SCAFFOLDING FUN: TEACHING GAME DESIGN IN A 21ST CENTURY CLASSROOM

by

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A dissertation submitted to the

School of Graduate Studies

Rutgers, The State University of New Jersey

In partial fulfillment of the requirements

For the degree of

Doctor of Philosophy

Graduate Program in Education

Written under the direction of

Erica Boling

And approved by

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New Brunswick, New Jersey

MAY, 2018

ABSTRACT OF THE DISSERTATION

Scaffolding Fun: Teaching Game Design in a 21st Century Classroom

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The purpose of this study was to examine the pedagogical practices associated with the implementation of videogame design activities in the classroom setting as a means of promoting students' 21st century skill development. In particular, it considered the role played by pedagogical expertise in teaching game design and provides an introspective look at the pedagogical challenges faced by instructors within the videogame design classroom. These goals were met by exploring one teacher's pedagogical scaffolds of student learning specific to game design by investigating the relationships among the teacher's pedagogical practices that support student learning.

This qualitative study approached the question of how an instructor scaffolds student learning of game design principles and concepts in terms of both lesson planning and in-class practices. These questions were addressed through the case study of an experienced videogame design instructor at a middle school in north-central New Jersey. Data collected include interview data, comprised of approximately three one-hour audio semi-structured interviews with the participant; textual artifacts such as lesson plans, classroom materials, and reflective blog posts; and more than twenty field-based observations with accompanying field notes. The results of this study contribute to a better understanding of the ways in which teachers can effectively implement videogame

design and development projects in their classroom settings. Such an understanding will in turn help other educators to identify, plan for and support student learning through the videogame design process.

DEDICATION

The ones that love us never really leave us. ~ Albus Dumbledore

To Doris Kennedy (a.k.a. Grandma)
and Dorisann Kennedy (a.k.a. [Aunt] Dar)

ACKNOWLEDGEMENTS

Words are, in my not so humble opinion, our most inexhaustible source of magic. ~ Albus Dumbledore

Thanks to Dr. Erica Boling, my doctoral chair, advisor, mentor, advocate, friend, and most importantly, my Albus Dumbledore. Thanks for helping me fine tune my skills to cast the longest and most arduous spells I've ever aspired to create.

You sort of start thinking anything's possible if you've got enough nerve. ~ Albus Dumbledore

When I was first accepted to graduate school to complete my PhD in Education at Rutgers University, I couldn't believe it. I felt exhilarated and terrified at the same time. I couldn't wait to start my program…

It is our choices, Harry, that show what we truly are, far more than our abilities. ~ Albus Dumbledore

Then I developed a terrible case of imposter syndrome, as we all do (or so I've come to find out), and felt as though I didn't belong, this wasn't the place for me, this dream was quite impossible to achieve, and I'd be having none of it.

After long internal struggle, and multiple thoughts of quitting, I powered through. I would never have been able to do so without the moral support of: my research cohort buddy, Mary Hough, Ed.D. candidate, who kept encouraging me as we went on this journey together, with plenty of jokes and shenanigans along the way (a.k.a. my Ron Weasley); and my committee member Sandra Abrams, (a.k.a. my Hermione Grainger) who taught me all about the greatest witches and wizards of the videogames and learning landscape, and how to follow in their footsteps and her own.

And now, Harry, let us step out into the night and pursue that flighty temptress, adventure. ~ Albus Dumbledore

To my committee members, Dr. Clark Chinn and Dr. Eli Silk, I am especially grateful for your guidance and expertise throughout this most arduous yet exhilarating journey!

It does not do to dwell on dreams and forget to live. ~ Albus Dumbledore

And so, as much as I wanted to power through this inexplicable journey I've found myself navigating, I realized upon the completion of coursework, that this wasn't a sprint, but rather, a marathon. Some of the best moments of my life took place over the course of this journey; meeting my husband, moving out of my parents' house, getting my first

apartment, getting my first full-time lectureship position, getting engaged, getting married, buying my first home, getting pregnant, giving birth to my beautiful daughter, Emma… So, it goes without saying that this is all possible thanks to my supportive husband, Jay – thanks for reminding me of how to live throughout the course of this journey.

