Chapter 15
Problem Solving Through Video Game Creation

Research, Models, and Implications of Video Game Design

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Abstract This chapter explores changing conceptions of learning brought about by technological changes and opportunities and examines more closely the potential of video game creation as a way to teach problem solving. A general background on video games for education is provided, followed by how video games teach problem solving skills. Problem solving skills are then examined in the context of game design with three empirical studies using three different models discussed. Each study explores how problem solving opportunities are presented, the properties of the models, and implications for game creation as a curricular enhancement. Four design models are analyzed for problem solving considerations and to conclude, implications for game design in education and future directions of problem solving through video game creation are examined.

Keywords Problem solving • Video game design • Learning

15.1 Introduction

In the United States alone there are more than 183 million active gamers (McGonigal, 2011). More than half the population of the United States log onto virtual worlds to plan virtual battles, engage in virtual conversations, save virtual damsels in distress, and wage virtual war against inequalities like famine and poverty. Is spending hours immersed in the virtual world of video games a waste of time? What can video games offer that the real world doesn't and how can we link the two? Video games "fulfill genuine human needs" (McGonigal, 2011, p. 4) and teach, engage, and bring together diverse populations to complete missions that save virtual worlds. We can

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take the immersive power of video games and turn it to solving real world problems that affect millions on a daily basis and the first step on this journey is understanding how problem solving can be taught with video game creation as a twenty-first century curricular model.

This chapter explores changing conceptions of learning brought about by technological changes and opportunities these afford. In this chapter the understanding of video game creation as it relates to learning, specifically problem solving, through critical analysis of current research is discussed in reference to twenty-first century skills. Video games are a powerful learning tool (Bogost, 2007; Gee, 2003) and the learning involved with video game playing and creation using curricular models is examined. Additionally, operational and critical aspects of problem solving, game design models, and tools specifically designed to teach video game creation are critically examined.

Designing and creating video games is a reality for some students in classes looking to relate to the Net generation. One of the most important issues in designing video games is to facilitate reflection and critical thinking while learning, and still create enjoyable games (Prensky, 2001, 2006). In this chapter three cases are discussed in relation to using game design as a teaching tool for problem solving. Moreover, this chapter discusses how different design models teach problem solving through phases of game creation and their relation to twenty-first century curricular models.

15.2 Background

The term "video game" has an elusive and highly contested definition within the field of education. While there are many varieties of video games it is widely recognized that all games have the following characteristics to a certain degree: story; gameplay; sound; interface; and graphics (Robertson, 2011). Given the complexity of these overlapping components, it is easy to see video game design and creation as a rich potential for learning. Learning itself is a complex term to define, and for the purposes of this chapter "learning" encompasses activities that enable people to acquire and apply new knowledge, to adapt to changes and challenges, make choices, and most importantly solve problems to create new learning opportunities. Learning is most commonly gained by experience or instruction.

Video games support learning by providing opportunities for exploring and manipulating virtual objects. Educational technologists such as Jonassen (2000) and Jonassen, Howland, Moore, and Marra (2003) applied these learning theories to the implementation of educational technologies. Jonassen concentrated on the use of technology to support intentional rather than incidental learning. Currently there is little argument that a great deal of incidental learning takes place in video games (this is the presumption behind the fear that video games will make children more violent); it may also be possible to employ the technologies of video games to increase and measure intentional learning in formal learning institutions, as Jonassen employed the incidental learning that occurs when browsing the internet for intentional purposes. There is a breadth of literature on the use of video games in education. Prensky (2001, 2006) demonstrated how video games are being used for training in the corporate and military spheres; moreover, he explained to parents and teachers what students can learn from several genres of video games. Gee (2003, 2007) explored 36 principles of learning that good games embody that many classrooms lack. Furthermore, he discussed ways in which video games could be better for student's academic performance than traditional teaching methods. Aldrich (2005) focused on the benefits of simulations and built a simulation to help players develop leadership. Shaffer (2006) conducted research to help students develop new identities using games and simulations, focusing on professional identities that involved innovative ways of thinking. Moreover, there have also been dissertations dedicated to examining learning in video games. For example, Squire (2004) researched the use of *Civilization III* with high school students, and Steinkuehler (2006a) explored the learning by apprenticeship that happens in massively multiplayer online role-playing games (MMORPGs).

