Gee's Learning Principles for Good Games: An Analysis of how Gee's Learning Principles meets Gardner's Theory of Multiple Intelligences

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Abstract: Today, gaming is a multi-billion dollar industry that produces games for children of all ages and backgrounds. The technology used for these video games has also been steadily evolving with improved gaming platforms and environments that captivate children and create an experience that is more realistic than any games that have been encountered previously. Children are intensely mesmerized by these games that they can play them for hours at a time. If it were possible for educators to harness the power of games and use them in an educational setting, gaming could potentially be a powerful tool for learning. James Paul Gee's (2005) Learning Principles in Good Games shows the elements of what makes a "good" game. By analyzing the learning theory of Howard Gardner and Gee's Learning Principles, educators can start to see how specific multiple intelligences could potentially be used in different elements of gaming. Practical implications of the findings are discussed.

Introduction

In an industry that is predicted to double by 2011, the effects of video games has extended beyond entertainment ("Video game", 2006). In a study of students 10-19 year olds in the 2002-2003 school year, it was reported that 36% of the survey population (80% males and 20% females) played video games for an hour on weekdays and an hour and a half on the weekend (Cummings & Vandewater, 2007). In comparison to their non-gaming peers, gamers spent 30% less time reading and 34% less time on homework. Rather than frowning upon student's use of video games, some educators have sought to embrace it (Olson, 2009, November 1).

Researchers have suggested that video games simulate authentic learning experiences (Gee, 2005). Video games offer students a consistent learning environment that incoporates learning through dynamic images, emotions, attitudes and values (Maybin, 2006). Learning in this manner is believed to be similar to contemporary life and thus prepares students for the future.

In an attempt to improve the educator's knowledge in this new and promising field, this study seeks to develop a matrix that compares the sixteen learning principles found in all good games posited by James Paul Gee (2005) against the eight multiple intelligences discussed in Gardner's book, *Frames of mind: The theory of multiple intelligences* (2008) in order to analyze how well Gee's learning principles for good games are aligned with Gardner's theory of multiple intelligences.

Background

Howard Gardner's Theory of Multiple Intelligences and its Applications

Gardner's theory has been studied and generally accepted over the last few decades (Peariso, 2008). Gardner's theory defines the following intelligences as the ability to: 1) use language effectively (linguistic); 2) reason logically in mathematics and science (logical-mathematical); 3) notice details of what one sees as well as visualize and manipulate objects in one's mind (spatial); 4) create, comprehend, and appreciate music and musical concepts (musical); 5) use one's body skillfully (body-kinesthetic); 6) notice subtle aspects of other people's behaviors (interpersonal); 7) have awareness of one's self (Intrapersonal); 8) recognize patterns and differences in nature (naturalist).

Gardner's Multiple Intelligences (MI) can be utilized in the construction of online educational games (Zajac, 2009). In a study conducted on integrating learning styles in online learning, the author suggests that an individual's body-kinesthetic intelligence could use simulations to solve problems in an educational game. Others, like musical intelligence can be met through the use of technology (Weiss, 2000). Regardless of whether or not a person can read music or play an instrument, he or she can still utilize their musical intelligence by using a computer to compose or arrange music. Depending on the software used, this act can also involve other intelligences like body-kinesthetic, spatial, and linguistic. Technology also offers increased student interaction for students with strong interpersonal intelligence (Schrand, 2008). Schrand created student activities that utilized a simple drag and drop interaction that not only increased student interaction and made it easy for students to share their work with one another, but also improved critical thinking. Other research has supported Schrand's findings.

Johnson and Levine (2008) make the argument that students learn in virtual worlds through social interaction. An example of this practice is an immersive language environment that allows language students to practice their oral skills with a native speaker. They believe that virtual worlds provide the social aspect that enables learning to transcend a student's geographical location. Lastly media, including computer games, videos, and TV, has not only dominated out-of school learning but also revolutionized the teaching of science (Habraken, 2004). In chemistry, drawings are essential for communication among chemists. This has increased the use of computer generated pictures and molecular models. Online viewing helps to rapidly process visual information by utilizing one's spatial intelligence, and can help close the gap between science and science education.

