

Impact of Popular Media on the Potential of Educational Games

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ABSTRACT

Research has demonstrated that playing games can positively impact educational results, both from playing games designed to achieve educational outcomes and tangentially from playing entertainment games. There has been a pervasive barrier to adoption of learning games rooted in concerns related to negative effects associated with entertainment video games. The game industry has been the subject of criticism for employing design practices linked to a number of potential negative outcomes among players including fostering gaming addiction, contributing to negative cognitive effects from too much screen time, and real-world carryover effects from exposure to violence and negative depictions of women in games. Popular media outlets have leveraged current events to sensationalize these concerns increasing the attention they receive potentially increasing barriers to the adoption of games for learning.

Because educational games leverage many of the same design elements as their entertainment counterparts, it is understandable for funders, educators, and parents to be concerned that common issues may impact learners. Beyond the popular media portrayal, there are volumes of research on gameplay and its associated real-world impact on players. Makers of learning games have an obligation to understand the current literature and to both educate potential users of educational games on the positives and negatives of their adoption and to reflect the known best design practices in creation of learning games.

To equip the educational games community to achieve these goals and ultimately limit negative impacts on the potential of learning games, this paper surveys current research on positive and negative effects of gameplay and provides design recommendations for educational games.

ABOUT THE AUTHORS

Jennifer McNamara is the Vice President of Serious Games at BreakAway Games, a recognized leader in training, education, and assessment games. As a researcher and developer of learning games, Jenn understands the power of game design and technology applied to real world learning needs. She is a dynamic speaker, most recently featured at Serious Play, the Annual Conference of the Society for Industrial and Organizational Psychology, the Interservice / Industry Training, Simulation, and Education Conference (IITSEC), Game Developers' Conference, Games for Change Festival, and ATP Innovations in Testing. Jenn serves as the Director of the non-profit Serious Games Showcase and Challenge (SGS&C), an annual international competition and exhibition for serious games hosted by IITSEC. In 2017 she received the Audience Choice and Game Changer Awards in the Association of Test Publishers' Shark Tank style Innovation Lab. Her team's games have been recognized as finalists (2008, 2012, 2013, 2016, 2017) and winner (2016) in the Serious Games Showcase and Challenge, medal winners in the International Serious Play Awards (2012, 2015, 2016) including Best in Show (2106), by the Society for Simulation in Healthcare as Best in Show Serious Game for 2015, and most innovative new product by the Association of Test Publishers (2016, 2017). Jenn holds her B.S. in Psychology from Drexel University and a M.Ed. in Instructional Systems Design and Development from The Pennsylvania State University.

Victoria Van Voorhis is the founder and CEO of Second Avenue Learning, an award-winning education technology company based in Rochester, New York. As a leader in the development and design of serious games, software, and interactives, Second Avenue Learning blends pedagogy and technology to serve the K-12, higher education, healthcare, and corporate markets. Victoria has been a thought-leader in the education and technology industry for over a decade. She has helped Second Avenue Learning's partners create innovative assessment types

and has driven the assessment authoring strategies for publishers and EdTech organizations. She has had the honor of presenting for both TEDx and Google Tech Talks, and has served as the principle investigator for both the Department of Education and the National Science Foundation. Her other achievements include: 2018 EDtech Cool Tool Winner for Social Sciences and Runner-Up for Science; 2017 Students' Choice Award from the Serious Games Showcase and Challenge; 2015 International Serious Play Bronze Medal Award; 2014 SIIA Innovation Incubator Runner-Up for Most Innovative; 2013 edWeb Top Ten Webinar; 2012 Harvard Innovations in America Government Award Finalist; 2011 Digital Rochester Woman of the Year; Google TechTalks featured guest for "Getting Serious Games into the K-16 Classroom"; and 2008 CODiE Award Finalist, Best Science Instructional Solution. She has been a featured author on designing and assessing serious games. Prior to founding Second Avenue, Victoria was a teacher at the middle school, high school and college levels. She played a leadership role in evolving the Xerox Corporation's business and innovation strategy. Victoria received her undergraduate degree from Smith College and her master's degree from New York University.