I solemnly swear I am up to no good. ~ Harry Potter

To my daughter, Emma, who reminds me every day how important it is to get into trouble sometimes…to learn from one's mistakes, to get back up and keep going, to remain tenacious, I learn from you every day, and I couldn't be more proud to be your mom.

All was well. ~ J.K. Rowling

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CHAPTER 1
INTRODUCTION

Statement of Problem

Games have been a longstanding tradition of many civilizations throughout the history of the world (Boocock & Schild, 1968; Donovan & Garriott, 2010; Howard, 2008; Kent, 2010; McGonigal, 2011), but with the dawn of technology, games have mutated into a form of entertainment far beyond the scope of imagination. A diverse range of skill-sets – creativity, engineering, design, problem solving – have combined to form one of the most lucrative industries in the United States today. Given that video game research is constantly evolving with each new gadget that develops, the field possesses much uncharted terrain. With an abundance of 'realms' to explore, the world of video game research can contribute a great deal to scholarship in many fields, particularly education (Gee, 2014; Squire, 2011). Gee (2003/2007a) argues that game designers in industry and educators (K-12) alike have a similar dilemma within their respective positions: how can we make learning *fun*? Game designers are saddled with the challenge of creating games that are engaging while simultaneously providing a stimulating learning environment which encourages players to persist in their quest to conquer/complete the game they've started. In a similar vein, teachers have the challenge of providing learning contexts for their students to (want to) learn, remain engaged, and find relevancy in the material with which they're being presented over the course of the school day.

The disconnect between what is being covered in textbooks and what applies to students' everyday lives is where the educational system fails our nation's youth according to Gee (2003, 2007a). We can overcome this dilemma however, if we apply the concepts designers employ in designing videogames that successfully challenge players in a way that encourages them to "keep on keepin' on" despite the conflicts they may encounter during play. According to Gee (2003):

> People are quite poor at understanding and remembering information they have received out of context or too long before they can make use of it [Barsalou 1999; Brown et al. 1998; Glenberg and Robertson 1999]. Good games never do this to players, but find ways to put information inside the worlds the players move through, and make clear the meaning of such information and how it applies to that world (p. 2).

Here Gee also argues the importance of delivering relevant content "just in time" so that students are able to contextualize their learning on demand, at the exact time they need it (e.g. learning a scientific concept applicable to a lab class that will conduct an experiment demonstrating how it works, thereby connecting the learning to lived learning experiences).

My focus on 21st century skills is particularly relevant at this juncture in the educational landscape given the U.S. Department of Education's recent emphasis on their interpretation of critical job-readiness standards (White House Office of Science and Technology Policy, 2014). These aptitudes include Science, Technology, Engineering, and Mathematics (STEM) concepts that favorably impact students' "problem solving

[and] critical thinking" (p.1) capabilities. Videogame use, design, and development promote the honing and development of STEM/21st century skills.

The purpose of this study is to shed light on the pedagogical practices associated with the implementation of videogame design curricula in the classroom setting as a means of promoting students' 21st century skill development. Further, this study will explore the role played by pedagogical expertise in teaching game design and provide an introspective look at the pedagogical challenges faced by instructors within the videogame design classroom. To meet these goals, my research explored one teacher's pedagogical scaffolds of student learning specific to game design while investigating the relationships among the teacher's pedagogical practices that support student learning as delineated in the research questions below.

Research Questions

The research is designed to answer the following questions:

How does an experienced middle school teacher who teaches videogame design scaffold student learning of game design principles and concepts?

- How does the teacher plan his instruction to support a video game design 8th grade course?
- Why does he make the choices that he makes when planning?
- How does the teacher scaffold student learning through this instruction?

Rationale and Significance of the Study

This study contributes to an understanding of the factors that impact videogame design and development programming that takes place during the traditional school day. For the purposes of this study, these factors primarily represent the scaffolds utilized by

an experienced videogame design instructor to teach students videogame design and development, in addition to the ways in which the instructor adapts his pedagogy dependent upon the program being utilized for design and development (which in turn is dependent upon the familiarity the student game designers have with the software platform being utilized as well as the teacher's own experience with teaching via this platform). By studying an *experienced* middle school instructor who teaches videogame design, I highlighted some of the most effective practices for implementing this sort of activity in the classroom setting.