Aside from the literature supporting the inclusion of Gardner's Multiple Intelligence in game and technology, the literature has also shown that they may be beneficial to students. Veenema and Gardner (1996) demonstrate that technology can improve a person's understanding of the subject matter. The authors propose that the variety of approaches offered by technology may change and add to a student's understanding of concepts. Barab, Gresalif and Arici (2009) agree that educational games can be beneficial for students as they develop a passion for the curriculum and can visualize themselves mastering the content. The authors studied the game Quest Atlantis (QA) that utilizes the concept of transformational play. By being immersed in the activity and experiencing the consequences of the game, the researchers found that students learned more about science in comparison to students in a traditional classroom. The students who used QA demonstrated increased engagement, motivation, and retained more information two months after the completion of the game.

Specifically, Gee's customization principle allows students to choose different options and shows how games can be adapted to a student's learning needs.

Learning in Good Games

A common thread while researching gaming in general and the primary reason for choosing these principles was noted by the aforementioned authors of QA (Barab, Gresalif, & Arici, 2009). This recurring thread was based on James Paul Gee's learning principles (2005) that were repeatedly cited as the fundamental criteria used in designing an educational game.

In 2005, James Paul Gee introduced sixteen learning principles found in all good games. He believes that these principles are essential for student engagement, learning, and success. Although Gee's Learning Principles continue to expand, researchers in this study have focused on the first 16 Learning Principles, which are summarized in the following figure.

Learning Principle	*Description*
Identity	The players commitment to their new virtual identity in the new virtual world
Interaction	The player talks and the game talks back offering feedback and the possibility of new challenges
Production	Players help co-design games trough their decisions
Risk Taking	Video games allow for players to explore with a calculated risk of failure
Customization	Games have different difficulty levels that players can adjust to their playing capabilities
Agency	Players feel a control over what they are doing
Well-Ordered Problems	Problems are ordered from easy to difficult, allowing players to develop skills
Challenge and Consolidation	Games use a system that allows players to master skills before they are guided to the next level, enabling them to become experts
"Just-in-Time" and "On Demand"	Games information is given to players just-in-time for accomplishing the task or when they request for it
Situated Meanings	Players learn through context rather than formal directed learning
Pleasantly Frustrating	Games manage to stay on a level of difficulty that is doable for the player, yet remains pleasantly challenging
System Thinking	Players are encouraged to think about how their actions might affect future actions and the actions of other players
Explore, Think Laterally, Rethink Goals	Games encourage players to think thoroughly before making moves, not only thinking linearly allowing for the fastest way to achieve the goal.
Smart Tools and Distributed Knowledge	Game characters carry skills and knowledge that can be given to players
Cross-Functional Teams	Players create teams with a common purpose that are not necessarily associated with race, class, or gender and enabmes players to understand each others specializations and how that integrates into game play
Performance before Competence	Games allow for players to perform before they are competent with the help of smart tools that give information concerning the play and with the help of other more advanced players

Figure 1. Gee's (2005) Learning Principles

Method & Analysis

In order to analyze how well Gee's learning principles for good games are aligned with Gardner's theory of multiple intelligences, the authors developed a matrix (see Figure 2) that compares the sixteen learning principles found in all good games posited by James

Paul Gee (2005) against Gardner's eight multiple intelligences. The 16 x 8 matrix consists of 16 rows of Gee's learning principles and 8 columns of Gardner's multiple intelligences. In the analysis, cells in the matrix where Gee's learning principles and Gardner's MI are judged to be closely aligned were identified with a cross ("x") mark.