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BACKGROUND

The Value of Games for Education

A significant number of research studies have demonstrated positive educational effects from playing entertainment video games. Six leading experts on the relationship between video games and player outcomes came together to share current thinking on the effect of games on the brain; drawing from their rich research backgrounds on gaming effects, Bavelier et al., (2011) addressed questions regarding beneficial and negative effects of playing video games on brain and behavior. As a group, they reported behavioral benefits from gameplay including: enhancements in low-level vision; visual attention; speed of processing and statistical inference; and an ability for gameplay to drive positive neurological changes to support improvement in working memory, pro-social behavior, and ability to handle increasing cognitive challenges if the games played required exercise of those same skills. In addition, Green & Bavelier (2012) authored an excellent review paper on the effects of playing entertainment action video games on enhancing attentional control that summarized several decades of work in the field. They found that performance on tasks requiring selective attention, task switching, multi-tasking, and visual short-term memory tasks were all greater in action video game players than non-players. And Greitemeyer & Osswald (2010) found that children who played pro-social games early in the school year demonstrated increased helpful behavior later in the school year. These findings are all based on the play of entertainment games.

Turning from a discussion of player effects from playing entertainment games to focus on games specifically designed to achieve educational objectives we find hundreds of published studies that discuss positive outcomes from the use of games in education. These studies provide results from research or use of educational games on a broad array of academic subjects; however, many of these studies focus on a specific application of learning games and/or don't apply appropriate scientific rigor to allow generalization of results. A research methodology and standards for studying the use of learning games is still evolving (see Mayer, 2012, for a discussion of the limitations of the current research literature). But that does not mean their positive effects are not valid evidence of games being used successfully in education. In an attempt to more scientifically assess the impact of learning games in education and training numerous meta-analyses have been conducted. Specific to the educational community, a meta-analysis found learning games to be more effective in terms of both learning (N=5,547) and retention (N=499), but not more motivating (N=2,216) compared with conventional educational counterparts; further, the learning effects were strongest when the games were supplemented by other instructional methods, played multiple times, and involved group play experiences (Wouters, van Nimwegen, van Oostendorp, van der Spek, 2013).

Significant research has been done evaluating attributes of games and their suitability for learning according to the principles in the science of learning. Learning science and game researchers generally agree on the following principles that support the use of educational games: games offer interactive experiences in task based environments, games offer clear objectives that are set at multiple difficulty levels to adapt to the prior knowledge and pace of each learner; they require learning to be active, with immediate feedback and sufficient practice to the point of mastery; games support practice until learning becomes automatic; mastery of a game is reinforced extrinsically, by points and levels, and intrinsically, by a feeling of accomplishment and social status; levels of progress are well-sequenced, offering successive tasks such that success at later levels is contingent upon mastering earlier levels; games encourage distributed practice across time; and games enable the gamer to practice the same concepts in different contexts encouraging transfer of skills. (discussed in Hussain et al., 2009; Murphy, 2011; and Bavelier et al., 2011; for discussions connecting these elements to the supporting learning science see Hussain et al., 2009 and Murphy, 2011). Positive educational outcomes are possible through the use of well-designed learning games. It is the responsibility of the game developers to ensure that learning games are designed to maximize their

potential as learning and assessment tools. As part of the design process, educational content and instructional design must be coupled with game design. And as part of the development process, the success of learning games must be assessed through their achievement of their intended learning objective outcomes.

Concerns Regarding Gameplay

Entertainment Gaming Concerns

The Entertainment Software Association reports that spending on video game content, hardware, and accessories in the United States was \$36 Billion in 2017 and 60% of Americans report playing video games daily (ESA, 2018). With a majority of households playing entertainment games, it is not surprising that they are a focus of media attention. Games have been featured in articles across popular media including CNN, *The New York Times*, *Rolling Stone*, and *Forbes*. Many of these reports have covered positive outcomes from gameplay, including their use in training, education, social transformation, and political change (for examples see Lee, 2017a; Paul, 2013; Swallow, 2013). Other reports express concerns over negative outcomes from gameplay, including harmful effects on players' psychological or physical health, or negative in-game depictions of violence or women, shaping players' real world perceptions and actions (for examples see Scutti, 2018; Markey & Ferguson, 2018; Lee, 2017b; Kain, 2016; Riley, 2018). While not all portrayals of games in the media are negative, media references and coverage of the undesirable impacts of games tend to upsurge following violent or misogynistic incidents or following reports made in the research and medical communities about the effects of entertainment video games on players.