The increasing popularity of video games, combined with the learning potentials of gameplay, has led to educational systems implementing the inclusion of technologies, such as video games into the classroom from elementary to post-grad. Just as we are redefining what it means to learn through video games (Gee, 2003; Steinkuehler, 2006b), we are also redefining what it means to be a gamer, with baby boomers and middle age executives engaged in video games like Sudoku (Cummings & Vandewater, 2007; Morris, 2006). Currently video games can be played on computers, cell phones, PDAs, smart phones, newspapers, schools, adult training courses, iPads, and tablets (Lopez, Harris, Moses, & Williams, 2007; Robinson & McNellis, 2011) Research on media has found that 90 % of US households with children had rented or owned a video game (Cummings & Vandewater, 2007), while other studies have shown that children are not the only demographic interested in games. A 2008 Pew study found that 53 % of Americans age 18 and older play video games and about 1 in 5 (21 %) play everyday or almost everyday, while a 2011 study found that over half of adult cell phone owners have game applications on their devices and 63 % of adults age 18–46 own a game console (Zickhur, 2011).

Video games are an important part of our social climate (Aldrich, 2005; Bogost, 2007; Gee, 2003; Lenhart et al., 2008). From daily interactions on *Facebook* applications to international gaming tournaments involving thousands, video games have become a substantial part of current society. Playing games can impart information and teach skills (Gee, 2003; Jonassen, 2000; Jonassen et al., 2003; Papert & Harel, 1991; Prensky, 2006; Shaffer, 2006; Squire, Barnett, Grant, & Higginbotham, 2004) in the cognitive (e.g., content knowledge) and psychomotor (e.g., hand eye coordination) domain. Moreover, these sometimes simple games, often browser-based and free, are constructed to engage the audience in interactive, digital representations of real world problems. Typically, the impetus behind these games, and the intended outcome of gameplay, is to urge users to learn about, be attentive to, and act responsibly regarding the topic. With over 97 % of US adolescents reporting that they play everyday (Lenhart et al., 2008), video games are a high interest media that allow learners to experience virtual problem solving.

15.3 Video Game Play and Problem Solving

Video game play, design, and creation provide spaces for powerful and meaningful learning through problem solving. In 2010, world-renowned video game academic Jane McGonigal told Technology Entertainment and Design (TED) audiences that, "playing games can change the world" (McGonigal, 2010). She went on to detail that games could bring us together as a civilization, encourage social cultures, and solve worldwide problems. Games have been helping people and animals practice both survival and practical skills for millennia (Huizinga, 1955) and have moved from the purely physical domain to the virtual one in recent years. The advent of affordable home computers as productivity and entertainment systems has led to a boom in the video game industry with more than 183 million Americans playing video games daily (McGonigal, 2011). The affordances for games to help students learn are evident in the claims made by proponents about what games can do for people and in larger terms for society. Simply put, games are idea changers that can manifest psychological and physiological realities (Foster & Mishra, 2009; Mishra & Foster, 2007).

The affordances for games to help students problem solve are evident in the claims made by proponents about what games can do for people and in larger terms for society. An example of this is the *Bronchi the Brachiosaurus* study (Lieberman, 2001) where young children with asthma learned rescue asthma skills on a computer game and were able to retain the skills they had virtually practiced and discuss the implications of knowing those skills. Another example of a problem solving game is EVOKE (2010), developed as a crash-course in changing the world. While no empirical study has been published on the EVOKE movement, it was created by Jane McGonigal (2010) to showcase "the kind of resourceful innovation and creative problem solving that is happening in sub-Saharan Africa to collectively imagine how the lessons from those scenarios can transfer, scale, and ultimately benefit the entire planet" (EVOKE, 2010, para. 2). Changing the world is achieved through virtual teamwork on challenges that range from providing fresh water to creating bank schemas for small business owners. Teams worked together for 9 weeks, creating scalable possibilities with real data. Unlike other games that focus on winning, EVOKE focused its players on the opportunities that they could create using shared knowledge.