Gee's Learning Principles	Howard Gardner's Multiple Intelligences							
	Linguistic	Logical-Mathematical	Spatial	Musical	Body-Kinesthetic	Interpersonal	Intrapersonal	Naturalist
Identity							X	
Interaction						X		
Production		X						
Risk Taking	X	X	X	X	X	X	X	X
Customization	X	X	X	X	X	X	X	X
Agency	X	X	X	X	X	X	X	X
Well-Ordered Problems		X						
Challenge and Consolidation		X	X					
"Just-in-Time" and "On Demand"								
Situated Meaning	X		X		X	X		
Pleasantly Frustrating							X	
System thinking						X		
Explore, Think Laterally, Rethink Goals							X	
Smart Tools and Distributed Knowledge						X		
Cross-Functional Teams						X		
Performance before Competence						X		

Figure 2. Matrix Comparison of Gee's (2005) Learning Principles and Gardner's Multiple Intelligences

The analysis, as summarized by Figure 2, reveal that several elements of Gee's Learning Principles are aligned with Gardner's Multiple Intelligences. Gee's principle of identity and Garner's intrapersonal intelligence focus on student awareness of self or game character. Gardner's intrapersonal intelligence asks the student to explore, think laterally, and rethink goals. The student reflects on progress in the game and makes needed adjustments. Games reflect a level of difficulty that is "pleasantly frustrating" and challenging and requires players to assess progression in the game.

Gee's interaction principle corresponds to Gardner's interpersonal intelligence. The student learns from the game environment and uses interpersonal intelligence, interacting with other players and game characters utilizing smart tools and distributed knowledge, cross-functional teams, and system thinking principles. Students are assisted by more advanced players in the performance before competence principle and use interpersonal intelligence in working effectively with others.

Students become experts in the challenge and consolidation principle, mastering a skill through repetition. This act supports the logical-mathematical and spatial intelligences and is utilized in the well-ordered problems and production principles, as students co-design and utilize skill and logic to further their roles in the game.

Gee's customization principle follows all intelligences. Students choose different options to adapt the game to learning needs. Like Gee's risk taking principle all intelligences require some degree of risk taking in order to optimize each intelligence. Gee's agency principle states that players, linguistically, musically, or logically, are in control of their roles in the game within each intelligence domain. The situated meanings principle is contextualized learning and is similar to Gardner's body-kinesthetic, spatial, and interpersonal intelligence. In body-kinesthetic intelligence the student learns through game action. In spatial intelligence, the student learns through images. In interpersonal intelligence, the student learns through conversations with other players or game characters. Furthermore linguistic intelligence is exercised since the situated meanings principle is largely vocabulary-based.

Practical Implications

In review of Figure 2, the analysis of Gee's Learning Principles and Gardner's Multiple Intelligences reveals that three major principles of good games (risk taking, customization, and agency) match all types of intelligences. The authors suggest these learning principles should be included on all game designs. They share the belief that the learner should be in control of the game. The customization learning principle allows learners to choose how to learn, the risk taking principle allows learners to choose when to take risks, and the agency learning principle further supports learner control.

While three of Gee's Learning Principles align with all of Gardner's Multiple Intelligences, the remainder aligned with few of the learning styles. What should be emphasized is that Gee's learning principle is most apparent when used by the specified multiple intelligence. Therefore, although all of Gardner's Multiple Intelligences are not

evident across each of Gee's Learning Principles, they should not be discounted. Each can be applied towards the players' dominant multiple intelligence. While Gardner's Theory of Multiple Intelligences may not fully support all of Gee's Learning Principles, the current study shows a relationship that warrants further study.

Conclusion

This comparison of learning styles and gaming principles initiate further research grounded in successful learning, instruction, and good games. The analysis section shows that Gardner's multiple intelligences supports fifteen of the sixteen learning principles proposed by Gee. Further study into learning theory and gaming would extend a body of knowledge related to gaming that has a basis in education, learning, and instruction.

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