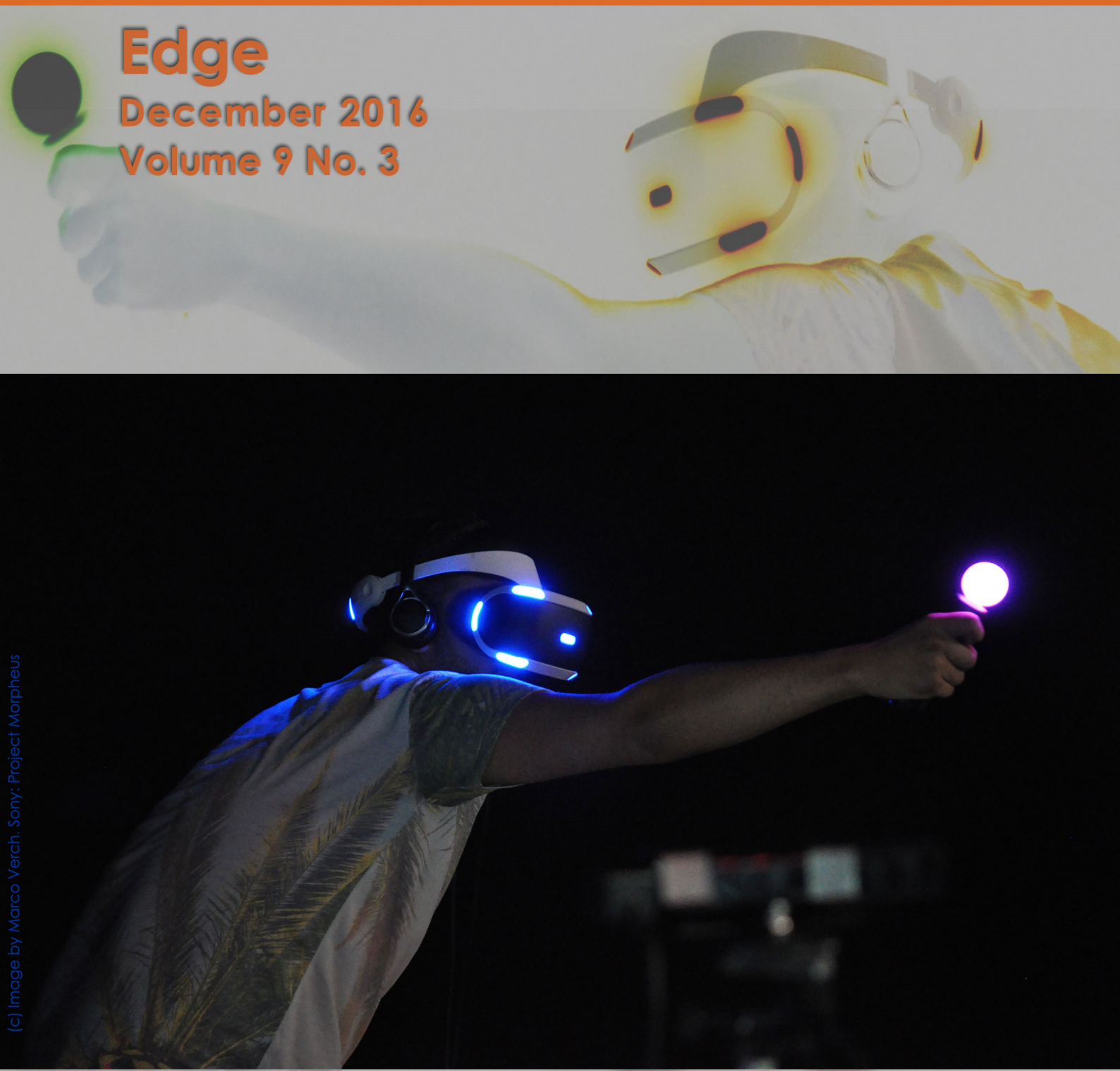
Journal of
Virtual Worlds Research
jvwresearch.org ISSN: 1941-8477

Edge

December 2016
Volume 9 No. 3



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Volume 9, Number 3

Edge

December 2016

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Journal of Virtual Worlds Research
jvwresearch.org ISSN: 1941-8477

Volume 9, Number 3
Edge
December, 2016

Playful Constructivism: Making Sense of Digital Games for Learning and Creativity Through Play, Design, and Participation

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Abstract

The goal of this article is to provide a conceptual framework to better understand digital games in learning and creative contexts through the dimensions of *play*, *design*, and *participation*. This framework can be used as a guiding tool for the selection, implementation, and evaluation of game-based approaches in formal and informal educational settings, as well as a blueprint for making sense of playful learning and creativity in virtual worlds and technology-mediated environments. In essence, this article seeks to answer the question "What are digital games and how can we make sense of them for learning and creativity?" The proposed visual model and conceptual framework, here defined as *Playful Constructivism*, is grounded on the learning theories of Situated Cognition, Social Constructivism, and Constructionism, and draws from play and game studies, design-based learning, and affinity spaces research. This framework is not intended as the "ultimate" conceptualization of game-based learning, but rather as an agile tool that can guide scholars, practitioners, and students through the affordances, challenges, and opportunities of implementing and using digital games in learning and creative contexts.

1. Introduction

Digital games have become a pervasive component of contemporary life and culture, as millions of players every day engage in playful practices mediated and supported by technology. This cultural, social, and creative phenomenon attracts people of virtually every age, gender, nationality, ethnicity, and socioeconomic status. Tens—if not hundreds—of game genres and subgenres have emerged, giving life to millions of games across a multitude of platforms and devices, such as home and portable video game consoles, computers, tablets, and smartphones. Besides and beyond their inherently entertaining, leisure, and social character, scholars started exploring the potential of digital games for learning and teaching in formal and informal environments. In the last decade, research on "game-based learning" or "games and learning" has grown exponentially, bringing new perspectives on their educational value and uses (Connolly, Boyle, MacArthur, Hainey, & Boyle, 2012; Hainey, Connolly, Boyle, Wilson, & Razak, 2016; Whitton, 2014).

