). Wissinger goes on to say, “...they will know how to shake off a low grade, re-focus their learning, and help others do the same.” By encouraging and practicing a growth mindset with students in the virtual world we will be able to transfer the abilities and use these skills in the real world.

Collaborative Games, Gameplay and Development

A collaborative experience is powerful as it has the potential to enhance an individual experience and to better prepare people for the real world (Kariippanon, Cliff, Lancaster, Okely, Parrish, 2019). It reflects the concept of teaming or teamwork where a group works together to complete a difficult task (Bonner et al., 2015). Games such as Pandemic utilize collaborative cooperation for success in a game. Meanwhile, game series such as Madden, FIFA, and NBA 2K also use aspects collaborative features to enhance the experience (Weber, John, Mateas, & Jhala, 2011; Jenny & Schary, 2014; Cotta, de Melo, Benevenuto, and Loureiro, 2016; Hawk, 2018; Saludo, 2018).

Pandemic is a strategic board game which has aspects of computational thinking (Berland & Lee, 2011). In the game, teams of 2-4 people work together to win or lose the game. Players work to prevent the spread of infectious diseases by isolating outbreaks and gather information which can potentially stop the spreading of it. Players take turns and utilize strategy to solve a potential problem via where they travel, what actions they take, and how they utilize each others knowledge. In the game this translates to success. However this cooperative collaboration is relative to real world collaborations in computational thinking according to Berland et al. (2011). The competitive aspect of collaborative game play is described by Verheijen, Stoltz, van den Berg, and Cillessen (2018) as contributing to aggressive behavior. Saludo (2018) describes the toxic online environments which plague games such as NBA 2K. Competition in Madden places players at odds as they compete for a goal. In the Madden NFL series, there are several forms of multiplayer modes (or collaborative gameplay) with the most common forms are either the one player versus another, or a player versus an AI player (Weber et al., 2011; Jenny & Schary, 2014). It is possible to play together, but it limits the interaction as one player has more control than the other.

Beyond competitive gameplay, Madden and NBA 2K have several forms of cooperative collaboration. The Madden series has the potential to teach those unfamiliar with the sports its rules. While extremely popular in North America, outside of the continent the rules may be unclear. As Jenny et al. (2014) explored, playing the game can teach the rules to newcomers. Additionally, through game play, players can provide feedback to game developers on what to improve or target for the next release. Weber et al. (2011) looked at a sample size of 25,000 Madden player habits to develop a tool for identifying the preferences of players. In this collaborative effort, player's data was used to determine features to improve. This practice follows what Saludo refers to by stating "Every year 2K Sports makes the effort of making the gameplay more realistic by tweaking its mechanics that players are unsatisfied with" (p.4). In this way players have a more active voice in revisions to games as more than their game play habits are reviewed.

Game Behavior in Intercultural Interactions

In a study by Chuah et al. (2007), the research team utilized the prisoner's dilemma (PD) game to...XYZ. The conditions were An American partnered with another American , with an international student, or with an American under stressed conditions. the researchers tested people from about 22 different countries with an average age of 22 and close to an equal gender split. The results displayed that there was less cooperation and less positive behavior under the intercultural condition than with the same culture. The intercultural results were comparable to the stressed group. They found that the greater the cultural difference (judged by a power distance score) the lower the cooperation and the higher the competition. The international students expressed feelings of pride and happiness during play, while the Americans felt more guilt and contempt.

(Chuah, Hoffmann, Jones, & Williams, 2007)

Matsumoto & Hwang (2011) researched the impact cultural differences have on one's behavior during game play. They used an ultimatum game (an experimental economics game) for the cultural game experiment. They targeted a smaller group than Chuah et al. (2007) did with the group consisting of Malaysian and UK communities. They used three cultural parameters, proposer, responder nationality, and location. There were six experimental conditions varying in inter- and intra- cultural games. What they found was that cultural differences existed between the offers made in the game. There was distinct differences in behavior observed when bargaining within the same cultural group than when faced with an opponent from another culture. For instance, the Malaysian group had significantly higher offers with in their own group than to the UK group. The UK group offers did not differ much between nationalities. The results supported the view that the culture of a group can outline the interactions between them, especially economically (Matsumoto & Hwang, 2011).

Bounded Generalized Reciprocity

Bounded Generalized Reciprocity proposes the idea that when people interact in inter-group situations, they display a positive attitude towards those who are expected to reciprocate in the same manner (Yamagishi, Jin, & Kiyonari, 1999). This behavior pattern protects and also extents someones self-interest. In addition to this, individual members in a group expect that the in-group members would reciprocate more positively more than the external group members (Yamagishi et al., 1999). In a co-playing video games, teammates who plays in the same group are categorized as the in-group, and the opponents are considered the outgroup. Players prosocial reciprocity expectations may be influenced by the type of the game which also later may influence their subsequent feelings and behaviors. Because of this factor, co-op games should promote positive attitudes and prosocial behavior towards a play partner as it has future consequences. In contrast to co-op gameplay, players display less pro social behavior and lower affiliation towards play partner in a competitive play. In agreement with the concept of

Bounded Generalized Reciprocity theory, It has been shown that interdependence among players increase cooperation during co-op gameplay (Velez & Ewoldsen, 2013) and the expectation of reciprocal prosocial behavior also increase positive behavior among players (Velez, 2015).It has also been found that when there is no previous interactions among players, reciprocity is guided by group members.

How to design a Collaborative Game

To successfully design a collaborative game, a strategy could involve having an individual person act as the facilitator or leader of a team. By utilizing a team leader strategy, several techniques could be applied. According to Zagal, Rick, & Hsi (2006), we need a game where players can be in different roles and receive different abilities to contribute to the success of the game. Another technique is that the designer can create a very difficult problem to solve so the player needs to work together in order to solve the problem. Another technique is to create a good narrative and flow so the player can enjoy the game and not feel like the game experience is boring. In addition, having a good outcome will motivate the player. In Lord of the Rings board game, several techniques above has been applied. The game was created where it gave each player a responsibility so players found their useful role in the game. In this game, communication among players is very important to help them to find different resources rather than a single player who tried to find all the resources by themselves. (Zagal, Rick, & Hsi, 2006)

Coordination Between Teammates in eSports

In sports, it is common knowledge that there is no “I” in team. There is also a common theme in media related to competitive sports about the bond between players in films such as “Remember the Titans” by Boaz Yakin, Jerry Bruckheimer, and Chad Oman, or “The Mighty Ducks” by Stephen Herek, Jon Avnet, and Jordan Kerner. For eSports, this should be no different. In “Team efficiency and network structure: The case of professional League of Legends”, the authors set out to prove that the social interaction between players, coordinating to be involved with the claiming of kills or objectives leads to better overall performance of the team. They call this “network intensity”. The researchers found that there was a pre-existing body of work that showed this was the case in basketball, and so they utilized an API developed by Riot Games, the creators of League of Legends, to track the data of 7,582 matches to find the win ratios relative to other in game metrics, primarily kill assists, which are granted when a player takes a part in the defeat of an enemy. In addition to kill assists, they keep track of factors leading to total gold, such as minion farm (Cantallops, Sicilia, 2019).

What the researchers found is that there was a distinct correlation between high network intensity and victory, as well as total gold and network intensity. They also found that low centralization, or less funneling of resources into a single player, was linked to a higher win rate

(Cantaloops, Sicilia, 2019). While greater pro-social behaviors are displayed in this study as leading to a higher success rate in the eSport, League of Legends, pro-social behavior is also in the game by design. Getting assists in League of Legends does not take away the gold that the player who got the kill received, it only adds a percentage of that gold to the assistant's pool. Additionally, the finite amounts of minion farm in the game encourages splitting of assets, as no one player can possibly claim it all. However, bot lane (or bottom lane) has two players in it from laning phase, unlike the others. In that lane, it is customary, with the exception of certain item effects changing this rule, that the player in the role of support only farm when necessary, and that the "marksman", a role that typically is a "carry", can claim as much of the farm as is possible to maximize their damage output. The support helps to funnel gold to that player in this regard, and often takes items that will be less dependant on this, or give the support more gold in exchange for allowing the marksman to claim gold. Additionally, a mechanic that did not get mentioned in the study is turret gold. When turret plating or the turret itself is destroyed, players near the turret get additional gold, meaning it is best that when a player destroys these that they make sure there are as many allies present as possible.

By this combination of factors, not only is League of Legends a highly interactive and social experience, it makes it a major mechanic of the game that good play is dependant on.

Game Reviews

Recommended Collaborative Games for team building

According to Keith, Anderson, Gaskin & Dean (2018), team gaming can lead to up to 20% improvement on team performance, similarly to other team building activities. The authors state that having people in a team play collaborative games for 45 minutes before a 3-5 hours task can be beneficial for their performance. The following list of games shows commercial tabletop and video games which may have positive effects on team building. The list is divided into VR games, online and offline video games and tabletop games. All of them can be played in sessions of 45-60 minutes. The majority of these games are not focused on violent interactions but on problem-solving or storybuilding instead.

1. Virtual Reality Games

- a. Black Hat Cooperative (Team Future, 2016). One of the main challenges when playing VR games is that, generally, there are only a few headsets available making it harder for a group of players to enjoy playing a game together. Black Hat Cooperative makes it possible for a group of players to interact even if they do not have a headset. The player wearing the headset plays the role of a spy which needs to infiltrate a building. There are guards patrolling corridors and many doorways. The rest of the players can see a map showing the player and indicators showing where the objectives of each mission are as well as the

position of the guards. The players will try to warn the spy against going into some rooms or walking through a corridor with a guard standing. However, the difference in perspectives may lead to confusions and get the spy into trouble. This game fosters communication among players and it is a rewarding experience for everyone. *Available on STEAM for PC. Requires HTC Vive or OCULUS Rift headsets.*

- b. Keep Talking and Nobody Explodes (Steel Crate Games, 2015). Similar to Black Hat Cooperative. One player will wear the headset while the rest of the team will collaborate to assist that player in accomplishing a mission. In this case, the VR experience will show a bomb with different wires, knobs, batteries and other props. The rest of the players cannot see the bomb but they have a manual to disable bombs. They can play with physical copies of the manual or use digital versions on their mobile devices. This will force the player using the headset to describe the bomb in detail and the assistants to find information in the manual to disable the bomb. If they make a mistake, the timer could reduce the time left or, even worse, the bomb could explode. Most puzzles can be solved (or not) in less than five minutes, making it possible for all players to interact with the VR headset. The game can be played without VR compatibility and is completely playable as long as the player who needs to disable the bomb does not show the screen to the rest. *Available on PlayStation 4, Nintendo Switch, Xbox One, Android, Microsoft Windows, Linux, Macintosh operating systems, iOS and STEAM. Compatible with HTC Vive and Oculus Rift.*

2. Tabletop Games.

- a. Pandemic Legacy (Z-MAN games, 2015). Pandemic is a collaborative tabletop game where a team of players must work together to save the world from an epidemic. The learning curve is higher than in other games but, after a few sessions, most players will learn the game. The board shows a map with different cities reminding players of games like Risk or War. Each turn, players have to complete three actions. First, they draw cards with cities names and infect them using small cubes. Each color of the cubes represents one strain of the virus. When a city has more than three cubes, it starts infecting other cities. The second action players need to make is traveling around the world to get to a city and treat the infection. To treat the infection they need to have cards with the names of the infected cities. The collaboration begins when players realize that the virus is spreading randomly around the world based on the cards they draw on each turn. Thus, they all need to travel to different parts of the world and they have a limited number of moves. Being close to a city without its card means they do not have the resources to cure the infection. Thus, their only way of saving some cities is meeting other players in agreed locations to exchange resources. They can also build headquarters to make it easier to travel from one place to another. Some players may realize that if they collect a specific number of cards of the same color may mean that the entire strain of the virus will be eliminated making the game easier. This game requires players to design a

strategy to win the game and will punish those players who decide to make moves without communicating their intentions. Collaboration in Pandemic is an essential component of the game and not just a way to play the game making it perfect for team building.

