

The Claims of Games: A Comprehensive Review and Directions for Future Research

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Abstract: Educational games have become the lightning rod for learning and preparing a future skilled workforce. Both the people, who argue against and for games agree that learning is possible, but what is learned is another issue. However, the claims about games for learning lacks substantial research and for the most part remains merely philosophical arguments. We report the results of an extensive review of these claims in the literature. Our grounded theory analysis leads to a broad two-fold categorization scheme (physiological and psychological claims) with the psychological group having four subcategories of claims. We discuss the strengths and weaknesses of existing research as well as point to areas for future research. In particular, we draw attention to the lack of attention paid to the demands of subject matter and argue for a greater emphasis on the development of technological pedagogical content knowledge (TPCK) in the design of learning games.

Introduction

Over the past few years serious games or rejuvenated educational games have been heralded, as the way to educate or prepare America's students for a world that requires innovation and creativity. The failure of schools to achieve and to produce innovative workers and the claims of games for learning have led to a proliferation of games being designed for learning (Kelly, 2005; Shaffer, Squire, Halverson, & Gee, 2005). The claims range from "games undeniable power to motivate" to games "causing obesity" or "being ideal for all learners." The proponents (e.g. Gee, 2003; Prensky, 2001) say games provide many of the essential affordances that are needed for learning (Foreman, 2004), while the opponents say games may be a waste of time, and possibly make students aggressive and violent (Walsh, 1998). What both sides agree on is that children can learn from games. What they disagree on is whether this learning is beneficial or harmful.

The claims come from a wide range of sources and from both proponents and opponents. Most claims are based on existing research in the cognitive sciences, often taken from lab-studies or studies that conflate variables such as game genres, content and individual differences. In addition, often ignored are the demands of subject matter, in that supporters of games for learning often do not specify what kind of content is best suited for learning. Given the wide range of claims being made about the value of games, it is important that we develop some ways of listing and categorizing them. This would serve two purposes: a) allow us to determine which areas have received research attention and which have not; and b) offer guidance for future research since each claim is a hypothesis.

In this research program we seek to survey the games literature by collecting, listing, and categorizing claims that have been made about learning from games. We offer a comprehensive overview of the claims regarding games and learning. The claims of games for learning present an opportunity for assessment in a field that will lose its good grace with people who are looking for results in the form of achievement. Reports from interviews with game designers reveal that they are concerned about the claims being made about games without research because games for learning will lose cultural credibility (Alarilla, 2006; Thompson, 2006). If the key for games to be accepted in culture is legitimacy then the key for games to be accepted as effective tools for learning is assessment or research.

Overview of learning claims

Proponents of games argue that games are a fundamentally different medium because they present a medium in which students can be competent, autonomous, take risks without serious consequences, and develop cognitive flexibility, among many other potential abilities for learning intrinsically. Further, playing games differ from other mediums because “one literally learns by playing” and usually do not sit down to read a manual first (Sandford & Williamson, 2005). Thus, people argue, games present an opportunity to use the interests of children as a way to educate them.

Games literature and claims

The gaming industry is over 30 years old and since the 1980's there have been reviews of the literature that deals with games and their impact on learning. These reviews (Kirriemuir & McFarlane, 2004; Mitchell & Savill-Smith, 2004; Randel, Morris, Wetzel, & Whitehill, 1992) all found that there are no firm conclusions about learning although most students reported an interest in using games to learn rather than using conventional classroom instructions. It is worth noting that these studies were not longitudinal, hence the game effects could not be validated. Further, the studies were not naturalistic. In two recent dissertations (Egenfeldt-Nielsen, 2005; Squire, 2004) which were more naturalistic and in classrooms, they revealed that students learned “superficial information – not enough to satisfy students educational needs, but enough for them to grasp on it.” Squire's dissertation examined Civilization III in classrooms. One of his conclusions was that the main problem was an incompatibility between the game content and what was required for the school curriculum. Both studies concluded that students developed a more holistic understanding and interest in historical information.