In this multifaceted and ever-evolving context, making sense of digital games for learning and creativity can be a daunting—and at times overwhelming—task. Nevertheless, such understanding is critical for learning, teaching, and interacting with 21st century learners, meeting them where they are, building a common ground for meaningful conversations, and designing learning experiences that harness the potential of interactive technologies. It is therefore important to attempt to answer the question "What are digital games and how can we make sense of them for learning and creativity?" by considering a "core" of salient characteristics and dimensions that can be used as a map and organizer for understanding them, using them, and designing them. By acknowledging their multimodal, heterogeneous, and versatile nature, this article seeks to conceptualize digital games for learning and creativity through the dimensions of play, design, and participation, presenting a unified, yet expandable—and, by all means, criticizable—model that can be used as "a compass to think with" by scholars, practitioners, and students.

2. Play

The traditional approach to a definition of digital games is commonly portrayed as a narrowing of the spectrum of analysis (Puentedura, 2009) proceeding from *play*, to *games*, to *digital games* (Fig. 1).

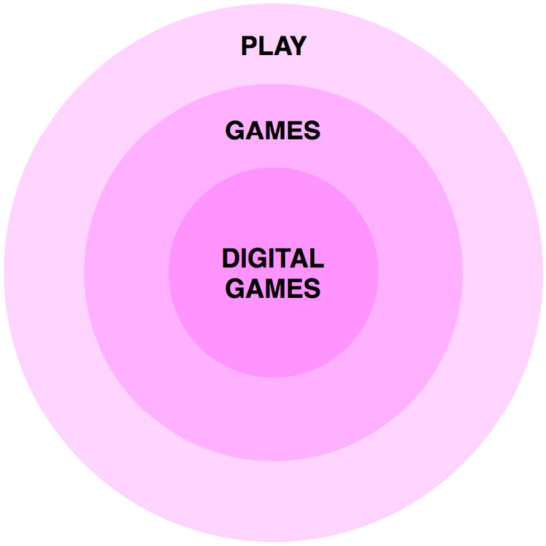

Figure 1: Situating digital games

Huizinga, in his classic work *Homo Ludens*, defines play as:

> A free activity standing quite consciously outside "ordinary" life as being "not serious," but at the same time absorbing the player intensely and utterly. It is an activity connected with no material interest, and no profit can be gained by it. It proceeds within its own proper boundaries of time and space according to fixed rules and in an orderly manner. (Huizinga, 1949, p. 13)

Caillois (1961) defines play as an activity that is free, voluntary, circumscribed, uncertain, undetermined, unproductive, governed by rules, and "make-believe." The author remarks that play involves the perception of a "free unreality" or "a special awareness of a second reality" (Caillois, 1961, p. 16). In the early Seventies, Abt put forth one of the most popular and influential definitions of games:

> Reduced to its formal essence, a game is an activity among two or more independent decision-makers seeking to achieve their objectives in some limiting context. A more conventional definition would say that a game is a context with rules among adversaries trying to win objectives. (Abt, 1970, p. 6)

Expanding on Abt's definition, Suits (1978) focuses on the foundational and somehow counterintuitive function of rules in games:

> To play a game is to engage in activity directed towards bringing about a specific state of affairs, using only means permitted by rules, where the rules prohibit more efficient in favor of less efficient means, and where such rules are accepted just because they make possible such activity. (p. 34)

Crawford (1984) talks about *representation*, *interaction*, *conflict*, and *safety*, as the defining characteristics of most games. Salen and Zimmerman (2003), in their classic study *Rules of Play*, define a game as "a system in which players engage in an artificial conflict, defined by rules, that results in a quantifiable outcome" (p. 96).

All these perspectives constitute just a partial picture of the numerous attempts made by scholars and game designers to define play and games. Acknowledging these definitions, in the effort to make sense of digital games, it is important to consider them in their complexity, as unique and somehow "uncatchable" interactive artifacts or "bizarre digital hybrids" that "appear as some kind of weird, hermetic monolith" (Poole, 2000, p. 30), rather than just as interactive media or traditional games augmented by technology. Squire (2006) defines them as *designed experiences* while Gee (2007, 2012) frames them as sets of well-ordered problems (not just facts or information) supported by copious feedback.

In *well-designed* digital games (hereinafter simply defined as "digital games," for brevity), problems are interesting to approach and fun to solve, and players are engaged in personally meaningful choices directed to the achievement of goals that are challenging but attainable, with the assistance of human (peers or more knowledgeable others) or virtual (designed or programmed) mediators. Vygotsky (1978) argues that

> play creates a zone of proximal development of the child. In play a child always behaves beyond his average age, above his daily behavior; in play it is as though he were a head taller than himself. (p. 102)

Digital games, by acting as "virtual more knowledgeable others" and by offering ideal levels of challenge in the zone of proximal development (Vygotsky, 1978), allow players to be "a head taller than themselves," extending and expanding their possibilities of doing and being. In this sense, digital games embody a dual nature of challenging and tutoring environments in which players/learners are presented with problems, tasks, and missions that are progressively adjusted to

match their current level of competence (Csikszentmihalyi, 1990). Digital games continuously "tell" players where they are and process their actions to set an ideal level of difficulty, thus enabling them to achieve overlapping short-, mid-, and long-term goals (Squire, 2011). The constant and copious feedback provided by these games (Gee, 2007) can be considered as a form of continuous assessment: the player/learner always knows his/her achievements, current level of knowledge and skills, and what needs to be done next.

In digital games players are immersed in a situated, constructivist, and (often) socially-mediated environment in which their decisions, actions, and interactions directly impact the understanding, progress, and outcome of the game. In this context, the learning theory of Situated Cognition assumes that thinking and learning do not reside solely in a person's mind, but rather are an outcome of the interaction between an individual and the environment or social setting (Anderson, Reder, & Simon, 1996). From this perspective, declarative knowledge ("knowing that") and procedural knowledge ("knowing how"), knowing and doing, are merged (Driscoll, 2005; Seely Brown et al., 1989), since knowledge is constructed through meaningful and "lived" practices in a situated context (Lave & Wenger, 1991). The learning theory of Constructivism holds that individuals, through experience and interaction with persons, objects, and situations, actively construct most of their knowledge, rather than just acquiring it (Bredo, 1997). Constructivism assumes that learning is a "process of meaning-making, not of knowledge transmission" and a "conscious activity guided by intentions and reflections" (Jonassen & Land, 2000, p. v). Social Constructivism stresses the importance of social interactions (e.g., learning in groups and learning with peers) in the active construction of knowledge and the development of the individual; learning is considered a culturally, historically, and socially mediated process that takes place in social environments in which learners negotiate meanings, shape identities, and solve problems with the aid of tools and mediation systems (Jonassen & Land, 2000; Vygotsky, 1978).