Games with clear problem solving goals have explicit content. One example of this is *Sim City*, a computer game in which the player is the creator of a city that they build from the ground up. The player sets the taxes, decides on the type of industry available, develops strategies for city growth, and must consider their approval ratings. By developing their city, players learn to respond to citizen demands with caution, balance the city budget, and deal with emergencies such as fires, job shortages, and educational reform. Another example of a game with specific content in relation to problem solving is *Civilization IV*, a popular video game readily available both online and in stores. Players in this game begin with an undeveloped piece of land that had a small group of settlers. They play the overall leader and have to make decisions about how to build a city, where to scout for resources, and how to develop protectors for the city. The game is linear and players begin in the Stone Age and move to the twenty-first century. As time goes on they have to make decisions that affect the civilization as a whole such as introducing reading, what religion to choose, and use of new tools such as the printing press or medicines. Throughout this process players have a chance to learn not only about the civics of leading a civilization but also the dynamics of economic, political, and legal systems. Engaging in these learning opportunities allows players to practice and develop problem solving skills in a specific context (Robertson, 2011). The nature and design of a good game experience although are not the sole domain of professional game designers, students can engage in game design and learn problem solving skills.

15.4 Problem Solving Opportunities from Video Game Creation

Game design has increasingly been used to engage students in various subject matter learning such as computer science, teacher education, and professional development. There are many claims about the benefits of using games in education including how game design can promote problem solving skills. Given the high interest in video games and the ability to create games aimed at promoting any agenda, plus the availability of game creation software, learners creating their own games to enhance problem solving skills has begun to appear in recent literature on learning design. Recent studies have found that adolescents who learn to develop their own video games learn skills such as problem solving and team work in conjunction with higher order thinking skills like analysis and processing (Hong, Fadjo, Chang, Geist, & Black, 2010; Ormsby, Daniel, & Ormsby, 2011; Robinson & McNellis, 2011). However, participation in game design does not automatically lead to better learning outcomes overall. The educative values of game design can only be realized when it is appropriately developed according to pedagogical goals and characteristics of the learner. Thus, to more effectively use game design as a way to teach problem solving, we need to have a deeper understanding of the key components of effective game-design learning environments as well as the problem solving processes triggered by game design.

15.4.1 Rationale for Change

From a constructivist perspective, there are theoretical reasons for believing that creating video games can be academically beneficial. Kafai (2006) argued that when making games, learners also construct knowledge and their relationship to it.

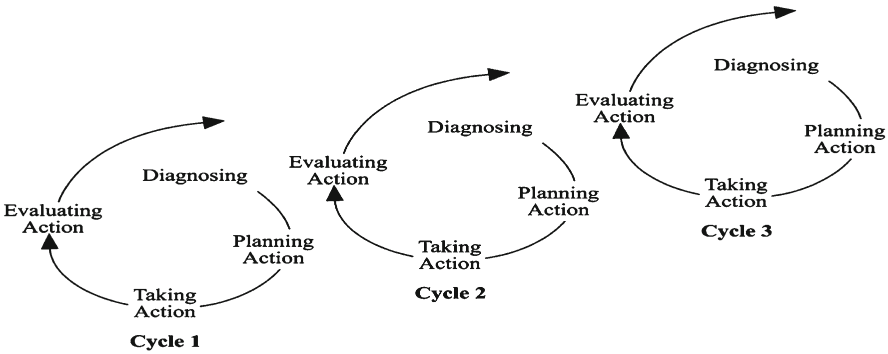
She goes on to describe that the learner is involved in all design decisions and begins to develop technology fluency. The fluency that develops in technology involves not only knowing how to use new technological tools, but also knowing how to make things of significance with those tools. This encourages development of new ways of thinking based on the use of those tools thereby promoting problem solving skills (Good, 2011; Robertson, 2011). As technology has moved to Web 2.0 tools, 3D graphics, and open source, computing opportunities have also arisen to develop problem solving skills and new media literacy through game creation. In the last 25 years, notions of media literacy have developed beyond the written word, moving more toward the visual (Buckingham & Burn, 2007; Jewitt, 2008). Theorists have highlighted the differences between traditional problem solving skill building through potential nonlinear visual, audio, and moving image elements as well as the written word. A major challenge in the use of game design to teach problem solving skills is that compared with other multimodal texts, computer games offer added complexity for both player and designer, including the challenge that the player (and what the designer must accommodate) can travel around the world of text and experience it from more than one visual, spatial, and textual perspective.