The connection between these precipitating incidents and the coverage of games can fit the conditions of media hype and/or the social amplification of risk. In their research review of the impact of media in the aftermath of disasters Vasterman, Yzermans, and Dirkzwager (2005) define that media hype is initiated by a key event that thrusts the media into a search for news on the topic, creating a self-reinforcing cycle with more and more information shared on the topic. With a goal to consistently generate more news, the media often reports prior similar incidents and/or adds evaluative or background information; reporters then pay attention to people's reactions to each wave to select further media to be shared. Social amplification of risk is experienced when events associated with low statistical risks become a focus in the media causing secondary consequences as the public responds with undue concern, this is normally associated with social and/or political controversy (Vasterman, et al., 2005). To demonstrate how each of these effects are at play with video game coverage in the media, we cite two examples: the discussion of violence in games and the proposed classification of a gaming disorder.

Media hype has surrounded the potential association of violent video gameplay with real world violence following a school shooting in February 2018 and President Trump's response stating concerns that violence in video games is "shaping young people's thoughts..." (Wolf, 2018). Between February 14, 2018 and March 31, 2018 the topic of violence in games received extensive attention in the media, including: 33 articles published across [cnn.com](#), [nytimes.com](#), [rollingstone.com](#), and [forbes.com](#) with titles including: "Do video games lead to violence" (Scutti, 2018), "The Real Problem With Video Games" (Schiesel, 2018), "Video games do not teach people to become shooters in real life" (Grace, 2018), "Do Video Games Lead to Mass Shootings? Researchers Say No" (Salam & Stack, 2018), and "Blaming Video Games for School Shootings Is Misguided, Dangerous" (Markey & Ferguson, 2018), over 250 related videos posted to [youtube.com](#), and over 450 tweets made on [twitter.com](#). These are just a few examples of the coverage by larger national sources; articles, tweets, and broadcast time discussing the potential role of violent games in triggering violent behavior in the real world were discussed widely across other publications and local new stations.

The media's coverage on the proposed inclusion of a gaming disorder in the International Classification of Diseases 11th Edition (ICD-11) by the World Health Organization has been accompanied by a social amplification of risk. While only a small percentage of game playing individuals would meet the criteria set forth by WHO, and the media does a good job of sharing data on the low prevalence of the potential disorder, the mere coverage of the proposed disorder has made it a topic of public awareness, concern, and discussion.

Both of these media driven phenomena illustrate that, while the media does cover both positive and negative impacts from video gameplay, the association of media hype and social amplification of risk cause a disproportionate amount of information dissemination supporting potential negative consequences of gameplay to the general public.

Resistance to Adoption of Educational Games

Regardless of one's personal beliefs regarding the relationship between video gameplay and potential negative impacts, we have seen potential clients, funders, and educators grow resistant to adopting games for learning and assessment following spikes in media coverage on gaming effects. These communities have referenced concerns about gaming addiction, screen time, and carryover effects from interactions in games as some of the reasons they are hesitant to adopt educational games. Makers of learning games need to understand the current research findings and recommendations to engage target users of educational games in meaningful conversation about the potential positives and negatives of their adoption. Further, educational game makers should follow best design practices in their work. The next sections of this paper share research behind the specific concerns we've encountered in the end user community regarding potential negative impacts of gaming, provide guidance on how to address concerns from potential end users, and recommends design best practices to help address end-users' concerns about using games in education.

GAMING ADDICTION

Defining Addiction – The World Health Organization's Proposed Definition of Gaming Disorder

The World Health Organization (WHO) is focused on supporting international health within the United Nations' system. The WHO's International Classification of Diseases (ICD) is used by medical practitioners around the world to diagnose conditions, by researchers to categorize conditions, and by governments and foundations to drive investments in developing public health strategies. The actions of WHO are significant for multiple reasons: 1. they provide standards for healthcare practitioners as well as provide the medical codes used and recognized by insurance companies for classification and coverage of diagnosis and treatment of diseases, 2. classification of a disease or disorder by the WHO can be used as justification for research funding to support treatments, interventions, or cures, and 3. they are recognized globally and referenced in public health strategy development.