Solving meaningful problems is an essential component of any engaging digital game, but a carefully crafted gaming and learning experience is not focused exclusively on performance, but also on experience. In fact, digital games are not only performative, but also transformative. For example, controlling an avatar in a digital game can be considered a process of hybridization as players become one with their "digital embodiments" and with their avatars' experiences, victories, and downfalls, that become their own, and vice versa (Gee, 2007). This reciprocity of play creates a connection between the player and the game that emphasizes the flow of the experience (Csikszentmihalyi, 1990). We may say that, when we play the game, the game "plays us" (Gadamer, 1989):

> All playing is being played. The attraction of a game, the fascination it exerts, consists precisely in the fact that the game masters the players. Even in the case of games in which one tries to perform tasks that one has set oneself, there is a risk that they will not "work," "succeed," or "succeed again," which is the attraction of the game. Whoever "tries" is in fact the one who is tried. (p. 106)

In this context, it is also important to highlight the role of game avatars as social agents that may engender care and responsibility (Banks & Bowman, 2016):

> It may be that when the game is approached as "we" (perhaps with empathy, loyalty, and protection cues) rather than as "I," humans may enter into interactive media toward more meaningful experiences *with* digital bodies. (p. 1273)

This deep connection and reciprocity of play develops in a safe environment, in which one can make mistakes and progressively work to fix them (Papert, 1981), instead of "shooting for the right answer" or struggling to avoid the wrong one at any cost. In this regard, digital games make failure a natural and often fun part of the process, thus encouraging repeated play and exploration of new

solutions. Cazden (1981) defines this approach as *performance before competence*: players apply *learning by doing* (i.e., by playing the game) rather than *learning before doing* (i.e., first reading the manual and then playing the game). The "failure space" is part of the identity of digital games and players/learners are encouraged to explore it. Bennahum (1998), talking about his experience with digital games says: "I could lose privately. No one to laugh or yell at me for missing. […] This was bliss" (p. 15). From this perspective, digital games let players safely act and learn (counter-paraphrasing Vygotsky) as "less knowledgeable others" within the designed system of a digital game. This "freedom to fail" amplifies the freedom to explore, tinker, and invent rules, goals, and missions. In fact, one of the most motivating and fun experiences related to digital games is the possibility to create user-set goals and narratives, different from those originally conceived by game designers. For example, a player in a multiplayer war game, instead of taking a side in the conflict, may try to pacify the two sides (an example reported by Will Wright, the creator of *The Sims* series). This kind of approach to gaming is called "transgressive play," as it goes against (or beyond) the rules and goals originally set by the designers of a game (Poole, 2000), which can also lead to "controversial" or "subversive" forms of game play (Mortensen, Linderoth, & Brown, 2015).

The perception of freedom and the active participation in digital games is reinforced by the narratives that accompany them and by the narratives that players create within the games or around the games, in social spaces. Players enter worlds and stories that give meaning to their actions, or create their own stories that help them frame their actions through a process of meaning-making that can be generative on both a personal and a social level. Further, some digital games let players explore interactive stories (Barab et al., 2010; Crawford, 2005; Murray, 1997) in which users can concurrently play the role of audiences, performers, and authors, influencing with their choices the events and outcomes of the story. In interactive storytelling (also known as interactive narrative), dilemmas are experienced through interaction ("a mutual or reciprocal action or influence," as defined by The Merriam-Webster dictionary) and agency, defined by Murray (1997) as "the satisfying power to take meaningful actions and see the results of our decisions and choices" (p. 126). In other words, every choice performed by the player, through a process of reflection and decision-making, has a consequence on the development of the story and, in turn, the story influences the actions and decisions of the player. These choices are personal and meaningful and can lead to deep self-reflection (Murray, 1997). There is an ongoing debate on the "impossible marriage" between story and agency, narrative and interaction, as one seems to mutually exclude the other. However, there are good examples of games that involve interactive storytelling, such as *Façade* (developed by Michael Mateas and Andrew Stern, Mac, PC, 2005) and *Heavy Rain* (Quantic Dream/Sony Computer Interactive, PlayStation 3, 2010), but this field has yet to be fully explored through film and theatre criticism, narratology, game design, artificial intelligence, and media studies.

Considering the multifaceted features, theories, and approaches presented above, in the effort of defining and understanding digital games, it is useful to conceptualize them from three interrelated perspectives, as *systems*, *models*, and *microworlds*.

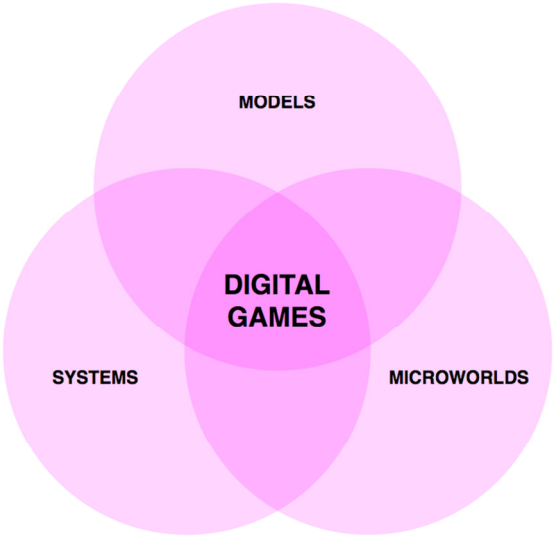

Figure 2: Digital games as systems, models, and microworlds

2.1 Digital Games as Systems

Digital games can be considered dynamic systems in which different elements interact one with another in response to rules set by designers, commands controlled by artificial intelligence, and the input of the player. For example, in a game like *SimCity* the player, as the mayor of a city, controls different aspects of its life and growth, such as electricity, roads, buildings, services, and taxes. All these elements are interrelated and contribute to defining the outcome of the game. For example, lowering taxes will attract more population, causing a higher demand for jobs and real estate, while at the same time increasing traffic and pollution.

In some games, such as *World of Warcraft*, players have different roles, powers, and levels of experience and need to aggregate in groups to defeat enemies that can be overcome only through a collaborative effort. These groups can be considered as situated sub-systems (formed in a specific time to defeat a specific enemy) within the broader system of the game (which includes game mechanics, dynamics, characters, narratives, locations, etc.). Further, on a macro level, game designers, developers, critics, scholars, players, online communities, and other stakeholders form a hyper-system that projects the understanding of digital games from playable artifacts to cultural, social, technical, creative, and economic dimensions that impact how games are created, shared, and experienced.