- b. Mysterium (Libellud, 2015). Mysterium is a collaborative game based on role playing. The new owner of an old house sensed a presence. He called a group of mediums to investigate what happened and release the house from this presence. There is no physical evidence but these mediums are not looking for DNA traces or weapons, they are actually going to try to contact the spirit of the deceased to uncover the secrets hidden in that house. The communication between the spirit and the mediums will not be based on words. Instead, the spirit will send the mediums different visions which players must interpret to solve this challenge. Communication is a very difficult skill to develop. This game promotes intersubjectivity by encouraging players to understand what someone else is trying to say through a collection of pictures rather than just words.
- 3. Offline collaborative video games
 - a. Overcooked! 2 (Team 17, 2018). In Overcooked players are meant to collaborate in a kitchen to prepare meals for a series of customers. As in other cooking games, players are expected to perform basic actions like slicing vegetables, boiling rice or grilling burgers. However, when four players join this kitchen, the experience gets very intense. Rather than creating a personal mind map to follow a series of steps to win the game, players need to communicate with each other to know what to do next. This sounds relatively easy. We could ask one player to boil rice, other players slice vegetables and they all win the game. The challenge in overcooked is that the kitchens are rather unusual. Some walls move locking players in different stations for a few minutes, sometimes there are narrow bridges making it possible for one player to accidentally push another cook off the bridge. Other stages require players to toss ingredients from one kitchen to another since they are on different islands or because they have to cross an avenue to get from one kitchen to the other. Frustration in Overcooked is inevitable. Players will need to take a minute to discuss which roles they are going to play and how they are going to react to challenges such as a pan turning on fire. Despite the cartoonish chaos of the game, it definitely resembles the experience of many players when they need to collaborate to solve a problem. Reflecting upon the game experience is a wonderful way to promote discussion about team issues that may be occurring in the real world. Available on PlayStation 4, Nintendo Switch, Xbox One, Microsoft Windows, macOS, Linux, Macintosh operating systems
 - b. Chariot (Frima Studio, 2014) This a 2D platformer game where two players are needed at all times. Instead of having two players complete the platformer by defeating enemies together, Chariot tasks the players with the challenge of carrying their dead father's coffin to his final burial place. Despite the somber context, the game is filled with humor as players need to find ways to move the

chariot together as they avoid obstacles and defeat enemies. This is a wonderful example of collaborative problem solving where the voices and actions of both players are essential to win the game. This game could provide two people who do not know each other very well or who may be going through a difficult relationship, to engage in fruitful conversations to win the game. Available on PlayStation 4, Nintendo Switch, Xbox One, Wii U, PlayStation 3, Microsoft Windows, Apple TV.

4. Online collaborative games

- a. Sea of Thieves (Rare, 2018). Sea of Thieves is a massive multiplayer online game where players represent different pirates who explore an open-world in a sandbox mode. Unlike other games where players are meant to follow main and secondary quests, Sea of Thieves allows players to roam freely around the many islands, caves and open seas. This feature allows players to join different crews or pair up with another pirate to discover hidden treasures or a new creature. One of the most salient features of the game is that players can all live their own stories, no gameplay feels the same just because you are sharing the experience with other people. You may face a storm and lose one of your companions who will respawn in a different place never to be found again. Players can even build their own stories by working together with other players and coming across unexpected challenges. As with most online games, many of your quest companions will be unknown to the players. Thereby, players are prone to suffer the consequences of dealing with people who actually behave as pirates. One mission where you loot a cave with a group of pirates may end up with some pirates getting away from the cave with their ship full of goods and leave you stranded. This is the only game on this list which depicts some form of explicit violence. However, there is potential in games which foster companionship, storybuilding and active exploration without recurring to violence. Sea of Thieves does include the possibility of engaging in fights, but when you can avoid them, it becomes a completely different experience from traditional MMOs. Available on Windows and Xbox One.
- b. SimCity (Maxis, 2013) is a game that has challenged players to build cities by constructing roads, electrical grids, pipes and attractions while assigning commercial, industrial and residential areas. Managing taxes, citizen's complaints, dealing with trash or criminality are all concerns that will determine the success of the city. The game was redesigned by Maxis in 2013 with a new version of SimCity which included the possibility of collaborating with other players in building regions. A player can find a group of friends and work on their cities. Each one of them can focus on a different thing. One player can work on developing a city where gambling and entertainment are encouraged while another player may focus on developing different industries to supply the region. Resources can be pooled together in order to build larger works such as an international airport. Cities can also share support in case of natural disasters or

fire. And, of course, they can sell each other different resources. This is a truly collaborative experience where shared management plays a huge role.

Module 9: Learning Supports

Definitions

Adaptive release

"Adaptive release is the ability to open content to students based on predetermined criteria. If a student completes a quiz, new content such as learning modules or rewards will become available" (Nadolny, Alaswad, Culver & Wang, 2017, p 4). For example, Anderson (2011), uses adaptive release in his AP Biology Class enhanced by game-design and providing a game-based learning experience. Anderson's former student, Russell, stated to Corriel (2017), that, "we were able to work on biology projects and homework, where we would level up as we learned. It fostered a motivation to get to the highest level you possibly could, while learning along the way." Adaptive release provides students with the ability to move through levels but only after they have shown mastery of a taught skill. This type of scaffolding provides immediate feedback to the student but is also a form of assessment for the instructor.

Quests

Quests can vary and are largely dependent upon what genre of game you are playing. For instance, if you are playing puzzle-based games then the quest may be a task that is specifically directed at a player with a varying level of challenge attached (Rettberg, 2008). The quest inside the virtual environment can be viewed as the constructor of play. There are several components that make up a quest and these include, the task, objectives, success and failure criteria (Ashmore & Nitsche, 2007). Quests can also be a means to set the plot going forward. Some games which have an end will use the quest to provide information about the final goal (Rettberg, 2008). Some quests require things be completed in a sequential order and others allow for side quests to happen in parallel. Quests are a large make-up of the game in genres like role-playing games and Multiplayer Online games and they contain starting and ending conditions which include explicit tasks to be completed (Ashmore & Nitsche, 2007). Games such as World of Warcraft are endless, so the quests are separated into small quests that the player can choose from, rather than one large quest (Rettberg, 2008). Some quests allow for exploration but lock out certain obstacles until defined skill levels are obtained (Ashmore & Nitsche, 2007). They can also be a player navigating through a scene, or several scenes, and mastering skills and gaining experience along the way. From the player perspective, quests are an instruction set which contain the tasks and goals for the player to solve or work towards. (Rettberg, 2008)

Discussion Topics

Identifying engagement needs of the middle school learner in GBL

According to Nadolny, Alaswad, Culver, and Wang (2017), the specific needs of the students factor into how GBL is implemented. The pedagogy presented is key for making that determination (Plass, Homer, & Kinzer as cited in Nadolny et al., 2017). Middle school students are more interested in game aspects, such as story/narrative, compared to high school and college counterparts whom hold academic achievement and/or class ranking. Additionally, there is a need for instant gratification for these students (Tillmann, Moskal, De Halleux, Fahndrich, M., Bishop, Samuel, & Xie, 2012; Nadolny et al., 2017). According to Tillmann et al. (2012), the use of instant gratification in mobile games can provide instant feedback to students, and provides ease of access. Furthermore, it can allow them to quickly engage in an activity as they are provided with resources "meeting a student's need for information just when she needs it" (Bowles-Terry, Hensley, & Hinchliffe 2010. p.25). In doing so, students may retain motivation and effort to stay engaged in an activity. Specifically for video or tutorial aides, Bowles-Terry et al. (2010) suggests a timeframe of 30-60 seconds.

AR and Multimedia Elements for Playful Learning and Discoveries

Numerous Research suggested that Augmented reality (AR) systems and environments can help learners to develop skills and knowledge in a more effective way compared to other technology-driven learning methods (El Sayed, Zayed, & Sharawy, 2011). AR environments can also help in acquiring skills. For instance, some AR games that have been developed for mobile devices allow learners to search, sort, and analyze collected data and information (Klopfer, 2008). By using these features, learners develop their skills in navigating information from open source and analyze them. Also, environments created in AR increase student motivation that eventually help learners to develop their analytical skills and help them to acquire more specific knowledge on the topic (Sotiriou & Bogner, 2008). In addition to this, there is evidence that AR learning environments helps learners understanding dynamic and complex concept because of its sense of authenticity (Rosenbaum et al., 2007).

Games Designed for Entertainment and/or Learning Purposes

An increasing number of studies have been done regarding the impact of learning and motivation from games. Players of a game can be engaged to learn, and the engagement can increase due to multi-sensory settings. The study of games for entertainment purposes has a larger history, focusing on the attributes, as well as causes, of enjoyment, motivation, and engagement. In these studies done solely for entertainment purposes, it is suggested that "gameplay is an experience that is both emotional and physical and that engagement in games can be reflected in players' emotions and thoughts" (Jabbar & Felicia, 2015, p. 741). According to Leemkuil (2006), there are multiple types of supports in games that can increase learning. These are: Feedback, Guidance, Additional Assignments, Cooperation and Collaboration, Debriefing and Group Discussions, and Monitoring Facilities.

Game Reviews

BioMan Biology

Brett Baughman is a game developer and Biology teacher who has created many Biology-related games to help students learn via Biology concepts through gaming. According to his website (Baughman, n.d.):

BioMan Biology is the fun place to learn Biology! Here you will find learning games, review games, virtual labs and quizzes that will help you learn about cells, ecology, genetics, physiology, and much more!

Games are categorized into eight overall categories, and each game is connected to various topics, including NGSS (Next Generation Science Standards). In each game and lab, students are guided through simulations and questions with immediate feedback on their choices and answers. Quizzes and assessments are built in, which score sheets that students can check as they play through each section of the game.

Succession Interactive Score Sheet

First Name:

Last Name:

Note: 50% of the overall score is the quiz score. Primary succession and secondary succession completion are each worth 25%.

Overall Score

0 %

Click here
when your
NAME is
entered
correctly!

Primary Succession
Complete
0 %

Secondary
Succession Complete
0 %

Quiz
Score
0 %

Submit Score to Your Teacher

How to Take a
Screenshot

Main Menu

SAVE Your Game!

(Screenshots of “Succession Interactive” and BioMan Bio website taken by Vanessa Dreessen)

Students have the option to repeat sections of games in order to improve their score and apply what they just learned from their mistakes in their previous game attempts.

Teachers can also set up accounts to have students submit their completed scores, allowing for formative assessment of learning from the game.

8 Ball Pool

8 Ball Pool is a video game released by Miniclip that can be played on Android, iOS and Web browser. It is exactly like the real pool game consisting of all the same rules.



Screenshots of 8 Ball Pool game taken by Aishah Khan from mobile device.

It allows the player to sign up with either Google Play, Miniclip, Facebook or Play as Guest.



Screenshots of 8 Ball Pool game taken by Aishah Khan from mobile device.

Once the player gets started, they can see the various options of game play in the home screen. It consists of 1 on 1 play, special tournament or playing a different version of the pool game, i.e., the 9-ball game, play minigames or enter a tournament. It also displays the player's total coins collected throughout the games, free rewards available, cues you have collected, leader board and their current rank etc.. This game can be played online with random strangers or players can challenge their own friends in the game, which makes socially engaging.



Screenshots of 8 Ball Pool game taken by Aishah Khan from mobile device.

Whenever the player wins a game, apart from the winning bet, they also receive mystery boxes which consists of new cues that get unlocked over time. The new cues are more powerful and help aim better so the player has an increased chance to win their next game.



Screenshots of 8 Ball Pool game taken by Aishah Khan from mobile device.

When the player selects 1 on 1 game play, they get various options of cities, which they choose according to their current collection of coins. Each city has different betting amounts which range from 50 coins to millions. If a player chooses a city which has the winning prize of 1000 coins, they each must bet 500 coins from their collection and the winner takes all.



Screenshots of 8 Ball Pool game taken by Aishah Khan from mobile device.

Once the player chooses which city they want to play in, they get placed against an opponent having a similar rank like theirs, to keep the game fair.



Screenshots of 8 Ball Pool game taken by Aishah Khan from mobile device.