The WHO is planning to release the 11th revision of the ICD in 2018. The published draft version includes Gaming Disorder as a new addictive behavior entry, defined as:

Gaming disorder is characterized by a pattern of persistent or recurrent gaming behaviour ('digital gaming' or 'video-gaming'), which may be online (i.e., over the internet) or offline, manifested by: 1) impaired control over gaming (e.g., onset, frequency, intensity, duration, termination, context); 2) increasing priority given to gaming to the extent that gaming takes precedence over other life interests and daily activities; and 3) continuation or escalation of gaming despite the occurrence of negative consequences. The behaviour pattern is of sufficient severity to result in significant impairment in personal, family, social, educational, occupational or other important areas of functioning. The pattern of gaming behaviour may be continuous or episodic and recurrent. The gaming behaviour and other features are normally evident over a period of at least 12 months in order for a diagnosis to be assigned, although the required duration may be shortened if all diagnostic requirements are met and symptoms are severe (World Health Organization, 2018).

Key to this proposed definition of gaming disorder are the concepts of compulsive play causing exclusion of other interests, clinically significant impairment or distress, and negative consequences including endangerment of the player's personal or social well-being, school, or job.

Addressing Barrier to Adoption: Addiction

Above, we shared the WHO's proposed classification of gaming disorder. Practically, countering addiction concerns from potential end users of educational games can be accomplished in a number of ways. First, we can cite the research recommending caution in classifying a disorder or addiction to gaming without proper research support. Second, we can ensure there is a clear understanding of the differences among disordered behavior and addiction and performance in a flow state of engagement. Third, we can explain how the design practices that support addiction in entertainment games are not recommended learning game design principles.

Recommendation of Caution from the Mental Health Research Community

To help game advocates understand the potential weakness behind the WHO proposal, we reference the decision by the American Psychiatric Association (APA) who produce the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), a manual that defines and classifies mental disorders to uniformly guide diagnosis, treatment, and research used by healthcare professionals across the United States and select other countries. For a decade, the APA has been interested in the psychological effects of online gameplay and in 2013 included Internet Gaming Disorder in Section III, conditions for further study, of the DSM-5. By including Internet Gaming Disorder in this section, rather than directly adding it to the DSM-V, the APA encouraged further research to determine if online gaming produces a neurological response that results, in extreme cases, in addiction. After 5 years of further study, the APA has not yet added the disorder to the DSM-V.

With regard to the WHO guidelines specifically, the draft WHO language planned for inclusion in ICD-11, shared above, was published for medical community awareness and feedback. A group of researchers from 24 institutions of mental health and social science research published a paper arguing that the formalization of a gaming disorder has potentially problematic medical, scientific, public health, societal, and rights-based repercussions and recommended caution until scientific support and clinical utility warrant classification of a new diagnostic category (Aarseth et al., 2017). After the initial paper received significant response from the broader scientific community arguing both for and against the establishment of a gaming disorder (Billieux, King, et al., 2017; Griffiths, Kuss, Lopez-Fernandez, & Pontes, 2017; Higuchi et al., 2017; James & Tunney, 2017; Király & Demetrovics, 2017; Lee, Choo, & Lee, 2017; Müller & Wölfling, 2017; Saunders et al., 2017; Shadloo et al., 2017; Van den Brink, 2017), a larger group with researchers from 36 institutions published a follow-on publication (van Rooij et al., 2018).

The claims in these publications help counter the WHO recommendations as being made too prematurely without enough research support. Findings from van Rooij et al. (2018) state concerns that, while some patients play video games intensively and are also functionally impaired to a clinically significant level, there isn't sufficient evidence to claim that the impairment is caused by the video game play. Core to their arguments are (1) a lack of robust scientific standards in research into the potential disorder, (2) that it remains possible that gameplay is a coping strategy for those with other disorders, (3) that a diagnosis is not necessary to justify treatment citing family therapy, bereavement, and sexual assault therapy as examples where this is also true, (4) that there is a potential to stigmatize healthy engaged gamers, (5) that the move to formalization might be both caused by and potentially increase moral panic, and (6) that excessive gameplay appears more often in specific countries suggesting it might be best handled as a domestic and not international issue (van Rooij, 2018).