The authors of these reviews and dissertations all call for research in game-based learning that deals with scalability and content. In their recent review of the games literature, Mitchell & Savill-Smith (2004) say that the literature base relating to the use of computer games for learning appears to remain small and that of 11 reviews that they examined prior their own, none of the studies focused on learners who had basic skills. They call for research in game-based learning to use appropriate populations. In one of the few longitudinal studies done in game-based research,

Williams (2004) found in his dissertation that research in game-based learning continues to use inappropriate samples, conflated variables and failure to acknowledge game genre which limits their claims.

In his study using 2200 Madison, a game for learning urban planning, Shaffer and colleagues (Beckett & Shaffer, 2005; Shaffer et al., 2005) studied identity formation with 11 ‘at risk’ students in a summer enrichment program to learn about urban planning. The study used an augmented by reality design done over two weekends. Participants’ knowledge was assessed pre-post using concept maps and interviews. The authors concluded that the students were beginning to think like urban planners and that games like Madison 2200 were needed to give students experience so that they may become creative and innovative. The study had a very short duration, but it presented a unique component, augmented by reality, which helps to solve the problems Squire and Egenfeldt-Nielsen spoke about in superficial information. However, the claims (e.g. “games help children build “islands of expertise” by including technical language, skills, and knowledge early in their life and prepare them for lifelong learning.”) made by Shaffer were weakly warranted because the findings, the sample, the design and the assessment did not allow such generalizations.

In other articles, (Asgari, 2005; Asgari & Kaufman, 2005; Becker, 2005; Galarneau, 2005; Gee, 2005) these authors present their claims about games for learning based on conceptual tenets about motivation and learning. However, most of these claims have not been validated empirically. For instance, Asgari (2005) used prior literature on motivation and compared it to the affordances of games in order to make claims about what games afford for motivation to learn. Becker (2005) used theories of knowing and intelligence from Gagne and Gardner and compared them to games affordances in order to make claims about games and learning. Though, these articles provide insight into possible areas to pursue research, the claims (e.g good games *already* possess the major components necessary to meet the needs for sound instruction”) they make about motivation to learn and learning are not warranted without research and context. These are only a few of the articles and studies about how the claims for games and learning were derived.

Methods

A comprehensive survey of claims about games for learning was done using over 60 different sources of information. The sources of information included online magazines, empirical and conceptual articles, newspaper articles, weblogs, web journals (electronic and paper), game websites, books, university websites, and conference proceedings.

Over 250 claims were found and written verbatim or paraphrased. Using a grounded theory analysis, the claims were then systematically (one-by-one) and thematically assigned a code relating to game effects or learning such as “expertise development” or “logical thinking.” After assigning the claims to themes, the themes were then coded and assigned to two emergent broad groups of “psychological” and “physiological” effects. Further coding within psychological

effects group revealed four more categories of themes, which connected to the list of claims. The emergent themes within the psychological group include practical skills, cognitive skills, motivation and social skills. Within the physiological effects group there were fewer claims than in the psychological effects group, which resulted in seven specific but comprehensive categories of effect (See Fig.1). Within both the psychological and physiological claims, there were both positive and negative effects.

Results

Two main categories or schemes emerged from our analysis of the extant literature: Psychological and Physiological claims. The psychological scheme focuses on claims that are cognitively and socially oriented. The physiological scheme focuses on claims that are more developmental or behavioral. Both sets of claims overlap. That is, there are some psychological claims that one could say cause physiological effects and vice versa. Our analysis showed that these claimed effects are related to learning and development in four ways, by shaping attitudes, affecting behavior, influencing understanding, and affecting spatial and motor abilities.

Physiological Scheme

Within the physiological effects, there were seven specific effects of how games relate to learning and development including aggressiveness, violence, antisocial behavior, introversion, motor skills, coordination, and obesity. An example of these claims is, “violent video games increases aggressive cognition, physiological arousal and aggressive behavior and affect and decrease prosocial behavior” (Carnagey & Anderson, 2004).

Psychological Scheme

The psychological scheme revealed four groups about how games relate to learning and development. These include practical skills, cognitive skills, motivation and social skills as shown in the continuum of psychological claims in Figure 1. Social skills also encompass identity formation, which also has sub-themes relating to it such as valuing roles and role-playing (See Fig 1). These groups overlap and are not distinctly separate as they influence each other.