2.2 Digital Games as Models

Digital Games can also be conceived as dynamic models (or systems of symbols) that represent imaginary or real world experiences with different levels of abstraction (Squire, 2011). As opposed to realistic representations or simulations, digital games are somehow less detailed, but more usable models. Similarly, a graphical map of the transportation system of a city that includes only a limited set of information relevant to commuters may be more usable than a satellite picture that represents a detailed view of the area.

From gaming, designing, and learning perspectives, models are easier to control, manipulate, and understand, and are better suited to represent complex problems and promote solutions that can be transferred to other contexts.

2.3 Digital Games as Microworlds

Considering their ecosystemic and model-like nature, digital games can also be interpreted as *microworlds* (diSessa, 2000; Minsky & Papert, 1971; Papert, 1980; Resnick, 1994), small "planets" with specific rules and affordances, which may or may not mimic those of the real world. In a digital game a player can take on different identities, experience adventures, do things or be persons (or even be things) he or she could not do or be in everyday life or in the real world (e.g., competing as a racing car driver, fighting aliens, or traveling through time). More broadly, a microworld can be considered a playground or sandbox environment for exploration, manipulation, learning, self-expression, and creativity through the interaction with human and/or computer-controlled agents. Microworlds can help players make sense of complex systems in a safe and delimited environment that affords and stimulates hypothesis-testing and discovery.

After considering digital games as *playable artifacts*, in the next section they will be examined as *designable artifacts* that can be created and shared by everyday users, not just by professional game designers.

3. Design

Creating computer-based artifacts can be a powerful and transformative experience (Schwarz & Hershkowitz, 2001). Designing and sharing a digital artifact means making a personal investment in the project, taking decisions throughout the process, and evaluating the progress and outcome, both on an individual and social level, seeking feedback from peers and more knowledgeable others (Driscoll, 2005). Through the design of interactive artifacts (such as digital games) people learn to think with a system of symbols by applying the iterative method of design (Gee, 2007; Squire, 2011). Design thinking (Hayes & Games, 2008; Kafai, 1995) and learning through designing (diSessa, 2000; Duncan, 2010, 2012; Kafai & Resnick, 1996) involve the development of problem solving and collaborative skills. Interestingly, "thinking like designers" is important even when players are "just" playing (not designing) games, as they need to unveil and fathom the system of rules hidden underneath the interface of the game (Gee, 2007, 2012). In the following sections game design will be analyzed as *programming*, *modding*, and *editing*.

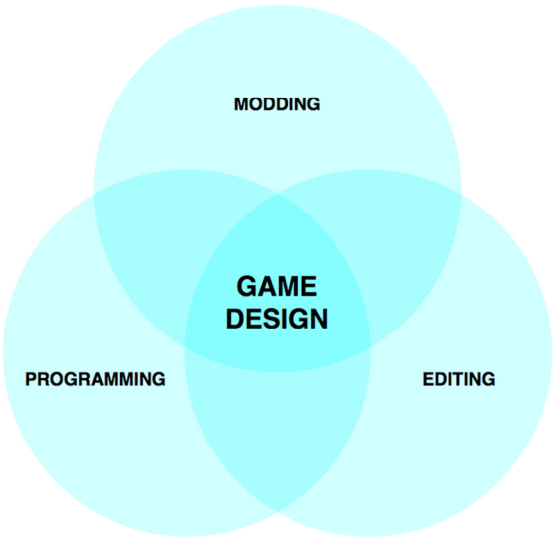

Figure 3: Game design as programming, modding, and editing

3.1 Game Design as Programming

With *Logo*, Seymour Papert pioneered the idea of programming languages and environments for non-experts, particularly children, to be used in educational contexts. This type of software (a simplified version of professional applications) makes programming accessible to users of virtually any age, in an approachable and streamlined environment. Through his research, Papert developed a learning theory called Constructionism, which implies programming and sharing digital artifacts (Carbonaro et al., 2006; Harel & Papert, 1991; Hayes & Games, 2008; Kafai, 1995, 2006; Kafai & Resnick, 1996). Papert worked with Piaget in the late Fifties and early Sixties (Ackermann, 2001) and his approach has been influenced by Piagetian Constructivism, as both approaches consider the learner as an active constructor and organizer of knowledge. Papert (1991) expresses the relation between the two theories in these terms:

> *Constructionism* – the N word as opposed to the V word – shares constructivism's connotation of learning as "building knowledge structures" irrespective of the circumstances of the learning. It then adds the idea that this happens especially felicitously in a context where the learner is engaged in constructing a public entity, whether it's a sand castle on the beach or a theory of the universe. (p. 1)

With new technologies and research, *Logo* has evolved into more elaborate and powerful environments such as *StarLogo* (Resnick, 2008) and *NetLogo* (Wilensky, 1999). One of the most popular and "radical" evolutions of these environments is *Scratch* (Resnick et al., 2009), which allows drag-and-drop programming in a visual environment that simplifies and makes available to children programming concepts like variables, arrays, and conditional statements. The program allows users to create interactive presentations, games, and animations that can be shared online in the dedicated community. As of December 2016, more than eighteen million projects have been created with *Scratch* and posted on the Scratch official website (http://scratch.mit.edu). Once a project is uploaded by a user, not only can it be played by other users, but it can also be modified and personalized, or, in *Scratch* language, "remixed." In this regard, the name "Scratch" was inspired by the DJ technique called "scratching," while "remixing" is a technique used in music to create alternative versions of a song by adding new elements or combining parts of different songs.

The programming code of each project is available for download to the entire *Scratch* community. This feature allows users to deconstruct and reverse engineer projects and see how they work "under the hood," and then publish new "remixed" versions. *Scratch* is being used in thousands of schools and educational programs around the world and is supported by a website dedicated to educators, called *ScratchEd* (http://scratched.media.mit.edu), with multiple resources divided by educational level, content type, curricular area, and language. Other programming languages and game-design environments for non-experts used in educational contexts include *AgentSheets* (www.agentsheets.com), *Alice* (www.alice.org), *Storytelling Alice* (www.alice.org/kelleher/storytelling), *Kodu* (www.kodugamelab.com), *Gamestar Mechanic* (www.gamestarmechanic.com), and *Swift Playgrounds* (www.apple.com/swift/playgrounds).