The process used by learners to create video games is important because it can assist in understanding variations in the game product and skills needed to make game design a successful part of the curriculum. Game creation is a complex design task. Game creation has the potential for learners to exercise a wide spectrum of skills such as devising game rules, creating characters, visual design, programming, and creating content. It is also authentic because making the game actively engages learners in a "mental workout" where they are faced with a stream of both long- and short-term decisions and must plan problem solving strategies which involve monitoring a series of complex tasks (Robertson, 2011; Robertson & Howells, 2008). Unlike passive learning where the teacher presents information to the students, game creation allows the students to engage in learning by probing, hypothesizing, reprobing, and rethinking (Gee, 2003). Throughout this cycle the learner is engaging in reflection where he or she thinks about the effect their design choices have on the game world, the content, and the underlying rule structure. Recent studies (Good, 2011; Robertsson, 2012; Vos, van der Mejiden, & Denessen, 2010) indicate that creating games is motivating, bolsters esteem, and develops technical programming skills as well as storytelling.

Game creation can be seen as a type of user-generated content, which is created and published by end users rather than media companies. Used in a learning context, these types of activities can empower learners by enabling them to express their creativity and share it with a real audience. However, the activity of game design and creation is more complex than publishing in other media because it involves the creation of an interactive element. Designing digital content that responds to user input through a series of rules requires specification of conditions, sequences of behaviors, and overall consequences. These rules are not always obvious to the novice game designer and require instruction to be implemented correctly. In the following three subsections empirical studies are discussed that analyze learning these rules and problem solving skills through game creation.

15.4.2 Game Design as a Compelling Learning Experience

Qui and Zhao (2009) explored the nature and design of game as a compelling experience. Thirty-six college juniors in the software engineering program participated in a semester-long project to design games for Chinese language learning using design-based research (DBR). The DBR paradigm enabled the researchers to create productive learning conditions and localized principles for others to apply to new settings. The project was designed to help engineering students understand educational and other issues in designing educational games.

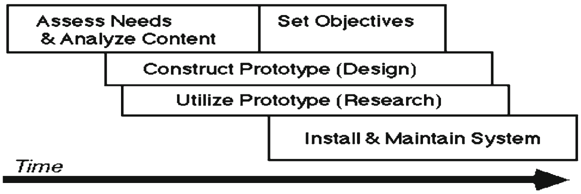


Design-based research paradigm demonstrating the iterative process of action and reflection

Qui and Zhao (2009) show that game design expanded students' perceptive capacity; enhanced their subject matter understanding, problem solving skills, meta-learning ability, and motivation; and facilitated students' reflection on themselves as well as their environments. Factors that affect the success of game design as a way to teach problem solving include authenticity, clear goals, dialogue, collaboration, and formative evaluation. Implications that can be drawn from this research are twofold; there are technological aspects and learning aspects. Technology wise, students mastered the two skills of problem solving and support seeking, as intentionally designed by the instructor. Without much structured help on the technical issues from the instructor, students developed problem solving skills by actively participating in broader social networks, seeking group support, and using internet resources. Learning implications focused on learning new skills as the students worked on the project. Adaptability and problem solving skills were seen in how students learned to identify their skill gaps and build up individualized learning plans to close those gaps. The reflection on their own learning processes led students to rethink their design knowledge, learning, and career preparation in a larger context.