Possible benefits of this research, while not the focus of my study, include contributing to a better understanding of the ways teachers can effectively implement videogame design and development projects in their classroom settings for optimal student learning outcomes (particularly as they relate to 21st century skills). A better understanding of these scaffolding measures may help other educators interested in this form of pedagogical exploration to identify, plan for and provide support to aid student learning through the videogame design process. Additionally, the findings from this study could potentially persuade those teachers who may be on the ledge about implementing videogame design pedagogy in their classroom settings to take the plunge, with guidance from research-based documents like this and other peer-reviewed publications.

Impetus

Since the age of six, I have been an avid gamer. I fondly recall the days of playing Duck Hunt with my younger brother and my father, taking turns with the

imitation firearm known as the "NES Zapper." Although my gameplay habits waxed and waned due to involvement in multiple clubs and organizations, band practices, piano lessons, and the like, I always enjoyed my alone time on the consoles that graced our rec room over the years. From Nintendo to Gameboy to Playstation, Playstation 2, Sega Genesis, Xbox, and Xbox360 (of which there were four, one for each of us four children), and occasionally the PC, gaming has always been and will always be a part of who I am.

Along with my passion for games comes my passion for learning and educating, and I have been a teacher-figure in some capacity for most of my life. First playing school as a child, then becoming a CCD (Confraternity of Christian Doctrine - a religious education program of the Roman Catholic Church) assistant at age 15, followed by a CCD teacher, then substitute, student teacher, course instructor, adjunct, and now a lecturer at the college level, my desire to learn and share my knowledge with others has only grown over the course of my lifetime. The combination of my identities as teacher and gamer, followed by meeting my husband (who is also a teacher and a gamer) made me wonder how many more of "us" there were out there. The more conferences I attended and presented at, the more educators I met who had a passion for playing *World of Warcraft* and playing videogames such as titles from the *Fallout* series, just as I have. Exposure to this community of teacher-gamers, coupled with a mission to find a suitable dissertation topic, led me to this very moment, as I draft the latest version of my dissertation. An awareness of the growing need for student engagement in learning, for instilling some creativity and passion in classrooms again, drove my desire to study those admirable teachers in the profession who successfully combine a love of teaching and learning with a love for videogames and the awareness that students need to be able to

play, regardless of age. My review of the literature for this dissertation has suggested that there is more to game playing than is currently recognized, particularly from the teacher perspective, and my proposed dissertation is an effort to contribute to the burgeoning discussion of videogames as they relate to teachers' pedagogical practices.

Contribution to the Field

By examining how my case study participant plans and scaffolds game design for his students, I am contributing to the body of videogame research at large in a number of ways. Although a multitude of studies have been conducted in the past fifteen plus years highlighting the impact of videogame practice as it relates to pedagogy, there has been a dearth of research collected specific to teacher-gamer habits as they relate to educators' pedagogical planning and scaffolding approaches in their classroom settings. My study situates itself at the intersection of these two gaps in the body of literature pertaining to videogame and game design pedagogy.

CHAPTER 2

REVIEW OF THE LITERATURE

Games have been a longstanding tradition of many civilizations throughout the history of the world (Boocock & Schild, 1968; Donovan & Garriott, 2010; Howard, 2008; Kent, 2010; McGonigal, 2011), but with the dawn of technology, games have mutated into a form of entertainment far beyond the scope of imagination. A diverse range of skill-sets – creativity, engineering, design, problem solving – have combined to form one of the most lucrative industries in the United States today (Siwek, 2014). Given that videogame research is constantly evolving with each new gadget that develops, the field possesses much uncharted terrain. With an abundance of 'realms' to explore, the world of videogame research can contribute a great deal to scholarship in many fields, particularly education (Gee, 2014; Squire, 2011). This review considers the findings of research into the relationship between games and players, and the theoretical and actual implications for learning.

