Twenty-first Century Literacy, Game-based Learning, Project-based Learning

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Abstract

Literacy in the twenty-first-century extends beyond symbolic representations of letters grouped

together to signify words or concepts on a piece of paper. Twenty-first-century literacy involves the

ability to compose and interpret imagery using visual and spatial reasoning through signs and

symbolism in a contemporary format, such as video games (Gee, 2003; Johnson, 2005). How do

video games support or even relate to literacy development? This paper will discuss the relationships

between literacy in video games, Gee's (2003) learning principles related to semiotics, critical

thinking, play, and the application of games, such as SimCity in the classroom, an interdisciplinary

project-based approach to learning.

Keywords: literacy, semiotics, reading comprehension, game-based learning, project-based

learning

Have you ever watched seven-year-olds play video games? The intensity and ability to concentrate for an extended period may be perplexing for adults, especially for elementary teachers. The same students can appear disengaged in class, reluctant to complete designated reading assignments, and/or inattentive when teachers' convey specific instructions. The National Research Council (Donovan, Bradsford, & Pellegrina, 1999) identifies the three major factors involved in how people learn. First, meaningful patterns of information increase processing and retrieval. Second, the organization of information affects the ability to understand and characterize problems. Third, the context for using information is necessary for long-term retention. Gamers, at any age, learn to use patterns and relationships to analyze situations, to set goals for long-term outcomes, and to make decisions without traditional instruction. Johnson (2005) indicates that "…a strong case can be made that the power of games to captivate involves their ability to tap into the brain's natural reward circuitry" (p. 34). The reward circuitry Johnson refers to is an intrinsic reward gamers receive as they construct patterns, organize information, analyze situations, set goals, and grasp relationships.

Game-based learning is a new cultural contextual form that stimulates patterning, organizing information and developing relationships, therefore, promoting problem-solving and critical thinking abilities within a socially constructed environment (Johnson, 2005). Games or game-based learning allow students to engage in various types of play: social play, imaginative and pretend play, storytelling and narrative play, and creative play (Brown, 2010). Play is driven by a player's need to make sense of the real world without being directed or controlled by adults' predetermined plans. It is an active process freely chosen, initiated and directed by students' curiosity and intrinsic motivation to learn. Researchers emphasize that "play" promotes a twenty-first-century cultural skills and dispositions necessary to work with others in current and future situations – critical thinking, creativity, self-control, empathy,

negotiation, communication, collaboration, problem solver, open-minded, flexibility, and organizational skills(Brown, 2010; Pink, 2005; Jenkins, et al 2007, Wagner, 2012).

Game-based learning encourages players' cognitive, language, emotional and social engagement in a social/cultural environment for collaborative play. Beck and Wade (2006) propose that game-based learning can provide a context that allows students to immerse themselves in complex, problem-solving tasks. Complex problem solving requires expertise, social networking, and collaboration where gamers are able to: rapidly analyze new situations; interact with characters they do not really know; solve problems quickly and independently; think strategically in a chaotic world; and, collaborate effectively in teams (Beck & Wade, 2006). Perhaps this is why seven-year-olds engage and participate in video games.

The foundational structure of video games includes "a challenge, a response, and feedback" (Plass, Homer, & Kinzer, 2015, p. 262). Such structure involves game-based learning design elements: knowledge/skills, incentives, motivation, meaningful interactions, aesthetic design, narratives, and social context/interactions (Plass, Homer, & Kinzer, 2015). How do video games support or even relate to literacy development? The remaining sections of this paper will discuss what I discovered as the relationships between literacy in video games, Gee's (2003) learning principles related to semiotics, critical thinking, play, and the application of games, such as SimCity in the classroom, an interdisciplinary project-based approach to learning.