3.2 Game Design as Modding

While dedicated programming and game design environments are focused on creating games from scratch (or "remix" games created from scratch by other users), "modding," short for "modifying" (Durga, 2012; Steinkuehler & Johnson, 2009), is "the practice and art of modifying digital games and software to augment or completely remodel their functions or appearances, diverging from what was originally intended by their designers and developers" (Marone, 2015a, p. 83). As opposed to the educational programming environments discussed in the previous section, modding usually requires advanced technical and programming skills. "Mods" are not completely

original games, but rather expansions or variations of commercial games, including new characters, settings, and storylines.

3.3 Game Design as Editing

The evolution of contemporary digital games, the development of programming languages, and the diffusion of the Internet paved the way for design-oriented digital games, such as *ModNation Racers* and the *LittleBigPlanet* series, that provide comprehensive environments for entertainment, expression, socialization, learning, and creativity. These games integrate "game level editors" that allow players to create enticing and professionally-looking 3D game levels. These editors offer visual and drag-and-drop tools that do not require writing code. These editable, design-oriented, or constructionist digital games (Marone, 2011, 2015a) can be considered a hybrid between educational programming environments like *Scratch* (visual, intuitive, and streamlined) and the practice of modding, which allows users to modify and expand an existing digital game, but without the need to write a line of code. These accessible and integrated game design toolkits prompt a convergence of roles between players and creators ("playators," cfr. Marone, 2015b), which allows users to express their creativity through playful design (see Fig. 5).

After looking at digital games as playable and designable artifacts, the next section will focus on how these two dimensions intersect and develop in social contexts, considering games as *participatory artifacts*.

4. Participation

Jenkins et al. (2009) define a participatory culture as a

> culture with relatively low barriers to artistic expression and civic engagement, strong support for creating and sharing creations, and some type of informal mentorship whereby experienced participants pass along knowledge to novices. In a participatory culture, members also believe their contributions matter and feel some degree of social connection with one another. (p. xi)

This definition acknowledges the cultural nature of interest-driven spaces, as opposed to a trivial perception of topics dealt in some of these communities, such as the construction of "virtual furniture" for the inhabitants of the digital game *The Sims* or the creation of spin-off stories featuring the characters of a digital game. Participatory cultures are exemplified by the construct of *affinity spaces* put forth by Gee (2004, 2005) to define informal interest-drive social spaces. In the context of playing and designing games, and, more broadly, in communities of play and play cultures (Pearce, 2009), affinity spaces can be conceptualized as *interest-driven places*, *knowledge resources*, and *hubs for collaboration* (fig. 4).

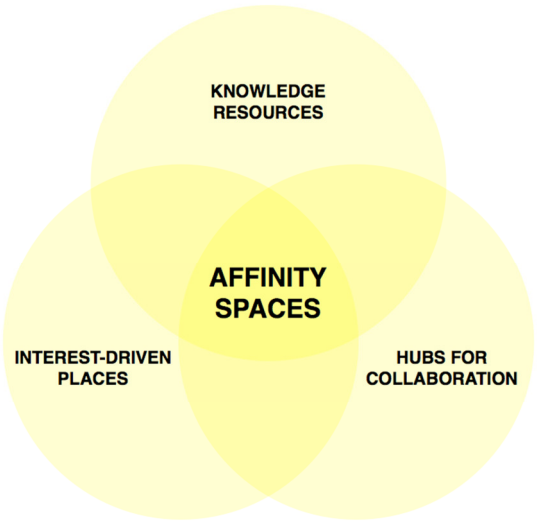

Figure 4: Affinity spaces as interest-driven places, knowledge resources, and hubs for collaboration

4.1 Affinity Spaces as Interest-Driven Places

In affinity space people meet and interact because of their common interests and passions, not because of social markers such as gender, nationality, or ethnicity. Gee (2004) argues that "learning becomes both a personal and a unique trajectory through a complex space of opportunities (…) and a social journey as one shares aspects of that trajectory with others" (p. 81). Through personal and social trajectories (Wenger, 1998) people explore their identities, share opinions, ideas, and artifacts, express themselves, negotiate meanings, and learn from each other (Hayes & Duncan, 2012) constructing their identities as novices, experts, and insiders. One may say that people actively participate in gaming affinity spaces *to influence* and *to be influenced* through interest-driven interactions focused on gameplay, game features, and discussions prompted by a game (*playful participation*), as well as game design strategies, tools, and critiques of user-generated games (*design-oriented participation*) (see Fig. 5). By engaging in these social-constructive endeavors learners "absorb part of the culture that is an integral part of the community, just as the culture is affected by each of its members" (Jonassen & Land, 2000, p. vi).

4.2 Affinity Spaces as Knowledge Resources

In gaming affinity spaces participants build cultural competence and knowledge (Wallace, 1988) related to a specific digital game, or digital games and game design in general. By asking and answering questions, sharing stories, creating step-by-step game walkthroughs and video tutorials, and proposing alternative solutions to game-related problems, users commonly construct a repository of resources and knowledge that far exceeds any user manual of a digital game or the information provided on a developer's website. Affinity spaces value and encourage intensive, extensive, individual, distributed, disperse, and tacit knowledge. Jenkins (2006) would argue that these spaces express a "collective intelligence" (see also Lévy, 1997), because the community "knows" more than each of its members.

Some affinity spaces are dedicated to creative and design-oriented participation. Sylvan (2007) defines such spaces as "Online Communities of Creators" (OCOCs):

> Personal creations are objects that people make as a form of personal expression and can include content such as photographs, music, stories, songs, and computer programs. In an OCOC, a network of people is brought together by the projects they share. Participants in

> OCOCs may post their creations in public forums, comment on each other's work, and tag their projects to describe their meaning. In some communities they may download the work of others, manipulate it, and then upload it for review. (p. 24)

Sylvan describes three core features of these creative social environments: 1) the possibility to share creations; 2) the possibility to comment on each other's work; and 3) the possibility to associate each contribution to their creators. Digital games are one of the most popular domains that spark these spaces, prompting social interaction, creative efforts, and reciprocal support (Gee, 2007, 2012; Jenkins, 2006).