Videogames used in the classroom setting cover subject areas from STEM to Home Economics. Games like *World of Goo* and *Virtual Cell* approach science-related content in such a rich, engaging format that most students would be more than happy to continue this kind of learning at home (Shute & Kim, 2011; Mayo, 2007). The humanities have just as much to gain from the use of videogames in the classroom, as has been shown with history-based games like *Civilization* and *Oregon Trail*, language-focused ones like *My Language Coach*, and mathematics games such as *DimensionM* (DimensionU, 2013), *Math Blaster* ("ON for Learning Award Winners," 2013), and

Abydos (a fractions-based game set in ancient Egypt created for primary level students, Masek, Boston, & Lam, 2017). Videogames have the potential to reach a large number of students simultaneously while providing individualized instruction, meeting player pupils where they are at (Annetta, et al., 2006; Gee, 2014; Squire, 2003). Students can be at a number of different levels based on their unique abilities and strengths, while being challenged to practice in those areas where they need additional conditioning (Marino & Beecher, 2010; Wolz, et al, 2007).

With the affordances of videogame use in the classroom mentioned above, my review of the research began here, examining studies dedicated to uncovering the ways in which teachers have sought to include videogames in their classroom settings (Rice, 2007; Squire, 2005). Given my experience with *qualitative* research in combination with my personal research interests and inquiries, I sought out studies on videogames and learning that focused on the *reasons why* and *ways how* teachers were employing videogames in their classroom settings. I also read a number of quantitative studies that focused on large populations of teachers and students, primarily to get a "big picture" sense of subjects' interest in the use of videogames to promote/engage learning, with foci on numbers and percentages as opposed to those researchers "collecting and/or working with text, images, or sounds" (Guest, Namey, & Mitchell, 2012, p.3).

As an educator, gamer, and researcher, my interest in pursuing this topic of study was three-fold: to uncover studies focused on the reasons why and ways in which videogames were being utilized in classroom settings; to review investigations of teachers' perspectives on videogame use in the classroom; and to search for studies pertaining to teachers' perspectives on the use of gaming in the classroom setting.

My initial search focused on academic journal articles, books, dissertations, thesis papers, research reports, and educational magazine publications. From prior searches conducted on the use of videogames in educational settings, I knew there would be a vast amount of research related to the use of "educational games", the use of "Commercial-Off-The-Shelf" (COTS) games, and the outcomes of videogame use in after-school clubs and extracurricular settings. I anticipated that there would be a limited number of studies (qualitative, quantitative, or mixed-methods based) that would focus on my primary research query: What studies have been conducted, if any, on teacher-gamers, and how, if at all, do teacher-gamers' videogame play habits outside of their classroom setting impact their pedagogical practice? In an attempt to focus solely on the "whys and hows" impacting research findings, I was primarily interested in qualitative studies as opposed to quantitative-based analyses. However, I ultimately included quantitative study findings within my review of the research in order to provide a fuller picture of videogame use in educational settings. Despite my initial hesitation to include "ordinal-based" studies in my review, I was able to garner a fair amount of information regarding the perceptions teachers across the United States have about videogame use in the classroom setting.

Similarly, more current research on videogames has focused on videogames and *students'* interests in and out of the classroom setting (Alvermann & Moore, 2011; Gainer & Lapp, 2010; Hull & Schultz, 2002; Moje & Tysvaer, 2010), but not specifically on teacher-gamers' hobbies and experiences. To better understand how videogames can impact 21st century skills and learning, it is important to know how these games can become part of classroom practice. I organized my review findings into categories as

follows: (1) defining games/videogames; (2) discussing what previous research indicates about the use of videogames for learning purposes in educational settings; (3) explaining learning theories associated with videogame use and design; (4) articulating the theories that contribute to my theoretical framework; (5) followed by a summary of the (re)search.

Literature Search and Method

My search surveyed the field using Rutgers and Kean University library databases, including articles from: ERIC, Academic Search Premier, PsycArticles, EdLib, Computer Source, Information Science & Technology Abstracts, ScienceDirect, Scopus, Communication & Mass Media Complete, and Articles+, in addition to performing breadcrumb searches (i.e. following references from one article of interest to additional articles). Search queries included *videogame, video game, K-12, game, education, teaching, learning, computers, teacher identity, gamer, gamer identity, pedagogy, pedagogical practice, teacher-gamers, teacher-gamer identity, MMORPG, play, World of Warcraft, Angry Birds, Civilization IV, out-of-school literacies, classroom, discourses, game mechanics, gamification, teacher scaffolding, scaffolding, teacher planning, TPACK, instructional planning, instructional design, planning, design, and technology.* To be included in my initial search, an article had to reference both videogames (or video games)[1] and pedagogical strategies (e.g. scaffolding, planning) and/or teacher