15.4.3 Preservice Computer Teachers as 3D Educational Game Designers

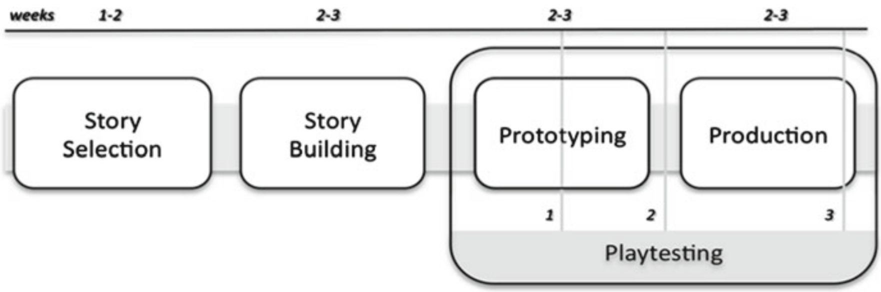
Yildirim and Kilic (2009) explored the prospective computer teachers' perceptions of and experience in goal-based scenario (GBS)-centered 3D educational game development process. Twenty-six preservice computer teachers enrolled in a Design, Development and Evaluation of Educational Software undergraduate course were a part of this case study and they, in groups, developed 3D educational games. The researchers qualitatively evaluated data through evaluation checklists, interviews, and formative tests. The findings indicated that the preservice teachers preferred the GBS-centered games to traditional games. The most important feature of educational games to the preservice teachers was their contribution to motivation, attention, and retention. Difficulties occurred for the preservice teachers in creating realistic scenarios and missions. Students went through design, development, and evaluation processes of effective educational software and used the Rapid Prototyping Model (Tripp & Bichelmeyer, 1990) in the development process. 3D games include clear and realistic goals, immediate feedback, and challenging missions. Designing the game was seen as a lesson in problem solving for the participants. As most of the participants in this study become computer teachers or work as instructional designers after graduating, their learning throughout this process may cause them to be more critical of the games created. Preservice computer teachers were exposed to game creation that may be carried to their future positions and possibly help a new generation of practitioners to recognize the value of game creation as a curricular tool.



Rapid prototyping model used to create the educational games

15.4.4 Game Design as a Model for Professional Development

Halverson, Blakesly, and Figueiredo-Brown (2011) examine how video game design can be structured to facilitate professional learning through a project titled Interactive Case for School Leadership (ICSL). They developed a five-step ICSL design process to structure the learning environment.