Perhaps most appropriate for inclusion in this paper is their recommendation to err on the side of caution and limit gaming disorder conceptualization to research:

... We remain opposed to enshrining gaming disorder in diagnostic classification manuals that are widely used and consulted in policy settings, school systems, and healthcare. They are used by individuals who might not be knowledgeable about the nuances of media use, moral panic, and normative game-related behavior (including parents of children) (van Rooij et al., 2018, p. 4).

For our purposes, we believe there is sufficient evidence that more research is necessary to establish if a gaming disorder or addiction exists, and if so, what elements of gameplay are triggers for disordered behavior.

Clear Definitions of Engagement

Immersion in an intrinsically rewarding activity where one's performance is completely optimal can draw a person into a state where nothing else seems to matter. Once this state is achieved, a person will maintain focus on the enjoyable activity, even at a great cost. That definition could easily be a description of the experience many people feel when playing a game. The inclusion of maintaining focus even at a great cost, could even begin to include criteria from the definition of disordered behavior. However, this is the definition of flow, a concept first described by positive psychologist Mihály Csíkszentmihályi (1990). Flow is described as achievement of a highly focused mental state that is ideal for well-being, performance improvement, and skill mastery, also called engagement. Achieving a flow state is viewed as a positive experience, which leads to desirable outcomes.

As mentioned above, many people are able to achieve a flow state when playing a game. In fact, game designers often refer to players achieving flow as a goal of game design, to dynamically keep a player engaged by keeping him

or her stimulated by tasks just beyond his or her current mastery level with consistent reward felt through accomplishing each goal encountered before being presented with a new challenge. But how does this engagement, immersion, flow state differ from addiction or disordered behavior? If a person will focus on a task even at a great cost, is that indicative of addiction? When we speak about the power of games to engage players or when game players refer to being immersed in games or completely consumed by games, or even colloquially “addicted” to a game, we are referring to their having achieved a flow state. Not demonstrating signs of addiction. When players begin to play compulsively, resulting in clinically significant distress and negative consequences on the player including to his or her well-being, social activity, or occupation, then he or she may be crossing over to a demonstration of addictive behavior as defined by the APA and WHO. Discussing the relationship between flow and addiction, Andrade & Pontes (2017) survey the literature indicating that the few empirical studies examining flow and addiction led to contradicting findings with no clear relationship established among flow, addiction, and healthy gaming. As a community, we can educate educational game consumers on the differences between the positive occurrence of flow and the negative impacts of addiction. And can also point out that there have been no reported instances of learning games contributing to addiction.

Avoidance of Addiction Associated Design Practices

Beyond the arguments of whether playing entertainment games can cause disordered behavior, as learning game creators, we avoid association with the concerns over entertainment games by specifically designing games to achieve learning outcomes, not based upon using game mechanics to drive repeated play for profit.

While all game designers inherently want to create games that players will find engaging, to help them achieve a flow state, entertainment game companies are also for profit and some focus on manipulating players to keep them playing longer, buying more, maintaining a subscription, etc. These practices are perhaps best known from social games and massively multiplayer online games (MMOG). This focus on the bottom line has pushed some game companies to use questionable practices, playtesting new game elements to study how they affect players and then use the lessons learned to design elements into their games exclusively to keep players playing. Blogs such as "How to Design a Mobile Game So Addictive It's Almost Irresponsible" (Piperides, 2016) actively suggest ways to hijack brain chemistry (most notably endorphins, oxytocin, dopamine and serotonin) to "hook" players and monetize obsessive behaviors. An entertainment game designer, Teut Weidemann quoted in (Sheffield, 2010) has said that the key to free-to-play success is to "... exploit human weakness. Essentially, find those areas in which players can be monetized, and go after that aggressively." In these entertainment game revenue models, this type of engaged player is necessary for profits.

Educational games are intentionally designed to achieve learning outcomes. While educational game companies can be for profit, the business model does not incentivize enticing the player to return to the game repeatedly, at least not beyond mastery of the target skills and knowledge. It is for this reason, that education game designers practice deliberate avoidance of addiction driven design practices. The meta-analysis conducted by Wouters, van Nimwegen, van Oostendorp, & van der Spek (2013) failed to show learning games as being more motivating compared with conventional education counterparts. While this finding is somewhat disappointing to the educational game development community, it does align with the principle that educational games are not designed for, nor achieving addictive conditions. Educational game designs include developing to a target time on task and provisions for a maximum time on task based upon content inclusion. Learning games are designed for finite numbers of play through, determined by the required amount of in-game interaction to achieve learning objectives.