[1] Abrams, Rowsell, and Merchant (2017) present a dynamic argument in favor of using the term "videogame" as opposed to "video game" when referencing the activity of individuals or collaborative groups engaged in gameplay, acknowledging *The Videogame Style Guide and Reference Manual* (Thomas, Orland, & Steinberg, 2007) as the initiator of the distinction. Abrams, et al. (2017) define the term videogame as "…a multimodal program manipulated by human reaction to on-screen and offscreen stimuli, decisions and actions mediated by the use of digital and nondigital tools" (p. 5) All references to

perspectives on the use of videogames in the K-12 classroom. From an initial set of several hundred search results, I selected 67 referenced texts for color-coding analysis (by printing out the abstract page associated with each hit and tagging them with small Post-It notes in various shades of neon and pastel colors). This selection was culled to reflect peer-reviewed journal articles, conference proceedings, and frequently cited books.

TABLE 1
Tags with example articles

Tag	Example
Neon Green—Highly usable studies	
(Videogames-Classrooms) Any research that describes the use of videogames in a classroom setting	Nelson, et al. (2016)
(Videogames-Classrooms-Pedagogy) Any research that describes the use of videogames in the classroom setting with pedagogical examples – i.e. describing how a videogame was used, for how long, outcomes, etc.	Bartholomew (2017)
(Videogames-Classrooms-Teacher Perspectives) Any research that describes the use of videogames in the classroom setting with teachers' perspectives on how or why videogame literate activity was occurring	Abrams, S.S. & Russo. M. (2015)
(Videogames-Classrooms-Teacher-Gamer) Any research that describes teachers who considered themselves to be gamers or stated that they engage in game-play outside the classroom setting	NONE SPECIFIC

videogames throughout this text are marked as such in support of this definition of the term.

Neon Orange—Potentially usable studies

(Conceptual paper) Any research that discusses the issues of videogame use in education, but without collecting any new data	Lamb, et al. (2018)
(Teacher Identity) Any research that discusses the ways teachers perceive themselves in the classroom and what influences those perceptions	Lasky (2005)
(Gamer Identity) Any research that discusses the ways gamers perceive themselves and what influences those perceptions	Mitgutsch's (2010)
(Education-Gamification) Any research that discusses the employment of gamification techniques in classroom settings	Simões, et al. (2013)
(Education-Game Mechanics) Any research that discusses the employment of game mechanics used in classroom settings	Nadolny, et al. (2017)
(Education-Game Principles) Any research that discusses the employment of game principles used in classroom settings	Gee (2011)

Neon Pink—Studies outside the scope of my focus

(Games-Psychology) Any research that focuses on the psychological impacts of videogame play, such as addiction, anger, violence, and disorders (epilepsy, ADHD, etc.)	Lee, et al. (2017)

Post-It note categorized studies were then organized into five main categories based on my primary research interests associated with this review: 1. Forms of Game Use in the Classroom; 2. Learning Theories for Video Games; 3. Teacher and Gamer Identity; 4. Learning Outcomes from Game Play/Design; and 5. Games and Pedagogy. Category 5 could be considered a subset of Category 1, but I decided given the number of studies I

had that fell specifically into the category of "Games and Pedagogy" that I would give the topic its own denomination. These categories provide an organizational framework for understanding design considerations revealed in the literature.

I was reluctant at first to selectively exclude almost two-thirds of the material that may have been relevant to my primary area of interest for conducting this review (the utilization of videogame design pedagogy in the classroom setting). Ultimately, however, I felt that the 34 weighted selections included for analysis here merited the omission of 56 references from this examination of the research as they did not meet my criteria as outlined above.

Major Categorizations of Findings

To establish the links between teacher identity with gamer identity and pedagogical practice with out-of-school literate practices, I first pinpointed relevant trends within each category as related to: defining games/videogames; discussing what previous research indicates about the use of videogames for learning purposes in educational settings; and explaining teacher planning and scaffolding practices as they are related to the videogame design classroom. Discussions of each category follow below; when combined, they provide a basis for my later conclusions regarding game play as it relates to pedagogy and learning.

What is a Game?