The rules of the games are simple and much like the real 8-ball pool game. The player who goes first gets to choose solids or stripes but only if they can shoot the same ball during their second turn. Whichever player pockets all their balls first followed by pocketing the black ball wins. The player has to aim the ball at the pocket and decide the strength of their shot before they hit any ball. It helps the player develop their aiming skills and also brushes off on their math and physics knowledge. If the player pockets the white ball by mistake, the opponent gets ball in hand which allows them to place the white ball anywhere before they play their turn. Each player has a fixed timer before which they have to shoot their shot or they end up losing their chance as well as allowing the opponent to get ball in hand. The winner takes all the coins. When they player keeps playing and constantly winning, they keep levelling up in rank as well

as collecting more coins which allows them to bet higher amounts and play in cities where the winning prize is higher.

Disclaimer: Even if you are great at this game, you can still be terrible at the real life pool game, also it is very addicting, indulge at your own risk.

Mario + Rabbids Kingdom Battle



Image taken from ubisoft.com

Mario + Rabbids Kingdom Battle is a turn-based strategy game with RPG elements borrowing many of its core mechanics from the XCOMM series. The basic premise is that the Rabbids of the Rayman universe have been transported to the Mushroom Kingdom from Super Mario Brothers and fused with many of the things around the Mushroom Kingdom. Some, while insane, are friendly and fight alongside Mario and friends. Others are aggressive, and will attack the hero in battles centered around a grid with breakable terrain and obstacles across the map.

The game has an interactive overworld littered with collectables and puzzles to progress through the 5 worlds of the game. Each world consists of some number of battles, and can be revisited to complete additional challenges.

The battles in the game take place on a grid. The grid has terrain that can either partially or completely protect a character hiding behind it, and may or may not be destructible. There will also be crates with a status effect listed on them that will affect any player characters or enemies that happen to be near them when they are hit.



Screenshot taken from godkeys.com

In each round, each of the player's characters move and attack, and then each enemy moves and attacks. A character can use a single movement for a number of squares specific to the character, an attack, and an ability (which will have a cooldown period of some turns).

Additionally, by pathing movements through an enemy, the player can get a light attack in without spending their primary attack, and they can path to an ally to bound off of them and clear terrain as well as additional tiles. Each character also has a health point (HP) bar, and when that runs out due to taking damage, they are out of that round and the game until a point is reached where they are healed. To win, each battle has an objective. It may be to reach a certain point, defeat all enemies, or defeat a boss.

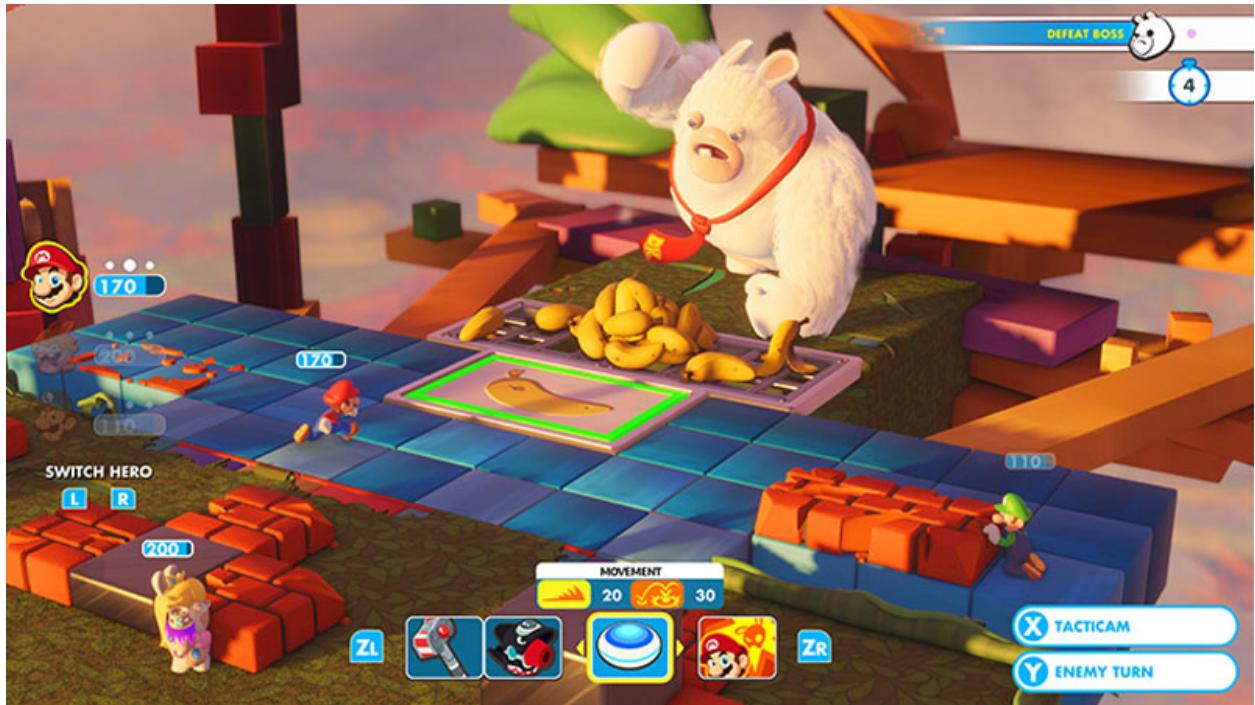


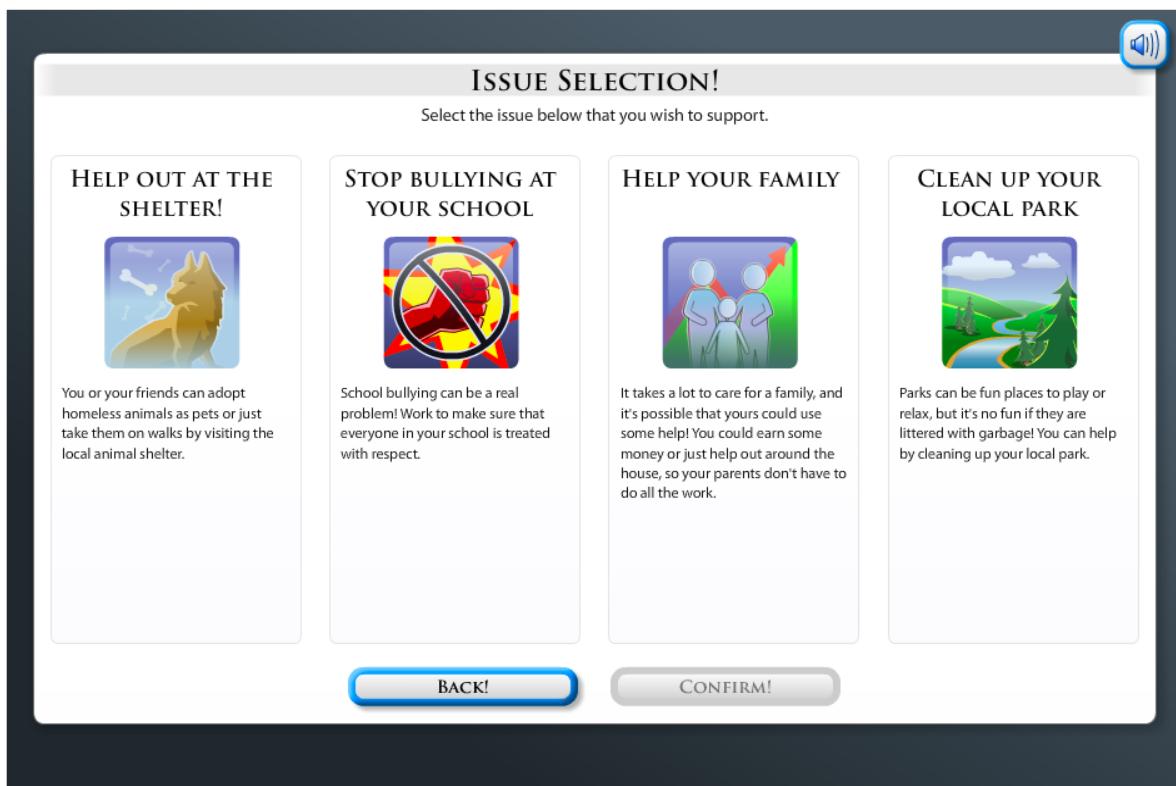
Image taken from venturebeat.com

The XCOMM games are known for their difficulty, but this game is developed with both fans of the XCOMM series and fans of the more “child friendly” perceived Mario and Rayman: Raving Rabbids fans, and that is what makes this game interesting for the topic of Learning Supports. The tutorial for the game might make the game seem overly simple at first, but there is plenty of challenge to be had later, especially if the player seeks to score well and return to complete challenges. The first battles are stripped down to only being able to move and attack. Slowly, they add mechanics piece by piece so that the player has an obvious use-case for each of the different skills. Then, once players know each of the core battle mechanics, they are opened up to the RPG customization elements. This is split across the entire first world of the game, and with there being only 5, this makes 20% of the main story missions essentially warming up the player to how the game works. Additionally, the tutorial is given in text, though in concise text blurbs with actions highlighted so that the player can see the feature in action and move on. For a more experienced player, this can surely feel tedious, but if the player appreciates the humor of the universe, they ought to be able to stick it out.

After the tutorial missions are completed, the training wheels come off, and it at times can be quite challenging to complete levels at all, let alone with the entire party in tact. It is fast to start over a battle, and the battles are relatively short, so for players up to the challenge, this does not come off as a large time waster. However, if it gets to be too much, each battle has an option at the beginning to put on “easy mode”, which drastically reduces the damage an enemy deals, allowing greater room for error.

Activate Game-iCivic.org- Vy Vo

Activate Game from icivics.org is an interactive gaming platform. Players will involve in a civic mission to help the local community and school. Topics include helping out at the shelter, stopping bullying at your school, helping your family, and cleaning up your local park. The game helps users to raise awareness of those topics and learn to cope with situations. The tasks are varies and it keeps the players engaging. It helps the deep meaning of the game and realistic solutions to the problem. I can see that the audience can be from grade 6-8 or even older. During the game, there is a coach to guide the player through the learning process. This game is a great tool for English learners or ESL students. It has labeled imagery, guided writing, embedded reading, interactive feedback and support, and repeated practice leading toward mastery.



Screen shot of Activate Game, taken by Vy.



Screen shot of Activate Game, taken by Vy.

ClassCraft

While ClassCraft is not a game, it is a learning management system which allows teachers to design game-based environments to support learning. ClassCraft allows teachers to grant experience points (XP). Their XP will help learners unlock different powers for their game as it happens in many role-playing games. Teachers can customize powers based on their needs by giving students opportunities to have permission to do things they like in class or just to praise their success during the school year.

In order to discourage negative behavior, teachers can also have students lose health points (HP). Whether teachers decide to use negative points to reflect a lower grade or just have the students complete an extra task or even do something funny in front of the class is up to the instructor.

The system also has a simple team-based competition system where they can use point or powers to protect other players who may be struggling in a course. If one student falls, everyone loses HP. Thus, collaborative attitudes are greatly fostered.

Tauled (2016) found that 90% of students in a middle-school class using ClassCraft in her study felt they were motivated by the gamified elements of the system while 15% considered they actually felt bored. Bonvin and Sanchez (2017) also highlighted the collaborative features of the system by tracking middle-school students' purchase and uses of powers. At the beginning, the authors noticed that when students had to purchase powers, they mostly purchased individual powers instead of team powers. However, by the end of the school year, 2 out of 3 classes were purchasing more team powers than individual powers as they realized they would have better chances of winning the games if they helped each other.

Studies on ClassCraft confirm Nadolny, Alaswad, Culver, & Wang's (2017) findings about the relevance of challenge, feedback and competition as game mechanics which are prominent in middle-school classrooms. However, as these authors also pointed out, the ages of the students may affect the relevance of some game mechanics over others. Additionally, ClassCraft is only a management system, thus, the effectiveness of each environment will depend greatly on the design decisions made by the instructors.

Destiny 2



Destiny 2 is a sci-fi story game. User's are given a choice between Titan, Hunter, and Warlock for their character. The user plays as a resurrected Guardian to fight against the enemies of humanity. Teamwork is rewarded throughout the game. You have the option to create a team or join a team. In destiny you are given missions throughout the game. Rewards such as more powerful gear, weapons, vehicles, etc are given for finishing missions. Users are also rewarded when helping other users during missions. The storyline in Destiny captures players. As a

player you are able to play the campaign solo and follow along the story, or play as a team and still be engaged in the narrative throughout the game. In the article *Gameplay Engagement and Learning in GameBased Learning: A Systematic Review* it was “found that narratives help students to relate to the story and the characters; narratives also help students to understand the situation depicted in the game and motivate students to explore and complete more missions” (Jabbar & Felicia, 2015, p. 757). Destiny uses the strength of the story and characters background to keep the users coming back for more.