ADOLESCENT SCREEN TIME RECOMMENDATIONS

Screen Time Restrictions

The American Academy of Pediatrics (AAP) recommendations regarding screen time for school-aged children and adolescents (ages 5-18) move from the recommendation for maximum time spent in front of a screen offered to children under 5 to focusing on guiding pediatricians and parents to work together to develop a Family Media Use Plan. They further state that a one-size-fits-all recommendation for screen time limits no longer serves this population (AAP, 2016). The AAP has successfully raised awareness about the risks associated with excessive

screen time in this population including, obesity, sleep problems, negative impacts on school performance, and risky behaviors in both the physical and digital worlds (AAP, 2016).

This creates another locus of concern for potential adopters of learning games related to the increase in screen time for adolescents and its potential negative consequences. As modern media developed, primary screen use concerns were associated with the introduction of more sedentary behaviors associated with television watching. Concern has extended as the media landscape became more complex with the introduction of video games (online, console and mobile), computers, and tablets. While this concern is understandable, there is room for a more nuanced conversation regarding the patterns of use of digital media.

Computer-use for both school related work and entertainment is rising as television use is declining internationally. However, overall screen time behaviors are increasing. In a study conducted from 2002 through 2010 in adolescents across 30 countries and with over 150,000 study participants, television viewing decreased slightly but higher rates of computer usage increased overall screen time by approximately 2 hours per day with notable increases in weekend usage. The increase in computer use was for both gaming and nongaming purposes in all countries and all regions (Bucksch, 2015).

Addressing Barrier to Adoption: Screen Time Restrictions

Not only is the face of screen usage changing, the responsibility for determining the appropriate approach for each child's usage has been placed in the control of his or her parents, with little overall guidance available. The data can be confusing, especially given the prevalence of information on sedentary screen time. Countering the concerns regarding screen time use in school-aged children requires digging deeper into the activities the child is performing with the device and ensuring parents have proper guidance on the risks associated with screen time and time to build an informed Family Media Use Plan that takes all applications into account. Not all media share the same impacts on child health. In general, as children move from passive consumption to more engaged activities such as using digital tools for school work or to create digital artifacts, the associated health risks are attenuated.

The Move from Sedentary Screen Time to Engaged Use and Active Creation

Television watching or passive screen viewing via DVD or streaming services is associated with sedentary screen time. Sedentary screen time is positively associated with increased caloric intake, and thus obesity and is inversely correlated to academic achievement (Sweetser, Johnson, Ozdowska, & Wyeth, 2012; Garcia-Heremoso & Marina, 2015). In a study designed to examine the relationship of weight, physical activity and screen time with academic achievement, Garcia-Heremoso and Marina found that obese adolescents of both genders who reported low physical activity and whose screen time exceed recommendations were less likely to have high academic achievement when compared with their non-obese peers who exhibited high levels of physical activity and levels of screen time within recommended limits. While their study did not control for underlying factors such as self-esteem, or study hours, the findings are consistent with multiple studies.

As the patterns of use change from passive viewing to more active use, or moving from consumption, to engaged use, to active creation, the cognitive and physiological impacts need to be more broadly disseminated. For example, in contrast to the wealth of evidence linking television watching to obesity, there is a lack of evidence linking obesity to video game play or active computer use (Wake, Hesketh and Waters, 2003). Moreover, there is a wealth of data which support positive effects of active screen time and creative activities such as coding, use of applications for school work, creation of videos, or other digital output. For example, video games can encourage both physical and cognitive activity resulting in positive effects ranging from reductions in classroom absenteeism to enhanced capacity for dynamic spatial skills (Sweetser, Johnson, Ozdowska, & Wyeth, 2012). In a study of 3000 children across six countries on the amount of time spent on video games, the association of video game use on academic performance, and the association of video game use on mental health found that video game use is not associated with an increase in mental health problems, and may serve as a protective factor, and video games appear to be linked to better intellectual functioning and academic achievement (Kovess-Masfety et al, 2017).