Twenty-first-century Literacy, Semiotics, and Gee's Semiotic Principles

Literacy in the twenty-first-century extends beyond symbolic representations of letters grouped together to signify words or concepts on a piece of paper. Twenty-first-century literacy involves the ability to compose and interpret imagery using visual and spatial

reasoning through signs and symbolism in a contemporary format, such as video games (Gee, 2003; Johnson, 2005). Therefore, semiotics, the study of signs and symbols, are essential aspects of the twenty-first-century students' literacy learning experiences through game-based learning (Gee, 2003). Gee (2003) designates semiotics in his game, learning and literacy principles. Semiotics involves interrelationships amongst a complex system of multiple sign systems (words, images, actions, artifacts, etc.) during the gamer's learning process. In other words, semiotics transmits to video game text. Comprehension of video game text increases concept understanding through gaming experiences with similar semiotics. For example, Simcity uses video game text graphs representing the city treasury's financial statement. The player, as mayor, gains experience reading and monitoring the city's financial statement while constructing the city.

Gaming-based learning creates a situation where students are required to use semiotics, signs, and symbols. The interpretation of text within video games conveys the significances of the signs and symbols including vocabulary and supports the syntactic, semantic, and pragmatic use of language. This is evident in the video game Skyrim. The storyline involves the player, as a character in the game, in a quest to defeat Alduin the World-Eater, a dragon out to destroy the world. Narratives involving semantic and syntactic signs are prevalent, similar to interactive storytelling. There are hidden stories to read for grasping the overall narrative. Players increase their pragmatic use of language including semiotics to understand the central objective of the story, defeating Alduin the World-Eater, the dragon.

SimCity is another example of semiotics, semantic, and pragmatic use of language in twenty-first-century new media literacy. As mayor of a city, the player engages the pragmatic use of semiotics for mapping; residential, commercial and industrial zoning; and zoning for

police, fire, health and education, transport systems (road, busses, and airports), etc. Organizing symbolic representations of structures and reading narratives that pop up during construction encourages text-to-self, text-to-text, and text-to-world narratives for solving problems. Text-to-self refers to personal connections to players own life, ideas or previous experiences. Text-to-text reminds players of other games, stories, movies, signs, symbols, etc. Text-to-world connects players to the world outside of their personal direct experiences. Game-based learning aligns semiotics, semantics, and pragmatics with text-to-self, text-to-text, text-to-world which promotes reading comprehension.

Critical Thinking, Literacy, and Learning

Vygotsky (1978) emphasizes cognitive enhancement, language acquisition or growth between a "shared" and an "individual" state of higher-level thinking i.e. the law of the development of higher mental functions. New media literacy, video games, are learning environments conducive to exploration and innovation through the use of manipulative tools necessary for solving problems. Manipulative tools create digital alterations or responses that increase the use of text-to-self, text-to-text, and text-to-world literacy narratives for solving problems within the video games. Video games also impose the need for critical thinking and reading comprehension when using manipulative tools.

Critical thinking is the process for assessing, analyzing and evaluating a problem or issue; therefore, restructuring one's thinking (Paul & Elder, 2008). The process requires self-directed and self-correcting thinking through active engagement in the learning process, including literacy. As noted earlier, Beck and Wade (2006) refer to gamers as complex problem solvers who analyze situations and think strategically. Semiotic text assimilation or accommodation is necessary for analyzing and solving complex problems when playing video

games. Such assimilation or accommodation promotes active engagement in text-to-self, text-to-text, and text-to-world literacy structures.

Video games require active learning. Active learning engages students in the act of doing and thinking about what they are doing (Bonwell and Eison, 1991). Actions include semiotic interrelationships between multiple sign systems (words, images, actions, and artifacts), critical thinking, effective communication, collaboration, problem-solving abilities, open-mindedness, self-discipline, and commitment to cultivating the learning process. Such actions are evident in video games such as Skyrim or SimCity.