Module 10: Learner Control

Definitions

Agency

Sawyer, Smith, Rowe, Azeved, & Lester (2017) define agency as “the degree of freedom and control that a student has to perform meaningful actions in a learning environment.” Giving learners choice and autonomy in their learning has been shown to improve motivation and support the development of intrinsic motivation (Evans and Boucher, 2015).

Intrinsic Motivations

Intrinsic motivation is the natural and unpersuaded desire to engage in an activity. (Burgers, Eden, Engelenburg, & Buningh, 2015). The opposite of intrinsic motivations are extrinsic motivations which are based on rewards. When inspired through intrinsic motivations, people play video games to gain a skill, get lost in a virtual environment, and enjoy the excitement and emotions induced through the play (Banyte & Gadekiene, 2015). The ability to make choices, rewarding through informational based feedback, and the lack of controlling type instruction, empowers the individual and in return enhances intrinsic motivation (Burgers, Eden, Engelenburg, & Buningh, 2015). People have an intrinsic motivation to play video games because it creates personal satisfaction. This may be for various reasons and often include pleasure, curiosity or interests (Banyte & Gadekiene, 2015). In the context of game-based learning, evidence has shown that intrinsic motivation has a direct impact on the learning of subject matter. It has been found that students in game-based learning have higher intrinsic motivation than those from traditional learning. (Chen & Law, 2016)

Discussion Topics

Choice and Control

Dickey (2006) presented both character design and the narrative environment of MMORPG games as feature which support intrinsic motivation. Within the narrative environment, players are given many choices in how to proceed and advance. These include quests, when and how to collaborate, where to be in the narrative environment, and more. The range of choices leads

to an increase in the intrinsic motivation a player has in that game. Within a quest, the player is exposed to a part of the game that is needed later on, such as resources or a part of the environment they have not yet explored. While the completion of a quest is required, when and how it is done is left up to the player. This allows for control, which is another important aspect for intrinsic motivation, according to Malone and Lepper (1987). Players are given options that match their level, providing appropriate opportunities for control and choice. This leads to higher levels of intrinsic motivation for the player. Aspects of MMORPG such as these, can be incorporated into education settings to aid in increasing the intrinsic motivation for students. Sawyer, Smith, Rowe, Azevedo, & Lester concluded “a key feature of many game-based learning environments is providing students with the freedom to experience agency by exploring and pursuing tasks in a manner of their choosing” (2017, p 10). Allowing students to have choice and control leads them to have higher agency. However, with more choice, the activity has less structure, which may lower the learning outcomes a student has. If in-game scaffolds are provided, there are supports to learning that can guide the student.

Moral Choice

In a study performed by Lewis and Weaver, they explain that while morals are at play in film, video games stand out as being a form of media in which the viewer is a moral actor (2012). They believed that anthropomorphizing elements of games, or perceiving characters as humans, means that prosocial behaviors should apply (Lewis, Weaver, 2012). In contrast to this, games that encourage violent behavior promote what Vorderer and Hartmann described as moral disengagement, in which the characters are dehumanized to enhance a person’s ability to discount game’s reality as not part of the real world (2010). Lewis and Weaver hypothesize that the moral choice’s present in games such as Fallout 3 reduce the dehumanizing elements necessary for moral disengagement (2012). Their research found that while committing antisocial behavior in Fallout 3 did carry with it feelings of guilt, it did not reduce the enjoyment of the game (Lewis, Weaver, 2012).

Game Reviews

Spent

Spent is an immersive game working to raise awareness about a situation that could easily happen to any person. The name ‘Spent’ has two main meanings within this game. Spent can refer to money or it can refer to the person’s feelings. This game challenges you to see if you can survive, if you can make decisions in a chain of events that seems to be spiraling out of control, and if at your last \$1,000 with a risk of losing everything you can make it through just one month.

This game was created by Urban Ministries of Durham (UDM) in hopes of educating those on how it may feel to be living on the edge of losing everything. “This game is the reality for many

of the 6,000 people who come to UDM each year because they have simply run out of options.” (UMD Wins Award for Spent).

Detroit: Become Human

It is Detroit in the year 2038. AI has made it possible for androids to behave like human beings as service machines. Detroit: Become Human (Quantic Dream, 2018) is a story-driven game where players’ decisions have meaningful impact over the outcomes of each character’s fate. The player will follow the stories of three androids during a chaotic scenario in which androids start to realize that the world is not just with their robots.

One of the androids was discarded and discovers the horrific fate of those androids which are no longer wanted. This experience makes the android start a self-discovery process. A second android is a babysitter which witnesses the misfortune of a little girl leading her to take actions which will put her at risk. Finally, one of the androids works as an investigator and is assigned to a human detective who hates robots leading to brutal conversations about the implications of AI and androids in human lives. The game will have players deal with dilemmas regarding life and death, survival or selfishness.

One of the most engaging aspects of Detroit: Become Human is that players are forced to make difficult decisions all the time. Some decisions even have very short reaction times since they are life or death situations. Others are difficult because they may lead your character to its death. As the game progresses, players may feel affection towards the androids and making rational decisions can be harder than one would assume in a video game. The game has thousands of options, multiple endings for each android, and a gripping story which will encourage reflection about the moral dilemma of AI androids in the near future.

Injustice 2

Injustice 2 is one-on-one fighting game. It is the sequel to the successful game Injustice: Gods Among Us (NetherRealm Studios, 2017). The Injustice series allows the player to take control of various characters from DC Comics canon. In the sequel game, players are allowed to make several choose your own adventure style story choices in gameplay which leads them to different pathways. These pathways eventually diverge to a final choice. Along these different routes, players are some background information from characters which may weigh into the game’s final decision to support one of two factions of characters.

While the game is a mainstream entertainment game, it allows for several learning possibilities. Despite the hyperbolic events of the game, it does present several sides of a complicated argument to the player. While it is unlikely that a supervillain will download cities in the real world, the choices characters make are symbolic of approaches to difficult decisions and the difference of opinions on them. As a whole the series looks at what can happen by making one choice and how that can completely change someone.

Borderlands 3

Borderlands 3 is an action role-playing first person shooter, and is also called a loot and shoot game. In the Borderlands series, you assume the role of a character known as a vault hunter. Players are allowed to choose from a list of different vault hunters that have their own unique abilities and even ability trees that allow the player to take control of the style they want to play with that selected character. The game follows a main story quest with many side missions throughout the virtual space in the game that can be accepted by the player. Completing side missions grants the players bonus experience points, money, and sometimes gear.

After completing the main story quest, players are able to continue with their character and level up to max level as well as another rank called Guardian rank that provides new additional stats for their player. Players are also able to replay the main story with a new character and start at level 1, but play in a new mode called True Vault Hunter. This mode makes the game more difficult, but is also more rewarding in terms of loot (in-game gear), and experience points. The game provides players with control to increase the difficulty, try new characters and builds, try out a variety of weapons and other gear, and even go into the game solo or cooperatively with others.

Dogfight 1942

Dogfight 1942 is an arcade air combat games developed by CI Games in 2012. As its name depicts, this game is designed on the backdrop of WW2 that includes European and Pacific theater. The player plays as a pilot where they fly a wide range of realistic airplane models ranging from P-51 mustang to supermarine spitfire and almost all well known allied fighter planes of that era. The game play is fairly easy and the control is very much intuitive which has eliminated the need for a lengthy tutorial and makes it enjoyable for gamers with various types of skill set. There are 3 unique types of co-op split-screen modes: Campaign, Survival and Dogfight. There is no option for online multiplayer games.



Screenshot of Dogfight 1942, taken by Md Imtiajul Alam

The campaigns and levels of the game are fairly straightforward. Whether the player is over Europe or the Pacific Ocean, they select from a variety of planes and fight the enemy. While a few missions require players to bomb certain targets, or use torpedo to sink the ships or escort or protect others, most of the gameplay consists of aerial dogfight against German or Japanese force. The player mostly uses machine gun in aerial combat. There is a feature for rocket as well which is more effective against ground forces.

As an arcade flight combat game, Dogfight 1942 is an average game and easy to play. There is a lack of challenges and the AI seems very much in basic level. Nevertheless, the simplicity of the game has made this game more enjoyable and easy even for the novice player.

Life is Strange

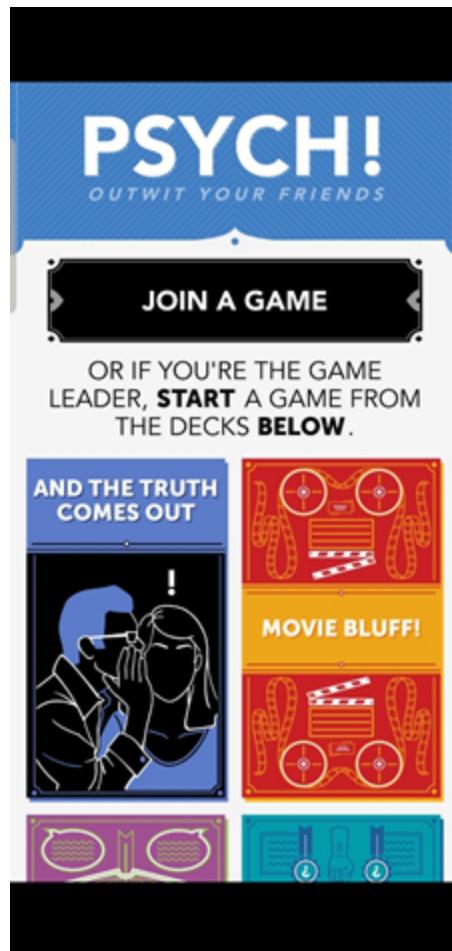
Life is Strange is the game about a student who has the ability to rewind time at any moment. Therefore, she is able to make different choices and see what's happening. One interesting fact about this game is that the player cannot save the process whenever they want. They can only save at certain points of the game and follow the flow of their options. According to Neely (2019), this game encourages the player to try different options to see the results. Whether a good choice or bad choice was made, a player can learn about empathy.

Screenshot of Life is Stranger game, taken by Vy.



Psych!

Psych is a fun party game to play with friends. It was created by the creators of Heads Up and is available on Android and iOS platforms. This game allows you to choose from a variety of fun categories in which each player makes up fake answers to real trivia questions. The rules of the game are simple. First you pick a category you want to play in, which will generate a secret code that can be shared with friends to invite them to play the game with you. It will also give you options of the number of rounds you want in that game, ranging from 5, 7 to 10 rounds.



Screenshots of Psych game taken by Aishah Khan from mobile device.

The main aim of this game is to win by scoring the highest number of points, which can be achieved by choosing the correct answer for the questions and making a believable answer that will get picked the most. Different versions of this game are played differently, for example, if you opt for 'Word Up', the app will prompt you to make a believable word/term for a particular definition, you aim should come up with a word closest to the right answer or something convincing enough to make the other players opt for your answer. All the responses will be displayed after each player is done entering their choice of word. It will then prompt the players to choose the answer they think is right. The player ends up either selecting the right answer and gaining points, or selecting someone else's made up answer and getting 'Psych-ed' or allowing other players to select their answer in turn 'Psych-ing' them.



Screenshots of Psych game taken by Aishah Khan from mobile device.

The game is very short but entertaining and keeps you on edge. The most fun pack to play with your friends is "And the Truth Comes Out" which asks interesting questions about the players in

the game. The responses will keep you hooked with laughter. It is extremely addictive and keeps you wanting to play more. It is most fun when played in larger groups.