4.3 Affinity Spaces as Hubs for Collaboration

In affinity spaces newbies share a common space with experts, while leadership is porous and leaders are resources for the entire community (Gee, 2005). Affinity spaces offer different routes to participation and everyone is welcome to contribute. The permeability and relatively low barriers of participatory cultures and affinity spaces invite participants with different skills to collaborate. Rogoff (1994) argues that in communities of learners "learning occurs as people participate in shared endeavors with others, with all playing active but often asymmetrical roles in sociocultural activity" (p. 209). This dynamic asymmetry is a crucial factor for the creative potential and evolution of a community and reflects the diversity of its participants. A defining characteristic of affinity spaces is their openness to participants of different backgrounds. This diversity is also embodied by different roles (e.g., moderator, member), types of contribution (e.g., asking, answering), and levels of experience (e.g., expert, novice), in a virtual ecosystem that evolves with its participants and creators (Steinkuehler, 2006). The progress and the achievements shared in an affinity space dedicated to digital games can lead to a spontaneous evolution of roles, from peripheral to central (Wenger, 1998), from reader to author, and from player to designer, contributing to the development of gaming strategies (solutions and techniques), assets (levels, tools, characters, etc.), and understandings (about and beyond the game). Gee (2012) argues that "a lot of the good learning that goes on when people play games does not happen just in the game, but also in social interactions around the game" (p. 235). In fact, contemporary digital games are naturally intertwined with affinity spaces: blogs, forums, fan-pages, websites, and social media can be considered their natural extensions.

Squire (2011) argues that "a great pleasure of gaming is becoming an *expert* […] and being recognized as such socially" (p. 147). In other words, the envisioned achievements in a game motivate the player both intrinsically (beat the game) and socially (beat the game better than others do). This state of mastery, superior competence, or expertise (Bergstrom, Jenson, Hydomako, & de Castell, 2015; Taylor, de Castell, Jenson, & Humphrey, 2011, August) makes the player recognizable and valuable not only for his/her achievements, but also for the opportunity to become a guide and mentor to other less skilled or less experienced players (beat the game better than others do to acquire the expertise and "status" to guide them). From this perspective, mastering a game becomes a bridge between learning the strategies to beat the game and teaching these strategies to others.

By participating synchronously and asynchronously in digital games and gaming affinity spaces, players can learn from each other as apprentices (Lave, 1996; Rogoff, 1995), through a dynamic form of reciprocal apprenticeship, exploring creative solutions to problems, negotiating worldviews, and socially constructing skills and knowledge. In apprenticeship settings (Rogoff, 1990, 1995), novices work on tasks that are beyond their existing skills along with experts (or more knowledgeable others) to achieve common goals, thus learning new skills, processes, and "hidden rules" necessary to successfully perform the intended work. This social activity, which reflects Vygotsky's theory of the zone of proximal development (Vygotsky, 1978), allows users to develop a shared and experiential understanding of problems, procedures, and solutions in a situated, authentic, and culturally-relevant setting. Given the complexity and depth of several digital games, peer

collaboration (Bruner, 1984; Slavin, 1995) can help users master games and game design strategies by reducing the cognitive load and facilitating the achievement of goals through a shared effort (Kirschner, Paas, & Kirschner, 2009). Through their openness and focus on participants' interests and passions, affinity spaces are ideal hubs for peer learning, sharing, and collaboration.

5. Playful Constructivism

The conceptual framework and theoretical model put forth in this article is defined as Playful Constructivism. Its purpose is to provide an interpretative and actionable tool for scholars, practitioners, and students to better understand digital games in learning and creative contexts through the dimensions of play, design, and participation (Fig. 5).

Figure 5: Playful Constructivism: Play, design, and participation

This framework and model is grounded on the learning theories of Situated Cognition, (Social) Constructivism, and Constructionism, discussed in previous sections in relation to digital games, game design, and affinity spaces, and it highlights their interconnectedness. A situated and social-constructivist approach to digital games for learning and creativity assumes that

> not only does knowledge exist in individual and socially negotiating minds, but it also exists in the discourse among individuals, the social relationships that bind them, the physical artifacts that they use and produce, and the theories, models, and methods they use to produce them. (Jonassen & Land, 2000, p. vi)

Digital games, as systems, models, and microworlds, provide a playful and participatory environment open to exploration, manipulation, and modification, within and beyond the boundaries of the game. The playful element that emerges from playing and designing digital games contributes to unpredictable, lateral, imaginative, and creative thinking (Resnick, 2003, 2004). The process of programming, modding, or editing digital games engages users in creative and participatory activities that transform personal and social meanings into concrete artifacts that can be shared, played, and critiqued with others. By exploring and contributing to shared interests and resources, collaborating with peers, and learning from each other, participants negotiate interest-driven ideas, roles, and identities through playful and design-oriented participation in games and affinity spaces. Playing, designing, programming, discussing, and critiquing interactive artifacts, individually, with others, and for others, opens up possible identities, worlds, and futures, which reflects the idea of digital games as "possibility spaces" (King, 2011; Squire, 2011).

Researchers can use the proposed model to identify delimited areas of interest related to digital games, or study their connections and intersections. For example, scholars may explore the construct of "playful participation," looking into the social interactions and discourses engendered by games, or analyze how "playful design" (e.g., design practices stimulated by tools and affordances embedded in a gaming environment) differs from the design of games (e.g., the work of professional game designers). Considering these two examples, other scholars may examine, compare, and contrast how learning is constructed in such environments and how it may be transferred from one setting to another. Further, the categories illustrated in the model may also be used as focal points for literature reviews and meta-analyses. More broadly, the model is meant to highlight the interconnectedness of game-related dimensions that need to be considered when working with games for learning. Further, the proposed framework can guide researchers, practitioners, and students in the interpretation and analysis of digital games, game design tools, and game-inspired communities, in both physical and online settings.

Practitioners can benefit from the model as an introductory guide to make sense of different dimensions related to digital games in educational contexts. The model can also function as a tool to evaluate games for learning or to design activities that revolve around games, such as writing about a game in an online affinity space, analyzing what features make a game a system, a model, or a microworld, or applying the construct of "playfulness" to design participatory activities. In this context, students may use the model to deconstruct different kinds of games into discrete components in order to better understand their complexities and functionalities. The dimensions and categories included in the model may also be used to develop rubrics for the assessment of student-generated games in educational and training settings. Journalists, bloggers, and enthusiasts may use such categories to review educational games and game-based activities for learning.