Practical skills

Practical skills refer to learning in games that contribute directly to the development of skills that are applicable to the real world or authentic settings. It is argued that good games affords expertise development, innovativeness, creativity as well as other skills needed for jobs of the 21st century (Greenfield et al., 1994; Shaffer & Gee, 2005).

Cognitive Skills

Learning within most game environments is by doing, where the knowledge and doing are inextricably linked (Barab, Hay, Barnett, & Squire, 2001; Shaffer et al., 2005). Players learn by

engaging in some activity and develop first hand experience of that activity or system. Based on arguments about games affordances for immediate feedback, socialization and collaboration, cognitive supports, problem solving, and transfer to name a few, proponents make claims about what is possible for learning based on research in the cognitive sciences. Some of these claims are “the instant feedback and risk-free environment invite exploration and experimentation, stimulating curiosity, discovery learning and perseverance” (Kirriemuir & McFarlane, 2004) and “virtual worlds of games are powerful because playing games means developing a set of effective social practices.” (Shaffer et al., 2005)

Motivation

The premise behind using games to teach is based on research and claims about the affordances of game environments to intrinsically motivate students to learn (Cordova & Lepper, 1996). These claims are based on motivational principles for empowering learners including the ability to grant power, autonomy, and challenge at player’s level and implications for learners’ identity, and so forth. A few claims relating to the motivation games afford includes, they allow you to create a world that somebody can be in and take on an identity. “People learn most deeply when they take on a new identity that they really want” (Foreman, 2004) and games provide challenges adjusted to the player's ability, provide the player with clear and immediate feedback, and give players choice and control over actions (Games-To Teach Research Project, 2006).

Social Skills

Social skills are related to when players collaborate with other players or when players learn about working with others in gaming situations. It is argued that playing games allow players to develop interpersonal skills, learning to work with others and develop identities that could be good or bad depending on the type of game and players personality. An example of these claims is video games allow “social and collaborative practices to emerge” among players (Sandford & Williamson, 2005).