ICSL five-step design process

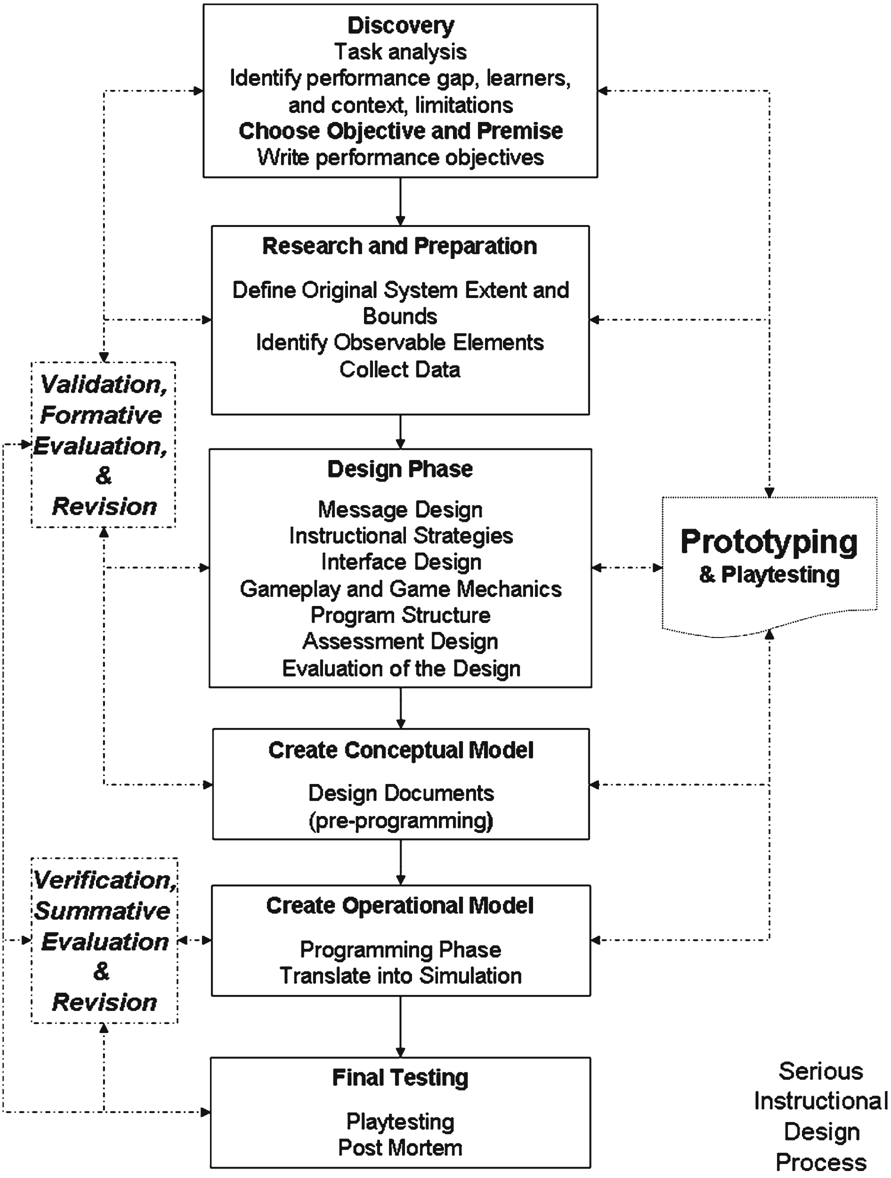
Two graduate level classes in Educational Leadership served as the participants for a study on how to feasibly implement game design as a scalable model for professional learning while using common technologies. Researchers provided templates for organizing student activities, elicited the requisite expertise to develop and test emergent game designs, and regularly assessed student learning using purpose built measures. Students followed a five-step plan (ICSL five-step design process) involving topic selection, narrative development, scripting an interactive narrative, playtesting, and postproduction activities. Students were able to use the ICSL design to integrate theory and practice while producing playable, reusable learning games. Halverson, Blakesly, and Figueiredo-Brown found that students were able to use problem solving skills to complete the game creation process by basing the process of video game design in the wider context of DBR (Barab & Squire, 2004). This study specifically focused on building branching narrative games for professional learning (i.e., interactive virtual fiction games). The researchers faced some problems in engaging students in an educational leadership class in game design and the game creation project. Another problem was that few students had any experience with technology design and so the game design process was confined to using PowerPoint with hyperlinking connections across slides to simulate a branching narrative game environment. Findings indicate that game creation provided opportunities for learners to test theoretical concepts in multiple, plausible, and relevant ways. The ICSL modeled detailed ways to scale back the technical requirements of game creation while still providing students the opportunity to make playable learning experiences. The researchers found that most students thought the game design project challenging but reported high satisfaction and enthusiasm at the end of the semester. Implications for this research are that game design activities have a place in professional development. Game creation enables students to generate and use feedback, develop problem solving skills, and engage throughout the design process.

15.5 Game Design Models with Problem Solving Elements

With the invention of interactive and networked tools for video game creation, the capability now exists for designers of all competencies and ages to create video games. Educational research scholars have linked a range of positive learning outcomes to learner participation in game-making activity across time. These outcomes include increased engagement, motivation, and meaning-making, as well as systems-oriented thinking and computational skills (Robertson (2011) and Robertsson (2012)). However, without frameworks and game design models to lay theoretical and practical background for game creation curricula, these outcomes remain nebulous in the academic world. There are game design models and instructional design models that have increased the technological opportunities for using game creation to teach problem solving. Three models are discussed below that have been proposed as ways to design and create video games.

15.5.1 Serious Instructional Design Process

Becker and Parker (2011) developed the Serious Instructional Design Process as a synergy between the simulation, game, and instructional design processes. Becker and Parker write, "Often, a commercial game design is built up from a single core idea—something (either some activity or some premise) the designer finds amusing or entertaining. Simulations on the other hand are built up to answer a question (or series of questions in a coherent domain), and educational interventions are built up from identified performance gaps" (Becker & Parker, 2011, p. 3). This synergistic compilation between simulation, game, and instructional design models demonstrates key considerations of all three design disciplines that can be uniquely adapted to teaching problem solving through game design. To start the discovery phase is meant to encompass the needs analysis and the choice of the objective. Second, the research and preparation phase focuses on collecting data from other games or simulations and deciding on what is relevant to the instructional goals. The design phase is where the simulation or game is created, maintaining the connection between the overarching goals with the gameplay. In the conceptual model phase the designer is forming the primary delivery method and problem finding and solving for the design process should be complete. The outcome of this phase is the design document for the next two phases. The operational model phase consists of creating a working prototype and playtesting it with users. Given feedback, the designer then revises and completes the final product. A key feature of this model is that validation and evaluation occur at every phase as well as prototyping. When using this model to teach problem solving, an instructor can use this process with simulation, instructional, or game design. If learners are novices in design, there will need to be scaffolding throughout the process in order to ensure success throughout the process.