A Skyrim player's actions necessary for creating a character's class, capabilities, skin tone, gender, weight, and even facial features represent semiotic literacy principles identified by Gee. There is also a heavy reliance on text-to-self, text-to-text, or text-to-world at various times within the game in order to comprehend literary narratives or respond to challenges. For instance, some quests include actions after talking, which includes reading dialogue, with other characters (text-to-world and text-to-text). Other quests present dilemmas that need decisive actions such as when or how to defend oneself against attacks or which objects to select in order to earn gold and other rewards (text-to-self). Sufficient experiences with video game text create an understanding of concepts for possible actions and decisions.

SimCity or Simulation Games - Interdisciplinary Project-based Learning

How can the key elements for how students learn (patterns, organization, and context) and new media literacy, game-based learning, happen in a classroom? Culturally, the integration of game-based learning within the field of education is encouraged (Gee, 2003). Abrams (2009) indicates that "students learned vocabulary or historical information as a result

of playing particular video games, experiences that later enabled the students to understand

and relate to the material when it was discussed in the classroom" (p.339).

Learning requires the development of dispositions (critical thinking, creativity, self-

control, empathy, negotiation, communication, collaboration, problem-solving, open-

mindedness, flexibility, organizational skills) that promote the acquisition of knowledge and

understanding. Seven-year-olds may intently play video games and ignore class assignments.

A social and intellectual paradigm shift toward new media literacy, game-based learning, can

serve as a practical and relevant avenue for learning within a classroom.

Game-based learning includes the attributes of play. Play is extremely important

during the learning process. Strategies that promote learning and play embrace metacognition,

intrinsic motivation, and involvement in a community inside and outside of the classroom.

Metacognition, intrinsic motivation and community involvement are also part of playing video

games based on game design principles (Salen, & Zimmerman, 2004). Game design contains

a purpose/goal, problem to solve, analytical and creative thinking, and learning by taking risks

(Gee, 2003; Simões, Redondo, & Vilas, 2013). Learning strategies and video game design

parallel how students learn. Learning involves using patterns and relationships to analyze

situations, goal setting for long-term outcomes, decision-making, and intrinsic motivation.

Therefore, game-based learning involves play and learning outcomes for the retention and

application of relevant information.

How can we, as teachers, create and design innovative curricula using what we need to

recognize as culture media in literacy? Gamification combines the key elements in video

game design with non-game applications (Simões, Redondo, & Vilas, 2013). Effective

curriculum design provides the groundwork for the development of such innovative curricula.

Wiggins and McTighe (2011) promote the design of curriculum, assessment, and instruction based on three key stages of backward design. The stages are identifying desired results, determining acceptable evidence, and planning learning experiences and instruction. Such stages align with game design principles of a challenge, feedback, and response (Plass, Homer, & Kinzer, 2015; Salen, & Zimmerman, 2004). Curriculum design promotes students' autonomy for developing understanding, making sense of, and transferring their learning through authentic performance (Wiggins & McTighe, 2005). Game design focuses on student autonomy, challenges, purpose/goals for desired results, evidence and planning experiences for learning by taking risks that transfer to authentic performance (Gee, 2003; Simões, Redondo, & Vilas, 2013). Therefore, curriculum development and game design are aligned.

Miller (2010) suggests four components characteristic for twenty-first-century teaching: experiential learning, personal relationships, concern for students' affective domain and embracing diversity. The four components complement an interdisciplinary curriculum approach for creating relevant connections between subject content knowledge and new media literacy. Academic rigor and interdisciplinary experiences are necessary when designing interdisciplinary curriculum (Jacobs, 1989). In other words, interdisciplinary curriculum merges several content areas into a recognized investigative framework. Concepts in one content area align with concepts in another content area. Game-based learning is now in schools to enhance and support learning (Simões, Díaz, & Vilas, 2013). Game-based learning merges game design elements, characteristics for games, and non-game contexts including learning objectives (Deterding, Dixon, Khaled & Nachke, 2011). It involves the use of digital video games as a classroom tool. The goal is to promote the framework for learning in and outside the classroom. Therefore, semiotics and reading comprehension become the format for delivering content knowledge while playing video games.