Module 12: Research Methods

Method	Citation	Notes/Comments
<ol style="list-style-type: none"> 1. GUESS Validation Tool development (Item Pool Generation, Expert Review, exploratory factor analysis) 2. Design-Based Research 	<p>Phan, M. H., Keebler, J. R., & Chaparro, B. S. (2016). The development and validation of the game user experience satisfaction scale (GUESS). <i>Human factors</i>, 58(8), 1217-1247.</p> <p>Chapman, J. R., & Rich, P. J. (2018). Does educational gamification improve students' motivation? If so, which game elements work best?. <i>Journal of Education for Business</i>, 93(7), 315-322.</p>	<p>The paper suggests how to measure video game satisfaction. It reviews satisfaction from the perspective of engagement, immersion, presence, and flow. Previous work tends to focus on only one of these aspects whereas the authors attempt to uncover key factors for determining a satisfying experience and development of a tool to do so.</p> <p>Design-Based Research can be referred to as "systematically testing theoretical interventions in the active context of learning environments" (Chapman & Rich, 2018, p. 316).</p> <p>Researchers</p>
<ol style="list-style-type: none"> 1. The effects of video game playing on attention, memory, and executive control 2. Review on psychophysiological methods in game research 	<p>Boot, W.R., Kramer, A.F., Simons, D.J., Fabian, M., & Gratton, G. (2008). The effects of video game playing on attention, memory, and executive control. <i>Acta Psychologica</i>, 129, 387-398.</p> <p>Kivikangas, J.M., Chanel, G., Cowley, B., Ekman, I., Salminen, M., Jarvela, S., & Ravaja, N. (2011). A review of the use of psychophysiological methods in game research. <i>Journal of gaming & virtual worlds</i>, 3(3), 181-199.</p>	<p>This article discusses the assessment measuring the effect of video games on visual and attentional tasks to improve perceptual and cognitive abilities.</p> <p>This article focuses on the use of psychophysiological method for game research. According to Kivikangas et al. (2011) psychophysiological research is described as using physiological signals to study psychological phenomena. These signals provide an insight into a game player's emotional and cognitive processes.</p>
(Vanessa Dreessen) 1. Methods for game user	Desurvire, H., & El-Nasr, M. (2013). Methods for game user	In this article, Desurvire and El-Nasr discuss many of the

<p>research: studying player behavior to enhance game design</p> <p>2. Game Analytics for Game User Research, Part 1: A Workshop Review and Case Study</p>	<p>research: Studying player behavior to enhance game design. <i>IEEE Computer Graphics and Applications</i>, 33(4), 82-87.</p> <p>El-Nasr, Magy Seif, Desurvire, Heather, Aghabeigi, Bardia, & Drachen, Anders. (2013). Game analytics for game user research, part 1: A workshop review and case study.(Technical report). <i>IEEE Computer Graphics and Applications</i>, 33(2), 6-11.</p>	<p>current methods utilized in the field of Game User Research (GUR). This field aims to help game designers improve the player experience. Methods include:</p> <ul style="list-style-type: none"> • Think-Aloud • Rapid Iterative Testing and Evaluation (RITE) • Heuristics • Playtesting • A/B Testing • Game Analytics (discussed in a previous article by El-Nasr) <p>This article discusses the emerging field of game analytics, assisting game designers in using data to help develop and improve games. They mention the ideas of “game data mining” and “interactive visual-analytics” to help visualize the data gained from user experiences. Quantitative and qualitative data are both mentioned as important, with the latter being discussed in part 2 of this article.</p>
<p>1. Cognitive Ethnography</p>	<p>Dubbels, B. (2011, January-March). Cognitive Ethnography: A Methodology for Measure and Analysis of Learning for Game Studies. <i>International Journal of Gaming and Computer-Mediated Simulations</i>, 3(1), 68-78.</p>	<p>Ethnography involves the researcher living or immersing themselves in their place of study where they gain an understanding of the language, lives, artifacts and the culture of the subjects. In cognitive ethnography it is similar to the same concepts except that the main purpose is to gain an understanding of the cognitive process through observing people in their native environment. This allows the researcher to take advantage of observations not always made available in a laboratory setting. It is under the assumption that human cognition will adapt to the natural environment and in the context of video games is applicable to games,</p>

	<p>2. Meta-Analysis</p> <p>Arrojo, M., Blanco, V., J.Antonio, G.-C., Otero, P., & Vazquez, F. (2018, December 11). Efficacy of video game-based interventions for active aging. A systematic literature review and meta-analysis. <i>PLOS ONE</i>, 13(12), 1-24.</p>	<p>simulations, narrative and interactions. Video games exist in the following three spaces: physical space, social space, and conceptual space. As a result of this, cognitive ethnography lends itself to a useful methodology.</p> <p>When using meta-analysis, the researchers will start with a research question they wish to focus on and will adhere to guidelines and protocols, such as the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA). It is typically used when there are several studies addressing the same question. The researchers then developed a search strategy (Query) to search databases of systematic literature. A selection process took place to screen for duplicates and topic relevance. Disagreements were settled through consensus meetings and decisions were made to include or exclude studies. Once all the data is extracted a decoding process takes place where data is analyzed and studied. During the data analysis the meta-analysis process is executed with either a fixed model or random effect model defendant upon the heterogeneity of the data.</p>
<p>1. What should be the role of computer games in education?</p>	<p>Mayer, R. E. (2016). What should be the role of computer games in education?. <i>Policy Insights from the Behavioral and Brain Sciences</i>, 3(1), 20-26.</p>	<p>Based on research literature, in this paper the author pointed out the fact that educators are not yet ready to completely replace traditional educational system with game based learning(GBL). Rather, GBL is still being used for targeted objective and learning. In addition to this, the author also suggested that game should supplement the traditional academic materials</p>

		as a part of instructional activities instead of replacing them. Also, this paper explained the difference between liking a game and learning from a game and noted that liking a game not always leads to learning.
2.Brain plasticity through the life span: learning to learn and action video games	Bavelier, D., Green, C. S., Pouget, A., & Schrater, P. (2012). Brain plasticity through the life span: learning to learn and action video games. <i>Annual review of neuroscience</i> , 35, 391-416.	This paper argues that even though the action games doesn't contribute in direct learning among gamers on any particular skill, playing action games increases gamers ability to extract patterns or regularities in real life environment. Thus it helps gamers in learning to learn. This paper also argues that playing action games may foster neuroplasticity which also helps in learning new skills.
1. Bridging the methodological divide in game research. 2. What's My Method? A Game Show on Games	Williams, D. (2005). Bridging the methodological divide in game research. <i>Simulation & Gaming</i> , 36(4), 447-463. Lazzaro, N., & Keeker, K. (2004, April). What's my method?: a game show on games. In <i>CHI'04 Extended Abstracts on Human Factors in Computing Systems</i> (pp. 1093-1094). ACM.	There are two very different approaches that have been used to study video games. One is used by social scientists who want to understand the effects of games on users. The second is used by humanists who want to understand the meaning and the context of the game. These each have different goals and methodologies. However, they both have a valid contribution to make to the research on video games. Three game researchers propose what they view as the best methodology to research questions from real games. It looked at traditional qualitative methods, biometric methods, as well as other qualitative measures which collect emotional and cognitive responses.
Think-Aloud Method	Desurvire, H., & El-Nasr, M. (2013). Methods for game user	Describes a variety of current methods in video game research

	<p>research: Studying player behavior to enhance game design. <i>IEEE Computer Graphics and Applications</i>, 33(4), 82-87.</p> <p>Ke, F. (2008). A case study of computer gaming for math: Engaged learning from gameplay? <i>Computers & Education</i>, 51(4), 1609-1620.</p>	<p>such as think-aloud, RITE, heuristics, playtesting, and A/B Testing.</p> <p>Think-Aloud is described as being introduced for user-experience professionals, but has been modified for the game industry. Players verbally express their thoughts and feelings, while explaining their actions and describing their experience, all while still playing the game. Because the player expresses their immediate thoughts as they play, it should reduce biases and inaccuracies that occur when resorting to self-reporting. It does stress the importance of having researchers, rather than game designers, conduct the study so as not to have the results impacted by attachment to the design.</p> <p>This study on math learning through gameplay utilized think-aloud, document analysis, and in-field observation to collect qualitative data. The data gained from students' following think-aloud protocol showed that not every drill in the math game would be found engaging by the children.</p>
Clear logic of inquiry	<p>Duran, R. P., Eisenhart, M. A., Erickson, F. D., Grant, C. A., Green, J. L., Hedges, L. V., & Schneider, B. L. (2006). Standards for reporting on empirical social science research in AERA publications: American Educational Research Association. <i>Educational Researcher</i>, 35(6), 33-40.</p>	<p>Allows readers / users to follow along the path of thought, problem, etc. The user or reader is able to understand the issue from the start to finish.</p> <ul style="list-style-type: none"> - Flow charts - Work flows - Narrative - Story line

	<p>1. The Game Performance Assessment Instrument (GPAI): Development and Preliminary Validation</p> <p>2. Games User Research and Physiological Game Research</p>	<p>Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The game performance assessment instrument (GPAI): Development and preliminary validation. <i>Journal of teaching in physical education</i>, 17(2), 231-243.</p> <p>Nacke, L. E. (2015). Games user research and physiological game evaluation. In <i>Game user experience evaluation</i> (pp. 63-86). Springer, Cham.</p>	<p>1.GPAI used to measure game performance behaviors. It measure how the player understand the problem and choose appropriate actions toward the action. There are 7 games components to evaluate (base,adjust, decisions made, skill execution, support, cover, guard/mark).</p> <p>2.Behavirol observation, think-aloud protocol, interviews, heuristic evalution, focus groups, surveys and questionnaires, and game metrics are very important elements to evaluate the game. To evaluate physiological game, there are several methods including electromyography (EMG), electrodermal activity (EDA), Galvanic Skin Response (GSR), Cardiovascular Measures, and Electroencephalography(EEG).</p>

References

- Adachi, P. J., & Willoughby, T. (2013). More than just fun and games: The longitudinal relationships between strategic video games, self-reported problem solving skills, and academic grades. *Journal of youth and adolescence*, 42(7), 1041-1052.
- Al-Azawi, R., Al-Faliti, F., & Al-Blushi, M. (2016). Educational Gamification Vs. Game Based Learning: Comparative Study. *International Journal of Innovation, Management and Technology*, 7(4), 132-136. doi:10.18178/ijimt.2016.7.4.659
- Amir, M. H., Quek, A., Sulaiman, N. R. B., & See, J. (2016, November). Duke: enhancing virtual reality based fps game with full-body interactions. In *Proceedings of the 13th International Conference on Advances in Computer Entertainment Technology* (p. 35). ACM.
- Amory, A. (2007). Game object model version II: A theoretical framework for educational game development. *Educational Technology Research and Development*, 55(1), 51–77.
- Amory, A., & Seagram, R. (2003). Educational game models: Conceptualization and evaluation: The practice of higher education. *South African Journal of Higher Education*, 17(2), 206–217.
- Andersen, E. (2012, May). Optimizing adaptivity in educational games. In *Proceedings of the International Conference on the Foundations of Digital Games* (pp. 279-281). ACM.
- Anderson, Paul. [Bozeman Science]. (2011, November 11). Using Game Design to Improve My Classroom [Video file]. Retrieved from <https://www.youtube.com/watch?v=XGE6osTXym8>.
- Ashmore, C., & Nitsche, M. (2007). The Quest in a Generated World. *DiGRA '07 - Proceedings of the 2007 DiGRA International Conference: Situated Play*. 4. The University of Tokyo.
- Balakrishnan, J., & Griffiths, M. D. (2018). Loyalty towards online games, gaming addiction, and purchase intention towards online mobile in-game features. *Computers in Human Behavior*, 87, 238-246.
- Banyte, J., & Gadeikiene, A. (2015). The Effect of Consumer Motivation to Play Games on Video Game-playing Engagement. *Procedia Economics and Finance*, 26, 505-514.
- Baughman, B. (n.d.). Biology Games & Virtual Labs! Retrieved October 22, 2019, from <https://www.biomanbio.com/index.html>.
- Barnett, S. M., & Ceci, S. J. (2002). When and where do we apply what we learn?: A taxonomy for far transfer. *Psychological bulletin*, 128(4), 612.
- Bellotti, F., Kapralos, B., Lee, K., Moreno-Ger, P., & Berta, R. (2013). Assessment in and of serious games: an overview. *Advances in Human-Computer Interaction*, 1-11.