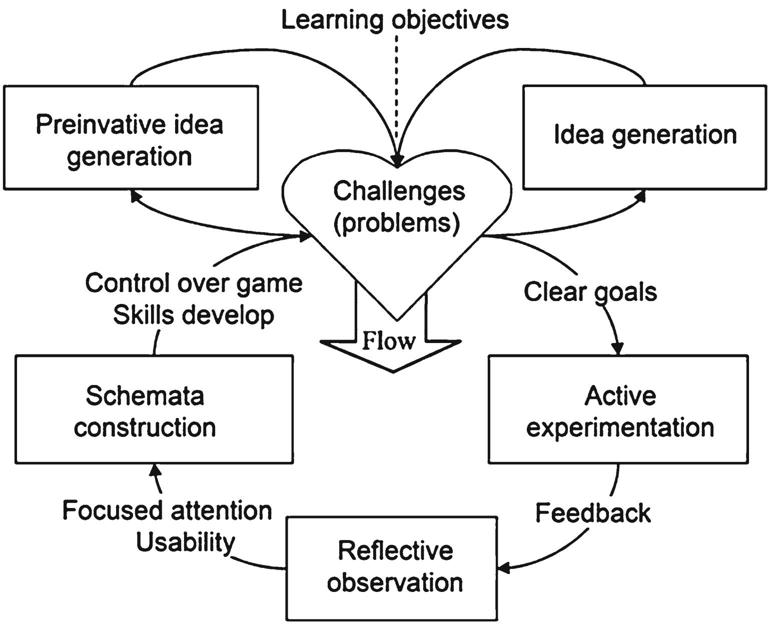


Serious instructional design process featuring game, simulation, and instructional design features

15.5.2 Experiential Game Design Model

Killi (2005) designed the Experiential Game Design Model as both constructivist and pragmatist learning, focusing on both cognitive and behavioral learning. This model can be used to design and analyze games with challenge featured as the central problem solving skill. Killi merges game design with educational theory and has also included theories related to motivation in game design. This circular process involves a set of three interconnected loops that focus on the challenges derived from learning objectives driving the game creation process. In order to increase motivation (flow) game designers are directed to have clear goals that lead to active experimentation, and with feedback from playtesting, create a schematic to develop the game.

Unlike the other models discussed herein, the Killi (2005) model does not include phases on the programming or evaluation of the game. Instructors using this game design model for novice game designers should note that this model focuses on the creation of game design documents. These documents are focused on learning objectives rather than the complete process of creating a game from concept to product.



Experiential game design model focusing on both game design and analyzing game features

15.5.3 Video Game Design (Crawford, 1982)

Designing a video game involves more than wrapping instruction in a game, and that game cannot be seen as merely the truck that carries and delivers the instruction. Game design is a highly complex process, and in the model proposed by Chris Crawford in his 1982 book, The Art of Computer Game Design, he outlines seven main phases in the design process:

- Choose a goal and topic
- Research and prepare
- Design
  - Interface
  - Gameplay and mechanics
  - Structure
  - Evaluation of the design
- Preprogramming phase
- Programming phase
- Playtesting phase
- Postmortem