Game designers, both professional and non-professional, can use the model as a blueprint for the inclusion/exclusion, extension/limitation, and integration/separation of specific characteristics of a game, considering how one feature can potentially influence another. The conceptual model outlined in this paper may also benefit game designers by helping them reflect on the affordances of their creations, beyond gameplay, game mechanics, and game dynamics, to include, for example, editing tools that are both playful ("playful design") and participatory ("design-oriented participation"). In other words, the model stimulates game designers to consider digital games in their expanded, organic, and social dimensions. Further, the model is grounded in theories of learning such as Constructivism and Constructionism, which can spur game designers to consider the educational potential of their interactive products. Moreover, the model suggests that an educational use of *any* digital game may be just "one feature away" from the intended design, even in games that are not primarily conceived for education.

In conclusion, Playful Constructivism offers an integrated and holistic approach to digital games through the interconnected dimensions of play, design, and participation. In its concise and graphical form, it is aimed at a broad audience interested in innovative practices with digital games in learning and creative contexts.

References

Abt, C. C. (1970). *Serious games*. New York: Viking Press.

Ackermann, E. (2001). *Piaget's Constructivism, Papert's Constructionism: What's the difference?* Retrieved from http://learning.media.mit.edu/content/publications/EA.Piaget%20_%20Papert.pdf

Anderson, J. R., Reder, L. M., & Simon, H. A. (1996). Situated learning and education. *Educational Researcher, 25*(4), 5-11.

Banks, J., & Bowman, N. D. (2016). Avatars are (sometimes) people too: Linguistic indicators of parasocial and social ties in player–avatar relationships. *New Media & Society, 18*(7), 1257-1276. doi:10.1177/1461444814554898

Barab, S. A., Dodge, T., Ingram-Goble, A., Pettyjohn, P., Peppler, K., Volk, C., & Solomou, M. (2010). Pedagogical dramas and transformational play: Narratively rich games for learning. *Mind, Culture, and Activity, 17*(3), 235-264.

Bennahum, D. (1998). *Extra life: Coming of age in cyberspace*. New York: Basic Books.

Bergstrom, K., Jenson, J., Hydomako, R., & de Castell, S. (2015). The keys to success: Supplemental measures of player expertise in Massively Multiplayer Online Games. *Journal of Gaming & Virtual Worlds*, *7*(1), 101-121.

Bredo, E. (1997). The social construction of learning. In G. Phye (Ed.), *Handbook of academic learning: The construction of knowledge* (pp. 3-45). New York: Academic Press.

Bruner, J. S. (1984). Vygotsky's zone of proximal development: The hidden agenda. In B. Rogoff & J. V. Wertsch (Eds.), *Children's learning in the "zone of proximal development"* (pp. 93-97). San Francisco, CA: Jossey-Bass.

Caillois, R. (1961). *Man, play and games*. New York: The Free Press.

Carbonaro, M., Cutumisu, M., Gillis, S., Onuczko, C., Schaeffer, J., Schumacher, A., Siegel, J., Szafron, D., & Waugh, K. (2006). Adapting a commercial role-playing game for educational computer game production. In *Conference Proceedings, GameOn North America, Monterey, CA* (pp. 54-61).

Cazden, C. (1981). Performance before competence: Assistance to child discourse in the zone of proximal development. *Quarterly Newsletter of the Laboratory of Comparative Human Cognition 3*(1), 5-8.

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers & Education*, *59*(2), 661-686. dx.doi.org/10.1016/j.compedu.2012.03.004

Crawford, C. (1984). *The art of computer game design. Reflections of a master game designer*. New York: McGraw-Hill.

Crawford, C. (2005). *Chris Crawford on interactive storytelling*. Berkeley, CA: New Riders Games.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience*. New York: Harper & Row.

diSessa, A. A. (2000). *Changing minds: Computers, learning, and literacy*. Cambridge, MA: MIT Press.

Driscoll, M. (2005). *Psychology of learning for instruction* (3rd ed.). Boston: Pearson.

Duncan, S. C. (2010). Gamers as designers: A framework for investigating design in gaming affinity spaces. *E-Learning and Digital Media, 7*(1), 21-34.

Duncan, S. C. (2012). Kongregating online: Developing design literacies in a play-based affinity space. In E. R. Hayes & S. C. Duncan (Eds.), *Learning in video game affinity spaces* (pp. 51-83). New York: Peter Lang.

Durga, S. (2012) Learning to mod in an affinity-based modding community. In E. R., Hayes & S. C. Duncan (Eds.), *Learning in video game affinity spaces* (pp. 84-102). New York: Peter Lang.

Gadamer, H. -G. (1989). *Truth and method* (2nd ed.). London: Sheed & Ward.

Gee, J. P. (2004). *Situated language and learning: A critique of traditional schooling*. New York: Routledge.

Gee, J. P. (2005). Semiotic social spaces and affinity spaces. In D. Barton, & K. Tusting (Eds.), *Beyond communities of practice language power and social context* (pp. 214–232). Cambridge, UK: Cambridge University Press.

Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (2nd ed.). New York: Palgrave Macmillan.

Gee, J. P. (2012). Afterword. In E. R. Hayes & S. C. Duncan (Eds.), *Learning in video game affinity spaces* (pp. 235-41). New York: Peter Lang.

Hainey, T., Connolly, T. M., Boyle, E. A., Wilson, A., & Razak, A. (2016). A systematic literature review of games-based learning empirical evidence in primary education. *Computers & Education, 102*, 202-223. doi:10.1016/j.compedu.2016.09.001

Harel, I., & Papert, S. (Eds.). (1991). *Constructionism*. Norwood, NJ: Ablex Publishing Corporation.

Hayes, E. R., & Duncan, S. C. (Eds.). (2012). *Learning in video game affinity spaces*. New York: Peter Lang.

Hayes, E., & Games, I. A. (2008). Making computer games and design thinking: A review of current software and strategies. *Games and Culture, 3*(1), 309-332.

Huizinga, J. (1949). *Homo ludens: A study of the play element in culture*. London: Routledge & Kegan Paul. (First published in 1938).

Jenkins, H. (2006). *Convergence culture*. New York: New York University Press.

Jenkins, H., Purushotma, R., Weigel, M., Clinton, K., & Robison, A. J. (2009). *Confronting the challenges of participatory culture: Media education for the 21st century*. Cambridge, MA: MIT Press.

Jonassen, D. H., & Land S. M. (2000). *Theoretical foundations of learning environments*. Mahwah, NJ: Lawrence Erlbaum Associates.

Kafai, Y. B. (1995). *Minds in play: Computer game design as a context for children's learning*. Mahwah, NJ: Lawrence Erlbaum Associates.