Berland, M., & Lee, V. R. (2011). Collaborative strategic board games as a site for distributed computational thinking. *International Journal of Game-Based Learning (IJGBL)*, 1(2), 65-81.

Bielaczyc, K., & Ow, J. (2014, March). Multi-player epistemic games: Guiding the enactment of classroom knowledge-building communities. *International Journal of Computer-Supported Collaborative Learning*, 9(1), 33-62.

Blizzard Entertainment (2019). Games. Retrieved from <https://www.blizzard.com/en-us/games/>

Bonner, D., Gilbert, S., Dorneich, M. C., Burke, S., Walton, J., Ray, C., & Winer, E. (2015, February). Taxonomy of teams, team tasks, and tutors. In *Generalized intelligent framework for tutoring (GIFT) users symposium (GIFTSym2)* (p. 189).

Bonvin, Guillaume, and Eric Sanchez. "Social Engagement in a Digital Role-Playing Game Dedicated to Classroom Management." *International Conference on Games and Learning Alliance*. Springer, Cham, 2017.

Bowles-Terry, M., Hensley, M. K., & Hinchliffe, L. J. (2010). Best practices for online video tutorials in academic libraries: A study of student preferences and understanding. *Communications in Information Literacy* Vol 4 (1) p.17-28. Retrieved From <http://www.comminfolit.org/index.php/cil/article/view/Vol4'2010AR1>

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). *How people learn* (Vol. 11). Washington, DC: National academy press.

Burgers, C., Eden, A., Engelenburg, M. D., & Buningh, S. (2015, July). How feedback boosts motivation and play in a brain-training game. *Computers in Human Behavior*, 48, 94-103.

Burk, D. L. (2012). Owning e-Sports: Proprietary rights in professional computer gaming. *U. Pa. L. Rev.*, 161, 1535.

Burke, L. A., & Hutchins, H. M. (2007). Training transfer: An integrative literature review. *Human resource development review*, 6(3), 263-296.

Britton, B. (2018). 17-year-old Sophia Floersch survives horrific airborne crash at Macau Grand Prix. Retrieved from <https://www.cnn.com/2018/11/18/motorsport/sophia-floersch-macau-grand-prix-crash-intl-gbr-sci/index.html>

Brown, E., & Cairns, P. (2004, April). A grounded investigation of game immersion. In CHI'04 extended abstracts on Human factors in computing systems (pp. 1297-1300). ACM

Byford, S. (2018). Nintendo NES Classic Mini Re-release date. Retrieved from <https://theverge.com/2018/5/13/17350686/nintendo-nes-classic-mini-re-release-date>

Campbell, J. (2008). The Hero with a Thousand Faces (Vol. 17). New World Library

Carbonie, A., Guo, Z., & Cahalane, M. (2018). Positive Personal Development through eSports. Association for Information Systems AIS Electronic Library (AISeL), 125. Retrieved from <https://aisel.aisnet.org/pacis2018/125>

Carbonie, A., Guo, Z., & Cahalane, M. (2018). Positive Personal Development through eSports. In *PACIS* (p. 125).

Chen, C.-H., & Law, V. (2016, February). Scaffolding individual and collaborative game-based learning in learning performance and intrinsic motivation. *Computers in Human Behavior*, 55(B), 1201-1212.

Chen, Y., Chen, X., Chen, J., Zheng, J., Xu, J., & Yu, X. (2016). Longitudinal impact on quality of life for school-aged children with amblyopia treatment: perspective from children. *Current eye research*, 41(2), 208-214.

Chuah, S.-H., Hoffmann, R., Jones, M., & Williams, G. (2007, September). Do cultures clash? Evidence from cross-national ultimatum game experiments. *Journal of Economic Behavior & Organization*, 64(1), 35-48.

Chung, Tsui-Shan. (2013). Table-top role playing game and creativity. *Thinking Skills and Creativity*, 8, 56.

Clarke, D. (2007). Ten key principles from research for the professional development of mathematics teachers. In Stepping Stones for the 21st Century (pp. 27-39). Brill Sense.

Coe, D. (2017). Why People Play Table-Top Role-Playing Games: A Grounded Theory of Becoming as Motivation. *The Qualitative Report*, 22(11), 2844-2863.

Conrad, M., Hassan, A., Koshy, L., Kanamgotov, A., & Christopoulos, A. (2017). Strategies and Challenges to Facilitate Situated Learning in Virtual Worlds Post-Second Life. *Computers in Entertainment (CIE)*, 15(1), 1-9.

Corriel, M. (2017, December 14). Flipping the Classroom: Paul Anderson teaches science to millions using old school charisma and new wave technology. Retrieved October 2019, from Montana State University:
<http://www.montana.edu/news/mountainsandminds/17331/flipping-the-classroom>

Cotta, L., de Melo, P. O. V., Benevenuto, F., & Loureiro, A. A. (2016). Using fifa soccer video game data for soccer analytics. In *Workshop on large scale sports analytics*. DOI: 10.1145/1235

Covington, M. V. (1985). The motive for self-worth. In R. Ames, & C. Ames (Eds.), *Research on motivation in education: Student motivation* (Vol. 1, pp. 77e113). San Diego, CA: Academic Press.

- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper Perennial.
- Cuthbert, D. (2013). Design Occlusion is Killing Your Creativity. *Game Developers Conference*.
- Deci, E. L., & Ryan, R. M. (2010). Intrinsic motivation. *The corsini encyclopedia of psychology*, 1-2.
- Derakhshan, A., & Khatir, E. D. (2015). The effects of using games on English vocabulary learning. *Journal of Applied Linguistics and Language Research*, 2(3), 39-47.
- DESPA, M. L. (2014). Comparative study on software development methodologies. *Database Systems Journal*, V(3), 37-56.
- Desurvire, H., & El-Nasr, M. (2013). Methods for game user research: Studying player behavior to enhance game design. *IEEE Computer Graphics and Applications*, 33(4), 82-87.
- Deterding, S. (2011). Situated motivational affordances of game elements: A conceptual model. Retrieved from https://www.researchgate.net/profile/Sebastian_Deterding/publication/303084050_Situated_motivational_affordances_of_game_elements_A_conceptual_model/links/595f6dbda6fdccc9b1a3c2cc/Situated-motivational-affordances-of-game-elements-A-conceptual-model.pdf
- Deterding, S., Dixon, D., Khaled, R. & Nacke, L. (2011). From Game Design Elements to Gamefulness: Defining "Gamification". Proceedings of the 15th International Academic MindTrek Conference: Envisioning Future Media Environments (p./pp. 9--15), New York, NY, USA: ACM. ISBN: 978-1-4503-0816-8
- Dickey, M. D. (2007). Game design and learning: A conjectural analysis of how massively multiple online role-playing games _MMORPGs_ foster intrinsic motivation. *Educational Technology Research and Development*, 55(3), 253-273.
- Dormans, J. (2012). Applied theory for game design. *Engineering emergence*, 48-49.
- Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). Motivation to succeed. In W. Damon, & N. Eisenberg (Eds.), *Handbook of child psychology*, 5th ed.: Vol. 3. *Social, emotional, and personality development* (pp.1017–1095). Hoboken, NJ: Wiley & Sons
- ECS Concepts. 2019. Retrieved from <https://docs.unity3d.com/>.
- El-Nasr, M. S., & Smith, B. K. (2006). Learning Through Game Modding. *ACM Computers in Entertainment*, 4(1). doi: 10.1145/1111293.1111301
- El-Nasr, Magy Seif, Desurvire, Heather, Aghabeigi, Bardia, & Drachen, Anders. (2013). Game analytics for game user research, part 1: A workshop review and case study.(Technical report). *IEEE Computer Graphics and Applications*, 33(2), 6-11.

El Sayed, N. A., Zayed, H. H., & Sharawy, M. I. (2010, December). ARSC: Augmented reality student card. In *2010 International Computer Engineering Conference (ICENCO)* (pp. 113-120). IEEE.

Epic Games (2019). Fortnite. Retrieved from
https://www.epicgames.com/fortnite/en-US/play-now/battle-royale?utm_source=GoogleSearch&utm_medium=Search&utm_campaign=an*Internalpr*FNBRct*Cpl*SearchBrandco*UScr*exact&utm_id=1698686527&utm_content=buildbattlewinplayfree&utm_term=fortnite&gclid=EAI

Evans, M., & Boucher, A. (2015). Optimizing the Power of Choice: Supporting Student Autonomy to Foster Motivation and Engagement in Learning. *Mind, Brain, and Education*, 9(2), 87-91.

Fassbender, E., Richards, D., Bilgin, A., Thompson, W., & Heiden, W. (2012). VirSchool: The effect of background music and immersive display systems on memory for facts learned in an educational virtual environment. *Computers & Education*, 58(1), 490-500.

Freeman, G., & Wohn, D. Y. (2019). Understanding eSports team formation and coordination. *Computer supported cooperative work (CSCW)*, 28(1-2), 95-126.

Fischbach, M., Wiebusch, D., & Latoschik, M. (2017). Semantic Entity-Component State Management Techniques to Enhance Software Quality for Multimodal VR-Systems. *IEEE Transactions on Visualization and Computer Graphics*, 23(4), 1342-1351.

Fullerton, T. (2006). Play-Centric Games Education. *Computer*, 39(6), 36-42.

Fullerton, T. (2008). *Game Design Workshop: A Playcentric Approach to Creating Innovative Games* (Vol. 2nd edition). CRC Press.

Fullagar, C. J., Knight, P. A., & Sovern, H. S. (2013). Challenge/skill balance, flow, and performance anxiety. *Applied Psychology: An International Review*, 62, 236e259

Gee, Domini. "Remixing Retro." *Journal of the Japanese Association for Digital Humanities* 4.1 (2019): 54-71.

Gee, J. P. (2008). Video games and embodiment. *Games and culture*, 3(3-4), 253-263.

Gilbert, S. B., Slavina, A., Dorneich, M. C., Sinatra, A. M., Bonner, D., Johnston, J., Holub, J., MacAllister, A., & Winer, E. (2018). Creating a team tutor using GIFT. *International Journal of Artificial Intelligence in Education*, 28(2), 286-313.

Greitemeyer, T., & Osswald, S. (2010). Effects of Prosocial Video Games on Prosocial Behavior. *Journal of Personality and Social Psychology*, 98(2), 211-221.

Griffiths, M. (2002). The educational benefits of video games. *Education and Health*, 20(3), 47-51

Griffiths, M. D., Davies, M. N., & Chappell, D. (2004). Online computer gaming: a comparison of adolescent and adult gamers. *Journal of adolescence*, 27(1), 87-96.

Hamari, J., & Eranti, V. (2011). Framework for Designing and Evaluating Game Achievements. In *DiGRA 2011 Conference: Think Design Play* (Vol. 6). DiGRA/Utrecht School of the Arts. Retrieved from <http://www.digra.org/wp-content/uploads/digital-library/11307.59151.pdf>

Hamari, J., Shernoff, D. J., Rowe, E., Coller, B., Asbell-Clarke, J., & Edwards, T. (2016). Challenging games help students learn: An empirical study on engagement, flow and immersion in game-based learning. *Computers in Human Behavior*, 54, 170-179.

Hardy, J., & Scanlon, M. (2009). The Science Behind Lumosity, 8–9. Retrieved from <http://www.lumosity.com>

Hartmann, T., & Vorderer, P. (2010). It's Okay to Shoot a Character: Moral Disengagement in Violent Video Games. *Journal of Communication*, 60(1), 94-119.

Hattie, J. A., & Donoghue, G. M. (2016). Learning strategies: a synthesis and conceptual model. *npj Science of Learning*. doi:10.1038/npjsciencelearn.2016.13

Hattie, J., & Timperley, H. (2007). The Power of Feedback. *Review of Educational Research*, 77(1), 81–112. <https://doi.org/10.3102/003465430298487>

Hawk, C. E. (2018). Effects of Competition in Violent and Nonviolent Video Games on Aggressive/Prosocial Behavior. Brigham Young University. All Theses and Dissertations. 7306 Retrieved from: <https://scholarsarchive.byu.edu/etd>

Hays, R. T., Jacobs, J. W., Prince, C., & Salas, E. (1992). Flight simulator training effectiveness: A meta-analysis. *Military psychology*, 4(2), 63-74.