CARRYOVER EFFECTS FROM INTERACTIONS IN GAMES

In-Game Violence

The concern about the potential influence of violent video games on youth aggression and violence has been studied extensively by social scientists, psychologists, cognitive scientists, and policy makers. However, no clear consensus on the impact of violent video games has emerged. For example, some studies have found casual linkages between video games and violence (Anderson et al., 2008; Anderson, 2004) and multiple studies have found only weak or no linkages. Still others have found correlations between the increase in video game play and the decrease in youth violence (Olson 2004). As in the study of learning games, the methodology for the study of the effects of serious games is still evolving. Of particular challenge is the control for covariants among study participants which may impact outcomes and then can also impact the ability to draw generalizable inferences from the data. Researchers are working to achieve both successful isolation of research variables and conduct well controlled longitudinal studies.

Ferguson (2011) outlines three theoretical views for the potential relationship between violent video games and violence. The first framework is that violent video games are effective learning tools which lead to aggression and violence. The second is that people who play violent games are more likely to have high levels of aggression and that because of their personality characteristics, they actively seek out media which features violence and aggression. And lastly, that the relationship between violence and video games is the product of an underlying variable such as antisocial personality traits. In his study (N=302) Ferguson recruited participants from a prior study of youth violence (N=603) where video game and television violence were not found to be strongly correlated with youth violence. Study participants were from the general population and not specifically at-risk for serious aggression. Ferguson used several different measures with psychometric properties appropriate for analysis. These included instruments related to the family environment, mental health, and social behavior. He concluded that there is no positive correlation between video game play or violent television exposure and violence. However, he did find that individuals exhibiting depressive symptoms with antisocial attributes were most inclined to violent behavior.

Ferguson's (2011) findings map to similar findings from a 2002 joint study by the US Secret Service and US Department of Education that found that 78% of school shooters had a history of feeling suicidal, that 61% had a history of significant depressive symptoms, and that 71% reported being bullied or threatened. This study found that 59% of attackers had expressed interest in violence through exploration of media. Attackers chose movies (27%), books (24%), and expressing interest in violence through their own writings in journals, poems or essays (37%). Only 12% exhibited an interest in violent video games (United States Secret Service and United States Department of Education, 2002).

Addressing Barrier to Adoption: In-Game Violence

There is strong consensus that there is no room for violence in learning games which are focused on academic content for the PreK-16 and adult learner markets. Learning game developers should eschew all game play mechanics and narratives, with the exception of relevant history or social science topics, which include physical violence, or which promote social aggression. In history and social science there are some lessons which necessitate discussion of violence or social aggression; thus, in educational game development there are cases where we would potentially need to cover these acts of historical significance, this still doesn't necessarily mean having students participate in using violent game play mechanics. But rather building age appropriate representation or interaction with violence or aggressive acts of significance. We don't argue against including these historically necessary events in learning games, but recommend proper discretion in determining how to include the violence and its impacts in game.

Negative Female Representation in Games

Historically entertainment video games and video game culture have been male dominated and misogynistic frequently resulting in hyper-sexualized representations of women, often in submissive or victim roles. In recent years, outrage against this aspect of gamer culture emerged as a critical conversation. Whether it was in response to overtly sexist game-related comics such as the Penny Arcade transgressions in 2010 (Lynch, 2010) or triggered by on-line harassment in 2014, #GamerGate, when a female game developer was subjected to on-line harassment which escalated into rape and death threats, the need to address this facet of the video game industry is evident (Todd, 2015).

Formal research studies on this topic are emerging. For example, using play of Grand Theft Auto, which encourages players to kill prostitutes to maximize points, Gabbiadini, et al. (2016) found that playing a violent-sexist video game for 25 minutes reduced empathy for female violence victims in the short term. Further, the effects were especially pronounced for male participants who strongly identified with the misogynistic in-game characters. This study did not examine violent or aggressive behavior effects.

Lynch, in her review of 31 games, found that the number of female characters had increased, though not in primary roles and that there was a change in the pattern of hypersexualized women in titles produced after 2006. However, this may not be a wide enough or deep enough change.

Addressing Barrier to Adoption: Negative Female Representation in Games

As developers of serious or learning games, we focus on shaping narratives and patterns of play that are inclusive and facilitate all students using the intervention and creating a sense of personal agency that is not in conflict with their identity so that they can focus on playing and learning.