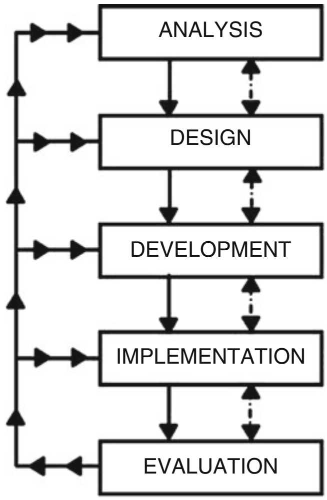
This process focuses on the goal or objective and refers mostly to what the player must do to get to the end and win the game. Learners who use this process to design games will find problem solving opportunities in all seven phases as each is fairly self-structured. After selecting a goal the learner will research and prepare, this refers to both looking for information about the premise and researching other games for comparison. The design phase is broken into four subparts. The interface is what we see on the screen, but it is also what controls the game and the information presented to the player. Mechanics and structure are the mechanisms by which the player achieves the goals of the game and the underlying structure by which all the gameplay is designed around. According to Crawford (1982), all of the above is what is included in the game design document and can be used as the "bible" that will guide the creation of the game itself. Preprogramming phase concentrates on problem finding and problem solving as a part of design evaluation. After the programming is complete, playtesting involves having people play the game and provide the designer with feedback. This helps uncover flaws and misconceptions. After the designer polishes the game, the final phase of the design process is a critical examination of the entire process written up as a postmortem. This game design model is the basis for game design models used in college level classes and focuses on the game as a product. Learners using this game design model require a teacher or peer mentor to navigate this process if they lack prior experience.

15.5.4 ADDIE

In the field of instructional design there exists a general understanding that no one method can work in all situations. Experts who make use of these models often use them as rough guides and practitioners new to the field may use these models as a support system. The well-known ADDIE template often forms the basis for these models and serves as a reasonable base for all. The acronym is popular and well known, and it remains a very popular model in professional training. It has also been used in teaching game design as it uses an iterative process that focuses on problem identification and solving as a part of the instructional design process. The five parts of the ADDIE model are outlined below (Dick, Carey, & Carey, 2001):

- Analysis: defining the desired outcome.
- Design: determining how desired outcomes are to be achieved.
- Development: establishing required systems and acquiring needed resources to achieve desired outcomes.
- Implementation: implementing design and development plans in the real world.
- Evaluation: measuring the effectiveness of the implemented system and using the data to close gaps between the actual and desired gaps.

The ADDIE model can be used as the basis for basic game design in order to teach basic problem solving skills and low level programming. As stated above ADDIE serves as the base model for most instructional design models in existence today. As designers become more proficient, they will be able to use this as a touchstone rather than a roadmap for creation.



The ADDIE model includes five iterative steps that are the basis for most instructional design models

15.6 Conclusion

> Tell me and I forget. Teach me and I remember. Involve me and I learn.
>
> –Benjamin Franklin

This chapter presented a critical analysis of game design as a way to teach problem solving. Video games for learning were discussed and problem solving in video game play analyzed as it relates to the design process. Three distinct cases were examined for problem solving features and the models they used discussed. Each case was explored for implications affecting video game creation in education. Four design models were examined, with phases of each process discussed and analyzed for how learners could use the model to create a game that would also teach the problem solving skills so implicit in game design.

Do the design models reviewed in this chapter involve fundamentally different elements? The answer to this question is no; all the models incorporate some of the same elements, some models include elements that are not common among others, and no model includes elements that are inherently contrary to the theoretical and applicable elements described herein. These models do differ. The vocabulary used to describe the models and elements varies significantly, but a detailed discussion of these differences is beyond the scope of this chapter. These models emphasize different elements that in turn emphasize different principles of game design. Becker and Parker emphasize the interconnectivity of games, simulations, and the instructional design process. Killi stresses the experiential nature of games through both design and play, while Crawford emphasizes the nature of the story in the problem solving process. Finally, the ADDIE model serves as the basis for all of the above models, working as an infrastructure to build more complicated models on.

15.6.1 Issues and Implications

Video games are not going away. Academics, industry, and education professionals are challenged to find new ways to incorporate this engaging and encompassing technology into learning opportunities for students. Not every design experience is necessarily a good one, and one of the most pressing implications of using game design for problem solving in education is that empirical research, including qualitative analysis and feedback from professionals in the field, is needed to evaluate the learning effectiveness and retention that occurs as students learn to design video games.

15.6.2 Future Developments and Directions

Video game creation has shown to encourage a powerful learning environment, a chance for students to produce and engage in the design process rather than simply consume. It can serve as a means to learning more about themselves as problem solvers and game designers and teaches skills that are transferrable to any industry requiring authentic problem finding and solving. Future developments in game design are occurring every year. Free game development software is widely available on the Internet, colleges offer degrees in game creation, and higher education has begun to recognize that the game creation process can teach twenty-first century skills in an engaging and authentic manner.

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