Heidig, S., Müller, J., & Reichelt, M. (2015). Emotional design in multimedia learning: Differentiation on relevant design features and their effects on emotions and learning. *Computers in Human Behavior*, 44, 81-95.

Holden, J. T., Kaburakis, A., & Rodenberg, R. M. (2018). Esports: Children, stimulants and video-gaming-induced inactivity. 54, 830-831. Blackwell Publishing. doi:10.1111/jpc.13897

Huang, H., & Gartner, G. (2009). *Using Activity Theory to Identify Relevant Context Parameters*. Springer, Berlin, Heidelberg: In: Gartner G., Rehrl K. (eds) Location Based Services and TeleCartography II. Lecture Notes in Geoinformation and Cartography.

iRacing. (2016, February 8). Getting Started // 2. License Classes. Retrieved from <https://www.youtube.com/watch?v=X1q7s4wxXi4>.

Jabbar, A.I.A., & Felicia, P. (2015). Gameplay engagement and learning in game-based learning: A systematic review. *Review of Educational Research*, 85(4), 740-779.

Jenny, S. E., & Schary, D. (2014). Exploring the Effectiveness of Learning American Football through Playing the Video Game " Madden NFL ". *International Journal of Technology in Teaching and Learning*, 10(1), 72-87.

Jenny, S. E., Manning, R. D., Keiper, M. C., & Olrich, T. W. (2017). Virtual(ly) Athletes: Where eSports Fit Within the Definition of "Sport". *Quest*, 69, 1-18.
doi:10.1080/00336297.2016.1144517

Jenny, S. E., Keiper, M. C., Taylor, B. J., Williams, D. P., Gawrysiak, J., Manning, R. D., & Tutka, P. M. (2018). eSports Venues: A New Sport Business Opportunity. *Journal of Applied Sport Management*, 10, 34-49. doi:10.18666/jasm-2018-v10-i1-8469

Jenkins, H. (2004). Game design as narrative. *Computer*, 44(53), 118-130.

Jha, Bali, Narula, & Kalra. (2014). Optimal component selection based on cohesion & coupling for component based software system under build-or-buy scheme. *Journal of Computational Science*, 5(2), 233-242.

Johnson, D., Necke, L., & Wyeth, P. (2015). 2015 SIGCHI Conference on Human Factors in Computing Systems. In *2015 SIGCHI Conference on Human Factors in Computing Systems* (pp. 2265–2274). New York, NY: ACM. doi: 10.1145/2702123.2702447

Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A. (2008). Measuring and defining the experience of immersion in games. *International journal of human-computer studies*, 66(9), 641-661.

Karagiorgas, D. N., & Niemann, S. (2017). Gamification and Game-Based Learning. *Journal of Educational Technology Systems*, 45(4), 499–519.
doi:<https://doi.org/10.1177/0047239516665105>

Kariippanon, K. E., Cliff, D. P., Lancaster, S. J., Okely, A. D., & Parrish, A. M. (2019). Flexible learning spaces facilitate interaction, collaboration and behavioural engagement in secondary school. *PloS one*, 14(10), e0223607.

Kasapakis, V., & Gavalas, D. (n.d.). Pervasive Gaming: Status, Trends and Design Principles. Retrieved from https://www.researchgate.net/profile/Damianos_Gavalas/publication/277784484_Pervasive_ga

[ming_Status_trends_and_design_principles/links/5a2927924585155dd42799a9/Pervasive-gaming>Status-trends-and-design-principles.pdf](https://www.researchgate.net/publication/310124365_Lumosity_training_and_brain-boosting_food_effects_on_learning/links/5a2927924585155dd42799a9/Pervasive-gaming>Status-trends-and-design-principles.pdf)

Kasapakis, V., & Gavalas, D. (2017). User-Generated Content in Pervasive Games. *Computers in Entertainment*, 16, 1–23.

Keith, Mark J.; Anderson, Greg; Gaskin, James; and Dean, Douglas L. (2018) "Team Video Gaming for Team Building: Effects on Team Performance," AIS Transactions on Human-Computer Interaction (10) 4, pp. 205-231

Kiili, K., de Freitas, S., Arnab, S., & Lainema, T. (2012). The Design Principles for Flow Experience in Educational Games. Virtual Worlds for Serious Applications (VS-GAMES'12)(15), 78-91.

Klopfer, E. (2008). *Augmented learning: Research and design of mobile educational games*. MIT press.

Klopfer, E. (2018). Resonant Games: Design Principles for Learning Games that Connect Hearts, Minds, and the Everyday. Cambridge: The MIT Press. Retrieved September 22, 2019, from Project MUSE database.

Klopfer, E., Osterweil, S., & Salen, K. (2009). *Moving learning games forward: Obstacles, opportunities & openness*. Cambridge, MA: The Education Arcade.

Kelleher, C., & Pausch, R. (2007). Using storytelling to motivate programming. *Communications of the ACM*, 50(7), 58-64.

Khaleel, F. L., Sahari, N., Wook, T. S., & Ismail, A. (2016). Gamification Elements for Learning Applications. *International Journal on Advanced Science Engineering Information Technology*, 6(6).

Kim, Y.-B., & Lee, S.-H. (2017). Mobile gamer's epistemic curiosity affecting continuous play intention. Focused on players' switching costs and epistemic curiosity. *Computers in Human Behavior*, 32-46.

Kpolovici, P. J. (2012). Lumosity training and brain-boosting food effects on learning. *Education Research Journal*, 2(6), 188–188. Retrieved from
https://www.researchgate.net/profile/Peter_Kpolovici/publication/310124365_Lumosity_training_and_brain-boosting_food_effects_on_learning/links/58295c3d08aecfd7b8c44103/Lumosity-training-and-brain-boosting-food-effects-on-learning.pdf

Kultima, A. (2015). Developers' Perspectives on Iteration in Game Development. *Proceedings of the 19th International Academic Mindtrek Conference*, (pp. 26-32). Tampere, Finland.

Law, E. L.-C., & Sun, X. (2012). Evaluating user experience of adaptive digital educational games with Activity Theory. *International Journal of Human-Computer Studies*, 478-497.

Learning, F. o.-B. (2015). Jan L. Plass, Bruce D. Homer & Charles K. Kinzer. *Educational Psychologist*, 258-283.

Lee, S. (2017, March 27). AP Style Guide Confirms Correct Spelling of Esports. Retrieved from <https://esports.hollywood.com/ap-style-guide-confirms-correct-spelling-of-esports-ba4932422d41>

Leemkuil, H. (2006). Is it all in the game? Learner support in an educational knowledge management simulation game.

Lenhart, A., Kahne, J., Middaugh, E., Macgill, A. R., Evans, C., & Vitak, J. (2008). *Teens' gaming experiences are diverse and include significant social interaction and civic engagement*. Retrieved from <http://www.pewinternet.org/Reports/2008/Teens-Video-Games-and-Civics.aspx>

Leutner, D. (1993). Guided discovery learning with computer-based simulation games: Effects of adaptive and non-adaptive instructional support. *Learning and Instruction*, 3, 113-132.

[http://dx.doi.org/10.1016/0959-4752\(93\)90011-N](http://dx.doi.org/10.1016/0959-4752(93)90011-N)

Liebenson, C. (2018). Gamification. *Journal of Bodywork & Movement Therapies*, 22(1), 232-234.

Lopes, R., & Bidarra, R. (2011). Adaptivity Challenges in Games and Simulations: A Survey. *IEEE Transactions on Computational Intelligence and AI in Games*, 3(2), 85–99. doi: 10.1109/tciaig.2011.2152841

Oslin, J. L., Mitchell, S. A., & Griffin, L. L. (1998). The game performance assessment instrument (GPAI): Development and preliminary validation. *Journal of teaching in physical education*, 17(2), 231-243.

MacAllister, A., Hoover, M., Gilbert, S., Oliver, J., Radkowski, R., Garrett, T., ... & Davies, P. (2017). Comparing Visual Assembly Aids for Augmented Reality Work Instructions. *Proceedings of the 2017 Interservice/Industry Training, Simulation, and Education Conference (I/ITSEC)*, 2017, 197, 1-14.

Malone, T.W., & Lepper, M.R. (1987). Making learning fun: A taxonomy of intrinsic motivations for learning. In R.E. Snow & M.J. Farr (Eds), *Aptitude, learning, and instruction*, Vol. 3: *Conative and affective process analyses* (pp. 223-253). Hillsdale, NJ: Erlbaum.

Marek, Sue. (2005). Cross-platform gaming lures new players: Publishers leverage the synergy between console gamers and mobile players by using marketing promotions and innovative game play to link the two platforms.(Content & Apps). *Wireless Week*, 11(23), 26.

Markman, A., & Duke, B. (2016). *Brain briefs: answers the most (and least) pressing questions about your mind*. New York: Sterling.

Matsumoto, D., & Hwang, H. S. (2011, September). Cooperation and competition in intercultural interactions. *International Journal of Intercultural Relations*, 35(5), 677-685.

Mazurek, M. O., Engelhardt, C. R., & Clark, K. E. (2015). Video games from the perspective of adults with autism spectrum disorder. *Computers in Human Behavior*, 51, 122-130.

McCallum, S. (2012). Gamification and serious games for personalized health . *Studies in Health Technology and Informatics*, 177, 85–96.

McLean, L., & Griffiths, M. D. (2019, August). Female Gamers' Experience of Online Harassment and Social Support in Online Gaming: A Qualitative Study. *International Journal of Mental Health and Addiction*, 17(4), 970-994.

McMahan, A. (2013). Immersion, engagement, and presence: A method for analyzing 3-D video games. In *The video game theory reader* (pp. 89-108). Routledge.

Minecraft Wiki. (2019, September 10). Retrieved from
https://minecraft.gamepedia.com/Minecraft_Wiki

Molin, J., Graneheim, U. H., & Lindgren, B. M. (2016). Quality of interactions influences everyday life in psychiatric inpatient care—patients' perspectives. *International journal of qualitative studies on health and well-being*, 11(1), 29897.

Mora-Cantallops, M., & Sicilia, M. (2018). Player-centric networks in League of Legends. *Social Networks*, 55, 149-159.

Mora-Cantallops, M., & Sicilia, M. (2019). Team efficiency and network structure: The case of professional League of Legends. *Social Networks*, 58, 105-115.

Nadolny, L., Alaswad, Z., Culver, D., & Wang, W. (2017). Designing with game-based learning: Game mechanics from middle school to higher education. *Simulation & Gaming*, 48(6), 814-831.

Nacke, L. E. (2015). Games user research and physiological game evaluation. In *Game user experience evaluation* (pp. 63-86). Springer, Cham.

- NetherRealm Studios. (2017, May). Injustice 2. Retrieved from <https://www.injustice.com/>.
- Neely, E. L. (2019). The Ethics of Choice in Single-Player Video Games. In *On the Cognitive, Ethical, and Scientific Dimensions of Artificial Intelligence* (pp. 341-355). Springer, Cham.
- Nicholls, J. G. (1979). Quality and equality in intellectual development: the role of motivation in education. *American Psychologist*, 34, 1071e1084
- Nielsen Games. (2018). *Games 360 US Report*. Retrieved from <https://www.nielsen.com/content/dam/corporate/us/en/reports-downloads/2018-reports/games-360-2018.pdf>
- Nodoushan, M. A. (2009, August). The Shaffer–Gee perspective: Can epistemic games serve education? *Teacher and Teacher Education*, 25(6), 897-901.
- Nowak, A., Wozniak, M., Pieprzowski, M., & Romanowski, A. (2018, September). Towards amblyopia therapy using mixed reality technology. In *2018 Federated Conference on Computer Science and Information Systems (FedCSIS)* (pp. 279-282). IEEE.
- Ortiz de Gortari, A., & Griffiths, M. (2015). Game Transfer Phenomena and its associated factors: An exploratory empirical online survey study. *Computers in Human Behavior*, 51, 195-202.
- Palincsar, A. S. (1998). Social Constructivist Perspectives on Teaching and Learning. *Annual Review of Psychology*, 49, 345–347. Retrieved from https://www.researchgate.net/publication/5285760_Social_constructivist_perspectives_on_teaching_and_learning
- Paltz-Spindler, L. A. (n.d.). *Crossing the Fourth Threshold: Freedom to Live*. Retrieved from <http://www.sfccenter.ku.edu/Workshop-stuff/Joseph-Campbell-Hero-Journey.htm#SW-M>
- Patino, A., Romero, M., & Proulx, J.-N. (2016). Analysis of Game and Learning Mechanics According to the Learning Theories. *2016 8th International Conference on Games and Virtual Worlds for Serious Applications (VS-GAMES)*. doi: 10.1109/vs-games.2016.7590337
- Pelánek, R. (2016). Applications of the Elo rating system in adaptive educational systems. *Computers & Education*, 98(C), 169-179.
- Plass, J. L., Chun, D. M., Mayer, R. E., & Leutner, D. (1998). Supporting visual and verbal learning preferences in a second-language multimedia learning environment. *Journal of Educational Psychology*, 90, 25-36. <http://dx.doi.org/10.1037/0022-0663.90.1.25>
- Perrett, D. I., Burt, D. M., Penton-Voak, I. S., Lee, K. J., Rowland, D. A., & Edwards, R. (1999). Symmetry and human facial attractiveness. *Evolution and human behavior*, 20(5), 295-307.