Design for Inclusion

As designers of serious games, our mandate is to ensure that we create games that meet the educational needs of our target demographic. Games should be designed for replay and encourage experimentation, exploration and creativity. Having a learner centered approach necessitates designing for inclusivity, typically only narrowing the audience to an age cohort with a wide range of abilities. Representations of characters should not exclude anyone. For example, in one of our earliest series of virtual explorations we opted to have a first-person perspective and then selected male and female voiceover artists from a wide array of ethnic backgrounds so that all the students could envision themselves as future scientists.

In the development of serious games, we typically have two methods for addressing the representations of characters that sidestep the issue of a potentially mis-stepping in the representation of a character. First, we can enable players to create avatars that facilitate their creation of agency, by enabling them to select physical traits, clothing or accessories that let them reflect their personal style, such as a beanie versus a beret. Another method for allowing players to enter the narrative without encountering an identity conflict is to have abstracted characters that might be anthropomorphized just enough to enable the narrative to work.

However, even when pursuing this strategy, we have encountered engrained reactions to female characters. In the early days of the design of the Martha Madison title, a serious game that was designed work with the patterns of play for both male and female middle school students, focus groups with different visual treatments of the characters revealed strong reactions to the female protagonist. Students responded using Likert scales and open response questions to character concept art in an effort to gauge what would be most appealing and consistent with the narrative arc defined for the series. While the students were engaged in their critiques, the developers stood at the back of the room, listening and watching, trying not to let their presence interfere with the process or influence the outcomes. From this vantage point, the team overheard the mothers discussing the art. One mother, in particular, was incensed by the representation of the plucky meerkat protagonist. She folded her arms and clucked her tongue, and said “She better wear pants, I can’t believe how provocatively she is drawn.” After two more focus groups, where similar comments were made by parents, the character Martha donned pants and lab coat for all of her adventures.

OVERALL EDUCATIONAL DESIGN GUIDELINES

Different learning game designers follow different educational design models. Even the two game development studios of the authors of this paper have nuanced differences in their approaches to learning game design. However, we generally agree on several foundational principles consistent with continuing to avoid introduction of any elements that will cause concern for end users.

1. Design for educational outcomes first with the understanding that children will be playing your educational game.
2. Leverage mature game development frameworks that have proven to be effective at achieving educational outcomes.

3. Involve administrators, teachers and parents in the early phases of the design process to understand their needs and concerns while engaging them in support for employment.
4. Involve the target audience (students) in the design process to improve the levels of engagement necessary to achieve the educational outcomes.
5. Involve the target audience (students) in early user testing and be prepared to make changes based upon feedback.
6. Stay on top of emerging research; be prepared to address potential key adoption concerns in advance of meeting with stakeholders.
7. Do not use gratuitous violence, gender or racial stereotypes, or techniques designed to “engineer” addiction.

SUMMARY AND CONCLUSIONS

The value of games for education has been demonstrated across the K-16 spectrum and in the work place in disciplines from health care to defense and as the industry matures more consistent study design and metrics for efficacy will be established. However, the negative media attention associated with entertainment games has created persistent barriers to adoption. The concerns have centered on addiction and the adverse consequences of excess screen time, violence, and negative representations of women. While the media attention on the entertainment game industry is often surfacing concerns worthy of public consideration, it does not do an adequate job of differentiating games for education from entertainment games. While we have presented an overview of the major concerns we’ve heard voiced regarding the adoption of learning games along with research to help dispel the media hype and social amplification of risk, it is important to remember that none of these claims have come from learning games. There are no credible reports of addiction, violence, or misogyny in educational games, and that may be the best overall statement one can make to assuage concerns in general.

To afford the greatest impact from the use of educational games, further research is recommended. While research into many of the elements discussed in this paper related to entertainment games is warranted, the recommendations here will focus upon advancing the body of knowledge surrounding the design and use of learning games. An explicit exploration of the factors that differentiate positive engagement and flow state experiences from disordered player behaviors during gameplay would prove valuable as guidance to inform best practices for learning game design. Additionally, a deeper understanding of immediate and long range effects on learning from interacting with or playing as diverse characters in games is a rich area deserving of further study to guide learning design practices, examine games’ role in creating less biased education and assessment opportunities, and to explore the use of games in diversity education. Finally, as mentioned earlier, the creation and testing of more consistent study design and metrics for educational game assessment is necessary to help to establish a more scientifically backed body of design and employment guidance for the educational game community.

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