As noted previously, players' engagement in twenty-first-century new media literacy requires critical thinking, motivation, action, and feedback (Jenkins, et al, 2007; Plass, Homer, & Kinzer, 2015). The foundation for designing curriculum can combine academic content within a game-based learning environment to encourage literacy development. For example, in SimCity there are progressive loops that involve a series of small challenges, which contribute to the main goal of building a functional city. Mastery occurs through trial and error as players receive feedback. Players use semiotics to interpret and gain an understanding of how a city functions. Students, as players, develop and convey their understanding when able to explain, interpret, apply, shift perspective, empathize, and self-assess their learning.

Curriculum design should focus on ensuring that learning happens for meaningful transfer of knowledge to understanding. The new cultural media skills engage "traditional literacy, research skills, technical skills and critical analysis skills taught in the classroom" (Jenkins, et al, 2007, p. 4). According to Jenkins and associates (2007), play, problem-solving, critical thinking, technology and literacy skills can be interconnected. Interconnection occurs when students are (1) defining problems and identifying information needed to resolve the problem, (2) using information research strategies to locate relevant sources, (3) determining relevant information within sources, (4) disbursing information, (5) synthesizing information, and (6) evaluating or judging information and/or processes (Jenkins, et al, 2007).

How can we connect game-based learning, literacy and academic concepts from an interdisciplinary approach to learning? Let's review. Video games contain multiple features for constructing meaning: sound, images, words, actions, symbols, color and the like, singly or in combination. Students learn to recognize the association of multiple features in order to understand the game, semiotics. Gee (2003) indicates that understanding the connections and

combinations of multiple features is important, 'learning about and coming to appreciate interrelations within and across multiple sign systems … as a complex system is core to the learning' (p. 49). Students explore, construct, consolidate and synthesize concepts from varied perspectives through an interdisciplinary approach, more than one academic source. Learning becomes meaningful, purposeful, transferable, and sustainable over time, creating intrinsic motivation.

Game-based learning allows for an immersive, engaging environment for multimodal literacies that sparks curiosity as well as self-determination. Consequently, one needs to consider the relationships between content concepts or required skills obtainable through a video game and the relevant concepts in academic content. For example, Minecraft is an open forum video game similar to building with Lego construction sets. Students focus on creating and building with textured cubes in a 3-dimensional world. Situational learning occurs in a world of biomes containing plains, mountains, caves, deserts, and bodies of water. Players respond to situations that place them in survival or creative modes when building. Balance of the Planet introduces students to global warming, jobs, health, food, wealth, and energy use concepts. Spore allows players to control the development of a species from a microscopic organism to an intelligent and social organism.

Designing interdisciplinary curriculum with the intentional use of video games can be challenging. It involves identifying curriculum objectives that correspond with the desired in-depth understanding of concepts as well as the multiple literacy features in a video game. The major challenge, as a teacher, is facilitating, encouraging, and connecting literacy with understanding of academic concepts in and outside the context of a game. One very important point to keep in mind is that developing an in-depth understanding of concepts eliminates the

use of educational games for memorization, drilling, and quizzing, with the focus on isolated facts. Following Wiggins, McTighe, Jenkins et al, Miller and Gee's recommendations, curriculum design includes students' autonomy, literacy, meaningful integrated connections, and the transfer of learning through authentic performances. This brings up one very important question. What questions should we ask ourselves when choosing or investigating the use of a video game for literacy and concept development? Specific questions and answers correlate with selected learning objectives. Yet, there are a few overarching questions to consider, see Table 1.

Table 1: Questions to Consider

What is the value derived from the game?
How much autonomy is available for students?
How many opportunities do students have for meaningful choices?
How clear are the rules or structure of the game?
What are the potential conflicts students may encounter?
Where are the connections between the game and various subject matter concepts?
How will you assess subject matter concepts?