Politis, Y., Robb, N., Yakkundi, A., Dillenburger, K., Herbertson, N., Charlesworth, B., & Goodman, L. (2017, June 01). People with Disabilities Leading the Design of Serious Games and Virtual Worlds. *International Journal of Serious Games*, 4(2), 87-97.

Prot, S., & Gentile, D. (2015). Turning Our Gaze to Prosocial Media Effects: What is and isn't Known. *Empirical Musicology Review*, 10(1-2), 75-79.

Qin, H., Patrick Rau, P. L., & Salvendy, G. (2009). Measuring player immersion in the computer game narrative. *Intl. Journal of Human-Computer Interaction*, 25(2), 107-133.

Rankin, Y. A., McNeal, M., Shute, M. W., & Gooch, B. (2008, August). User centered game design: evaluating massive multiplayer online role playing games for second language acquisition. In *Proceedings of the 2008 ACM SIGGRAPH symposium on Video games* (pp. 43-49). ACM.

Rettberg, J. W. (2008). Quests in World of Warcraft: Deferral and Repetition. In H. Corneliusen, & J. W. Rettberg, *Digital Culture, Play, and identity: A World of Warcraft Reader* (pp. 168-174). Cambridge, MA: MIT Press.

Riot Games (2009). Its On! League of Legends. Retrieved from
<https://signup.na.leagueoflegends.com/en/a4/welcome?utmexpid=.JmW6YyHBQZyt6TPGX2ASFw.1&utmreferrer=https://na.leagueoflegends.com/en/>

Robbins, R. A. (2005). Harry Potter, Ruby Slippers and Merlin: Telling the Client's Story Using the Characters and Paradigm of the Archetypal Hero's Journey. *Seattle UL Rev.*, 29, 767.

Rosenbaum, E., Klopfer, E., Boughner, B., & Rosenheck, L. (2007, July). Engaging students in science controversy through an augmented reality role-playing game. In *Proceedings of the 8th international conference on Computer supported collaborative learning* (pp. 612-614). International Society of the Learning Sciences.

Ryan, R. M., & Stiller, J. (1991). The social contexts of internalization: Parent and teacher influences on autonomy, motivation and learning. *Advances in motivation and achievement*, 7, 115-149.

Rankin, Y. A., Gold, R., & Gooch, B. (2006, September). 3D role-playing games as language learning tools. In *Eurographics (Education Papers)* (pp. 33-38).

Sadler, D. R. (1989). Formative assessment and the design of instruction systems. *Instructional Science*, 119-144.

Saludo, J. (2018). "NBA 2K". Art 108: Introduction to Game Studies. San Jose State University. Art and Art History & Design Departments. Retrieved from:
<https://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1013&context=art108>

Scacchi, W. (2011). Modding as an Open Source Approach to Extending Computer Game Systems. *IFIP Advances in Information and Communication Technology*, 365. Springer, Berlin, Heidelberg. doi: 10.1007/978-3-642-24418-6_5

Seager, S. (2018, September 16). Beyond the Hero's Journey: Four innovative narrative models for digital story design. Retrieved from
<https://medium.com/@steveseager/beyond-the-hero-s-journey-four-innovative-narrative-models-for-digital-story-design-f7458983bc16>

Shaffer, D. W. (2006). Epistemic frames for epistemic games. *Computers & Education*, 46(3), 223-234.

Shaw, A. (2010, 11). What is video game culture? Cultural studies and game studies. 5, 403-424. doi:10.1177/1555412009360414

Shelstad, William & Smith, Dustin & Chaparro, Barbara. (2017). Gaming on the Rift: How Virtual Reality Affects Game User Satisfaction. Proceedings of the Human Factors and Ergonomics Society Annual Meeting. 61. 2072-2076. 10.1177/1541931213602001.

Shernoff, D. J. (2010). *The experience of student engagement in high school classrooms: Influences and effects on long-term outcomes*. Saarbruken, Germany: Lambert Academic Publishing.

Shernoff, D. J. (2013). *Optimal learning environments to promote student engagement*. New York: springer

Sherstyuk, A., Vincent, D., & Treskunov, A. (2009). Towards Virtual Reality games. *Proceedings of the 8th International Conference on Virtual Reality Continuum and Its Applications in Industry - VRCAI 09*. doi: 10.1145/1670252.1670322

Shute, V. J., & Ke, F. (2012). Games, learning, and assessment. In *Assessment in game-based learning* (pp. 43-58). Springer New York.

Shute, V. J., & Ke, F. (2012). Games, learning, and assessment. In *Assessment in game-based learning* (pp. 43-58). Springer, New York, NY.

Sicart, M. (2008). Defining Game Mechanics. *The International Journal of Computer Game Research*, 8(2). Retrieved from
http://www.caseyodonnell.org/files/TC839/Defining_Game_Mechanics.pdf

Siriaraya, P., Visch, V., Vermeeren, A., & Bas, M. (2018). A cookbook method for Persuasive Game Design. *International Journal of Serious Games*, 5(1). doi: 10.17083/ijsg.v5i1.159

Smedslund, J. (1953). The problem of "what is learned?". *Psychological Review*, 60, 157-158. doi:10.1037/h0057364

Sotiriou, S., & Bogner, F. X. (2008). Visualizing the invisible: augmented reality as an innovative science education scheme. *Advanced Science Letters*, 1(1), 114-122.

Sturm, D. (2019). Not Your Average Sunday Driver. *Understanding Esports: An Introduction to the Global Phenomenon*, 153-165.

Suits, B. (2014). *The grasshopper: Games, life and utopia*. Broadview Press.

Tauler Ferrer, M. (2016). El classcraft com a mesura per incentivar la motivació, l'atenció a la diversitat i l'aprenentatge de les ciències naturals.

Tear, Morgan J., & Nielsen, Mark. (2014). Video games and prosocial behavior: A study of the effects of non-violent, violent and ultra-violent gameplay. *Computers in Human Behavior*, 41, 8.

Tillmann, N., Moskal, M., De Halleux, J., Fahndrich, M., Bishop, J., Samuel, A., & Xie, T. (2012, July). The future of teaching programming is on mobile devices. In *Proceedings of the 17th ACM annual conference on Innovation and technology in computer science education* (pp. 156-161). ACM.

Turkay, S., & Kinzer, C. K. (2013). The effects of customization on game experiences of a massively multiplayer online game's players. In C. Williams, A. Ochsner, J. Dietmeier, & C. Steinkuehler, (Eds.), *Proceedings of GLS 9.0: Games + Learning + Society Conference* (pp. 330-337). Pittsburgh, PA: ETC Press.

Tyack, A., Wyeth, P., & Johnson, D. (2016). CHI Play '16 Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play. In *CHI Play '16 Proceedings of the 2016 Annual Symposium on Computer-Human Interaction in Play* (pp. 313–325). New York, NY: ACM. doi: 10.1145/2967934.2968098

UMD Wins Award For Spent. (n.d.). Retrieved from Urban Ministries of Durham:
<http://www.uddurham.org/news-and-events/news/umd-wins-awards-for-spent.html>

Um, E., Plass, J. L., Hayward, E. O., & Homer, B. D. (2012). Emotional design in multimedia learning. *Journal of educational psychology*, 104(2), 485.

Valve Corporation (2013). Defense of the Ancients 2. Retrieved from
<http://blog.dota2.com/?l=english>

Valverde, H. H. (1973). A review of flight simulator transfer of training studies. *Human Factors*, 15(6), 510-522.

van de Weijer, S. C., Kuijf, M. L., de Vries, N. M., Bloem, B. R., & Duits, A. A. (2019). Do-It-Yourself Gamified Cognitive Training. *JMIR serious games*, 7(2), e12130.

Van Rooij, A. J., Schoenmakers, T. M., Vermulst, A. A., Van Den Eijnden, R. J., & Van De Mheen, D. (2011). Online video game addiction: identification of addicted adolescent gamers. *addiction*, 106(1), 205-212.

Velez, J. A., & Ewoldsen, D. R. (2013). Helping behaviors during video game play. *Journal of Media Psychology*.

Velez, John A. (2015). Extending the theory of Bounded Generalized Reciprocity: An explanation of the social benefits of cooperative video game play. *Computers in Human Behavior*, 48, 481–491

Vergara, D., Rubio, M., & Lorenzo, M. (2017). On the Design of Virtual Reality Learning Environments in Engineering. *Multimodal Technologies and Interaction*, 1(2), 11. doi: 10.3390/mti1020011

[Verheijen, Geert , Stoltz, Sabine E.M.J. , van den Berg, Yvonne H.M. , Cillessen, Antonius H.N.](#) (2019). The influence of competitive and cooperative video games on behavior during play and friendship quality in adolescence. *Computers in Human Behavior*, 91, 297–304.

Visch, Valentijn & Vegt, Niko & Anderiesen, Hester & van der kooij, Katinka. (2013). Persuasive Game Design: A model and its definitions. Retrieve from
http://gamification-research.org/wp-content/uploads/2013/03/Visch_et.al.pdf

Wang, H., & Sun, C.-T. (2012). Game Reward Systems: Gaming Experiences and Social Meanings. *DiGRA 2011 Conference: Think Design Play*. The Netherlands.

Wang, L., Shute, V., & Moore, G. R. (2015). Lessons learned and best practices of stealth assessment. *International Journal of Gaming and Computer-Mediated Simulations (IJGCMS)*, 7(4), 66-87.

Weaver, A., & Lewis, N. (2012). Mirrored morality: An exploration of moral choice in video games. *Cyberpsychology, Behavior and Social Networking*, 15(11), 610-614.

Weber, B. G., John, M., Mateas, M., & Jhala, A. (2011, August). Modeling player retention in madden nfl 11. In *Twenty-Third IAAI Conference*. 1701-1706.

White, R. W. (1959). Motivation reconsidered: the concept of competence. *Psychological Review*, 66, 297e333

Wood, D., Bruner, J. S., & Ross, G. (1976). The Role of Tutoring in Problem Solving. *Journal of Child Psychology and Psychiatry*, 17, 89–100. doi: <https://doi.org/10.1111/j.1469-7610.1976.tb00381.x>

Wulf, T., Bowman, N. D., Rieger, D., Velez, J. A., & Breuer, J. (2018). Video games as time machines: video game nostalgia and the success of retro gaming. *Media and Communication*, 6(2), 60-68.

Yamagishi, T., Jin, N., & Kiyonari, T. (1999). Bounded generalized reciprocity: Ingroup boasting and ingroup favoritism. *Advances in group processes*, 16(1), 161-197.

Yazzie-Mintz, E. (2007). *Voices of students on engagement: A report on the 2006 high school survey of student engagement* (p. 12). Bloomington, IN: Center for Evaluation & Education Policy

Zagal, J. P., Rick, J., & Hsi, I. (2006). Collaborative games: Lessons learned from board games. *Simulation & Gaming*, 37(1), 24-40.

Zhang, F., Kaufman, D., Schell, R., Salgado, G., Seah, E., & Jeremic, T. (2017). Situated learning through intergenerational play between older adults and undergraduates. *International Journal of Educational Technology in Higher Education*, 14(1), 1-16.