Kafai, Y. B. (2006). Playing and making games for learning: Instructionist and constructionist perspectives for game studies. *Games and Culture, 1*(1), 36-40.

Kafai, Y. B., & Resnick, M. (Eds.). (1996). *Constructionism in practice*, New York: Laurence Erlbaum Associates.

King, E. (2011). Possibility spaces: Using The Sims 2 as a sandbox to explore possible selves with at-risk teenage males. *International Journal of Game-Based Learning (IJGBL)*, *1*(2), 34-51.

Kirschner, F., Paas, F., & Kirschner, P. A. (2009). A cognitive load approach to collaborative learning: United brains for complex tasks. *Educational Psychology Review, 21*(1), 31-42.

Lave, J. (1996). Teaching, as learning, in practice. *Mind, Culture, and Activity, 3*(3), 149-164.

Lévy, P. (1997). *Collective intelligence*. New York: Basic Books.

Marone, V. (2011). I play, therefore I create: Constructionist video games for empowered communities of learners. In D. Gouscos & M. Meimaris (Eds.), *Proceedings of the 5th European Conference on Games Based Learning. The National and Kapodistrian University of Athens, Greece, 20-21 October 2011* (pp. 710-716). Reading, UK: Academic Conferences International Limited.

Marone, V. (2015a). From discussion forum to discursive studio: Learning and creativity in design-oriented affinity spaces. *Games and Culture, 10*(1), 81-105.

Marone, V. (2015b). Online humour as a community-building cushioning glue. *The European Journal of Humour Research, 3*(1), 61-83.

Minsky, M., & Papert, S. (1971). *Progress report on artificial intelligence*. Retrieved from http://web.media.mit.edu/~minsky/papers/PR1971.html

Mortensen, T. E., Linderoth, J., & Brown, A. M. (Eds.). (2015). *The dark side of game play: Controversial issues in playful environment*. New York: Routledge.

Murray, J. (1997). *Hamlet on the Holodeck: The future of narrative in cyberspace*. New York: The Free Press.

Papert, S. (1980). Computer-based microworlds as incubators for powerful ideas. In R. Taylor (Ed.), *The computer in the school: Tutor, tool, tutee* (pp. 203-210). New York: Teacher's College Press.

Papert, S. (1981) *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Papert, S. (1991). Situating constructionism. In I. Harel & S. Papert (Eds.), *Constructionism* (pp. 1-11). Norwood, NJ: Ablex Publishing Corporation.

Pearce, C. (2009). *Communities of play: Emergent cultures in multiplayer games and virtual worlds*. Cambridge, MA: MIT Press.

Poole, S. (2000). *Trigger happy: Videogames and the entertainment revolution*. London: 4th Estate.

Puentedura, R. R. (2009). *Game and Learn: An Introduction to Educational Gaming.* Retrieved from http://hippasus.com/rrpweblog/archives/000039.html

Resnick, M. (1994). *Turtles, termites, and traffic jams: Explorations in massively parallel microworlds*. Cambridge, MA: MIT Press.

Resnick, M. (2003). Playful learning and creative societies. *Education Update, 8*(6). Retrieved from http://web.media.mit.edu/~mres/papers/education-update.pdf

Resnick, M. (2004). Edutainment? No thanks. I prefer playful learning. *Parent's Choice. Children's Media and Toy Reviews*. Retrieved from http://www.parentschoice.org/full_abstract.cfm?art_id=172&the_page=consider_this

Resnick, M. (2008). *StarLogo TNG*. Cambridge, MA: Media Laboratory and Teacher Education Program, MIT. Retrieved from http://web.mit.edu/mitstep/starlogo/gettingstarted/getting_started.html

Resnick, M., Maloney, J., Monroy-Hernandez, A., Rusk, N., Eastmond, E., Brennan, K., . . . Kafai, Y. (2009). Scratch: Programming for all. *Communications of the ACM,* 52, 60-67.

Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in the social context*. New York: Oxford University Press.

Rogoff, B. (1994). Developing understanding of the idea of communities of learners. *Mind, Culture, and Activity, 1*(4), 209-229.

Rogoff, B. (1995). Observing Sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In J. V. Wertsch, P. Del Rio, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 139-164). New York: Cambridge University Press.

Salen, K., & Zimmerman, E. (2003). *Rules of play. Game design fundamentals*. Cambridge, MA: MIT Press.

Schwarz, B. B., & Hershkowitz, R. (2001). Production and transformation of computer artifacts toward construction of meaning in mathematics. *Mind, Culture, and Activity, 8*(3), 250-267.

Seely Brown, J., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Slavin, R. E. (1995). *Cooperative learning* (2nd ed.). Boston: Allyn & Bacon.

Sylvan, E. A. (2007). *The sharing of wonderful ideas: Influence and interaction in online communities of creators*. Unpublished doctoral dissertation, MIT (Massachusetts Institute of Technology). Retrieved from https://dspace.mit.edu/handle/1721.1/42404

Squire, K. (2006). From content to context: Video games as designed experiences. *Educational Researcher, 35*(8), 19-29.

Squire, K. (2011). *Video games and learning. Teaching and participatory culture in the digital age*. New York: Teachers College Print.

Steinkuehler, C. A. (2006). Massively multiplayer online video gaming as participation in a Discourse. *Mind, Culture, and Activity, 13*(1), 38-52.

Steinkuehler, C. A., & Johnson, B. Z. (2009). Computational literacy in online games: The social life of a mod. *The International Journal of Gaming and Computer Mediated Simulations, 1*(1), 53-65.

Suits, B. (1978). *The grasshopper*. Toronto: University of Toronto Press.

Taylor, N., de Castell, S., Jenson, J., & Humphrey, M. (2011, August). Modeling play: re-casting expertise in MMOGs. In *Proceedings of the 2011 ACM SIGGRAPH symposium on video games* (pp. 49-53). ACM.

Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes* (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds.). Cambridge, MA: MIT Press.

Wallace, C. (1988). *Learning to read in a multicultural society: The social context of second language literacy*. New York: Prentice Hall.

Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. Cambridge, UK: Cambridge University Press.

Whitton, N. (2014). *Digital games and learning: Research and theory*. New York: Routledge.

Wilensky, U. 1999. *NetLogo*. Evanston, IL: Center for Connected Learning and Computer-Based Modeling, Northwestern University. Retrieved from http://ccl.northwestern.edu/netlogo