Interdisciplinary project-based learning provides a catalyst for curriculum development with an emphasis on game-based learning. The decision for using video games in the classroom depends on student motivation, opportunities for meaningful choices, classroom environmental structure, and potential conflicts. The new media literacies, game-based learning, focus on individual and community involvement requiring collaboration and networking to increase academic learning (Jenkins et al, 2007). Project-based learning mirrors

such a focus. Project-based learning begins with student interest, motivation, choices, and connections to the real world. Students locate a significant problem in their own community. The project becomes a search for solutions to the identified problem. Problems might be a lack of adequate housing, obesity, pollution, city services, zoning, or even park and building restoration. The use of video games within a project-based learning approach depends on selected concepts, objectives, perceptions, and performances students develop during the interdisciplinary learning process. Although this is a new approach to curriculum development, it fits into everything we already do.

For example, *SimCity* correlates nicely with a project-based learning interdisciplinary approach. Experiences necessary for addressing a project's problem evolve through playing *SimCity*. Literacy includes reading and vocabulary development through pop-up tooltips. The tooltips give updates on the city's finances, crime, pollution, etc. Semiotics transmits *SimCity*'s game text. Semiotics is present as a complex system of multiple sign systems (words, images, actions, artifacts, etc.) within the game. Understanding how the city functions occur through sufficient video game text experiences i.e. text-to-text, text-to-world, and finally text-to-self. There are line and bar charts for crime, power usage, and demographics related to literacy development as well as math, science and social studies. Balancing the city's budget and allocating money for utilities and services involves mathematics yet interconnected with economics and zoning within social studies concepts. Social studies concepts are present: economics, mapping, zoning for police, fire, health and education, transport systems (road, busses, and airports), population distribution (residential, commercial and industrial) and disasters, citizenship and how a community works. The social studies concepts interconnect with science concepts when confronted with pollution, energy sources, tornadoes, and fires. Yet, all game text experiences align with semiotics, text-to-text, text-to-world, and finally

text-to-self. Table 2 describes the relationship between literacy, game design, game-based

learning and project-based learning.

Table 2: Literacy, Game Design, Game-based and Project-based Learning Comparison

Literacy	Game Design	Game-based Learning	Project-based Learning
Experiences	Storyline Narratives	Experiences	Experiences
Traditional literacy	Genre	Real world	Real-world connections
Research skills	Environment	Patterning	Patterning
Genre	Characters	Organizing information	Organizing information
Semiotics – words, images, actions, artifacts, signs, symbols	Challenge	Problem solving	Problem solving
	Response/Feedback	Critical thinking	Critical thinking
	Student-driven	Student-driven	Student-driven
Syntax	Conflicts	Conflicts	Multifaceted assessment
Semantics	Simulation experiences	Simulation experiences	Collaboration
Pragmatics	Goals: short-long term	Learning outcomes	Core standards
Narrative-storyline	Motivation	Collaboration	Structured collaboration
Text-to-Self	Meaningful interactions	Negotiation	Authentic content
Text-to-Text	Aesthetic design	Motivation	Motivation
Text-to-World	Social context	Social/Cultural	Public involvement
	Knowledge/skills	Rules of play	Significant content
	Revisions & reflections – feedback	21st Century skills	21st Century skills
	Student voice &	Revisions & reflections – feedback	Revisions &
		Student voice & choice	
		In-depth inquiry &	

choice	innovation	reflections – feedback
		Student voice & choice
		In-depth inquiry & innovation