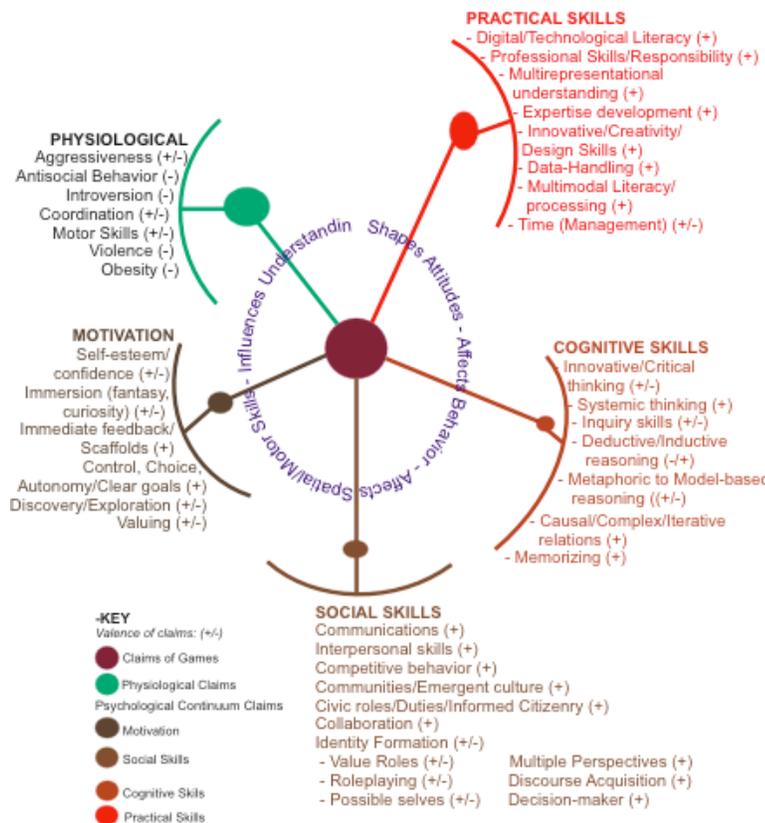


Figure 1: Emergent themes from the claims of games

Our review also showed the strengths and weaknesses of current research practice. Generally the strengths are that there are studies moving away from lab environments such as Beckett and Shaffer (2005), Williams (2004), Egenfeldt-Nielsen (2005), and Squire (2004). Further studies such as Beckett and Shaffer are seeking to augment game playing with reality-based support. However, most of the claims of games are not supported by research or the research support is from small studies, which questions their generalizability to larger contexts and different populations. Further, most of the claims conflate game genres and are related mostly to the structural elements of games and not content/subject matter.

Conclusions and Educational Importance

It is clear that the current claims about games for learning needs to be verified empirically and with appropriate research designs. Squire (2002) discusses the cultural aspect of games and how better research is needed in game-based studies. *New York Times* reporter, Thompson (2006) noted that games are a force in society for making people personally become experienced about issues that demands their attention, but he also questions if it trivializes important causes. In his interview of games proponents such as Henry Jenkins and Ben Sawyer, they warn against claims

because research in game-based studies are so fragmented, though some good results have been documented. Games may afford a lot claims for learning that have been argued, however, empirical studies in authentic settings needs to be done so that these claims are validated. Like Squire (2002), Williams (2004), the review by Mitchell & Savill-Smith (2004) and Jenkins (Thompson, 2006) indicates, more and better research is needed in game-based learning.

The claims about games for learning are usually presented as neutral as if content does not matter. They are usually conflated and do not distinguish what is learned such as what subject matter. This is important because what is learned from *Tetris* or *Pac-man* may be useful for old people who need to maintain hand-eye coordination and not children who will develop that ability. Research should separate game genres (e.g. adventure, fighting, puzzles, role-playing, simulations, action, sports and strategy games as well as their hybrids) and examine what can be learned in them. Each game genre represents a different pedagogy and each pedagogical stance represents a different epistemological stance. Thus, research should elucidate which genre is better for what content. Until game-based learning and design deals with the interaction of content, pedagogy, and technology (what has been called Technological Pedagogical Content Knowledge, or TPCK, See Fig. 2), it is unlikely that there will be much significant progress in this domain's research program.

Two areas that demand urgent attention in light of the fact that educators and designers are designing games based on claims that have not been proven empirically include, research using a representative sample, which recognizes game type characteristics and that is longitudinal and naturalistic inquiry to examine (1) what kind of learning is possible in specific types of games, (2) and research that focus on what content is better in specific game types. These areas have implications for content and pedagogy in games

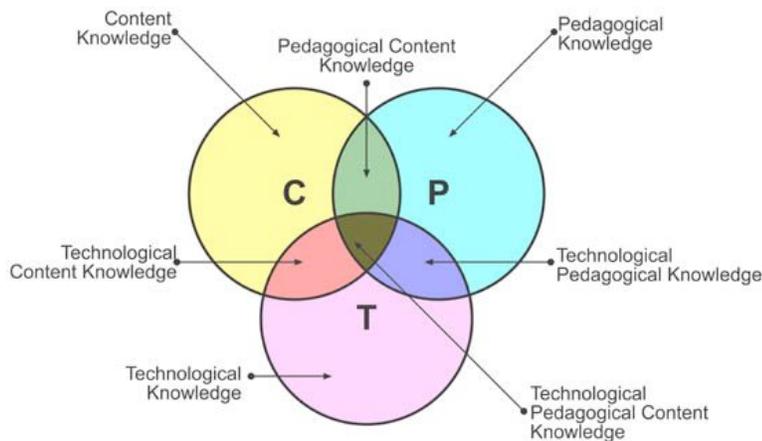


Figure 2: Technological Pedagogical Content Knowledge

These kinds of studies are important to education and game research because they would help in finding new research designs for games research and also help in theory and framework building. Without appropriate research and methods, games for learning will not advance because there

would be no way to assess the effectiveness for learning and preparing students for innovative jobs of value.

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