Conclusion

Teaching for meaning and understanding is the goal of education. Research indicates that sustainable learning occurs when students are intrinsically motivated to engage in the learning process (Pink, 2005; Wagner, 2012). Culturally, video games support students' desire to learn and need for play. Play facilitates the development of the brain's pre-frontal cortex (executive control) for regulating emotions, making plans and solving problems during the learning process (Brown, 2010). Designing curriculum for meaningful engagement in the learning process is similar to game design. Meaningful learning occurs when students receive challenges that encourage setting short to long-term goals, making decisions, taking actions, receiving feedback, and demonstrating knowledge and skills while engaged in the learning process (Wagner, 2012). The same attributes for meaningful learning are present in game design, game-based, and project-based learning. Game-based and project-based learning stimulate students' intrinsic motivation through challenges associated with real-world problems. Literacy is a key component in the learning process, game design, game-based and project-based learning.

New media literacy, video games, encourage the development of literacy and understanding academic understanding in a natural, challenging and engaging format. Such video games are very different from the textbook-style educational programs or point and

click games, currently in schools for practicing basic academic skills. New media literacy integrates students' learning process with game design mechanisms. Perhaps the best way to understand how new media literacy, video games, connect with students' understanding of academic content is to play the games or watch YouTube videos that demonstrate how to play the games.

References

Abrams, S. S. (2009). A gaming frame of mind: Digital contexts and academic implications. *Educational Media International,* 46(4), 335-347.

Beck, J. C. & Wade, M. (2006). *The kids are alright: How the gamer generation is changing the workplace.* Boston, MA: Harvard Business School Publishing.

Bonwell, C. C., & Eison, J. A. (1991). *Active learning: Creating excitement in the classroom (ASHE–ERIC Higher Education Rep. No. 1).* Washington, DC: The George Washington University, School of Education and Human Development.

Brown, S. (2010). *Play: How it shapes the brain, opens the imagination, and invigorates the soul,* New York, NY: Penguin Group.

Deterding, S., Dixon, D., Khaled, R., & Nachke, L. (2011). From game design elements to gamefulness; Defining "Gamification'. *MindTre'11.*

Donovan, M .S., Bradsford, J. D. & Pellegrina, J. W., Eds. (1999). *How people learning: Brain, mind, experience, and school,* Washington, DC: The National Academies Press.

Gee, P.J. (2003). *What video games have to teach us about learning and literacy*, Hampshire, UK: Palgrave Macmillan.

Jacobs, H.H., (1989). *Interdisciplinary Curriculum: Design and Implementation*, Alexandria, VA: Association for Supervision and Curriculum Development.

Jenkins, H., Clinton, K., Purushotma, R., Robison, A .J., & Weigel, M. (2007). *Confronting the challenges of participatory culture: Media education for the twenty-first-century.* Chicago, IL: MacArthur Foundation.

Johnson, S. (2005). *Everything bad for you is good for you: How today's popular culture is actually making us smarter*. New York: Riverhead.

Miller, J. P. (2010). *Whole Child Education.* Toronto: University of Toronto Press.

Paul, R., & Elder, L. (2008). *The miniature guide to critical thinking, concepts and tools,* Dillon Beach, CA: Foundation for Critical Thinking Press.

Pink, D. H. (2005). *A whole new mind, Why right-brainers will rule the future,* New York, NY: Penguin Group.

Plass, J. L, Homer, B. D. & Kinzer, C. K. (2015). Foundations for game-based learning, *Educational Psychologist,* 50(4), 258-283.

Salen, K., & Zimmerman, E. (2004). *Rules of play: Game design fundamentals.* Cambridge, MA: MIT Press.

Simões J., Redondo, R.D. & Vilas, A.F. (2013). A social gamification framework for a K-6 learning platform, *Computers in Human Behavior* 29, 345–353.

Vygotsky, L. (1978). *Mind and society: The development of higher mental processes.* Cambridge, MA: Harvard University Press.

Wagner, T. (2012). *Creating innovators: The making of young people who will change the world.* New York, NY: Scribner.

Wiggins, G., & McTighe, J. (2011). *The Understanding by Design guide to creating high quality units*. Alexandria, VA: ASCD.