While there are multiple interpretations of how to define a game, McGonigal's (2011) articulation of the term states that games are comprised of four characteristics: "a *goal, rules,* a *feedback system*, and *voluntary participation*" (p. 21). These four features are fairly unanimous among the research I reviewed, with some researchers breaking

down the traits McGonigal identifies into more explicit terms (see Juul, 2005). Games come in a variety of formats, with any number of players, platforms, and outcomes. Games like *World of Warcraft* (WoW) are Internet dependent, making the game accessible primarily on personal computers. Millions of players access WoW on a daily basis. This game is nothing like Solitaire, which simply requires a deck of cards, one player, and time. Board games, strategy games, massively multiplayer online role-playing games (MMORPGs), arcade games, and games used with decks of cards–all of which qualify as a type of game, make investigating the use of games in the classroom setting much more difficult to generalize across the board.

In spite of this, games of all types still fit the criterion identified by McGonigal (2011) and others (Juul, 2005). Game designer, co-founder and CEO of the world-renowned GameLab in New York City, Eric Zimmerman (2003) defines games as "a voluntary interactive activity, in which one or more players follow rules that constrain their behavior, enacting an artificial conflict that ends in a quantifiable outcome" (p. 160). Zimmerman together with fellow game scholar Kate Salen argue that games can simply be defined as "an activity with some rules engaged in for an outcome" (p. 96). Salen and Zimmerman (2003) consider a game as an activity defined by two elements: the rules and the result, the latter coming from a previous goal. In sum, according to Salen and Zimmerman, there are several basic criteria that define every game: common experience, equality, agency, interactivity, and immersion. Additional criteria for "games with rules" include: the game's rules, goals, the element of chance, and competition.

Videogame Use in the Classroom Setting: Three Camps

This review of the literature has shown that there are essentially three different camps that emphasize digital game use in the classroom setting: edu-games, student game design, and gamification. As I will explain below, these camps are of varying degrees of relevance to my study.

Edu-games

The first camp is the use of edu-games—the traditional "old school" educational games (i.e. Math Blaster) developed specifically for making content area learning fun. This paper does not go into detail about edu-games because I personally believe they are not particularly innovative and they do not capture the teacher-gamer spirit of pedagogical praxis; more specifically, there are better game-based resources for students to learn from than those programs that focus on skill and drill exercises packaged in a playable format. In this vein, as Kurt Squire (2003) articulates, "Although drill and practice games can have an important role in student-centered learning environments such as problem-based learning (Savery & Duffy, 1995), using videogames to support student exploration of microworlds or as a construction tool (Papert, 1980; Rieber, 1996) is more consistent with the emerging paradigm of instruction" (p. 56). Here Squire suggests that the use of microworlds, or simulated learning spaces, (i.e. game environments), promotes student learning because these spaces can be designed and/or modified (either by students, teachers, etc.) for specific learning outcomes. Microworlds, he argues, much more fluidly assist educators in leading students to develop critical 21st century skills.

Game Design in the Classroom

The second approach to videogame-oriented practice is through the world of design. When students are encouraged to create their own videogames, they attain a sense of empowerment. Programs like MIT's Scratch (Lifelong Kindergarten Group, 2006), Gamestar Mechanic (E-Line Media, 2008), and Microsoft's Kudo (FUSE Labs, 2009) engage students through the power of their imagination. While Gamestar Mechanic (2008) is more of a videogame design primer, Scratch (2006) and Kudo (2009) immerse students in the world/language of coding, a skill set which in itself will prove invaluable on the job market come graduation time. All three of these programs are valuable in their own right. It is important to note there are many other videogame design platforms available for classroom use. Those discussed previously are some of the most popular design tools used in schools in recent years (Resnick, Maloney, Monroy-Hernández, Rusk, Eastmond, Brennan, Millner, Rosenbaum, Silver, Silverman, & Kafai, 2009; Salen, 2007; Stolee & Fristoe, 2011; Torres, 2009).

A multitude of research studies have been conducted in recent years specific to game-based learning as it relates to the field of education (Blunt, 2007; Ebner & Holzinger, 2007; Hwang, Chiu, & Chen, 2015; Papastergiou, 2009; Prensky, 2005; Tobias, Fletcher, & Wind, 2014; Van Eck, 2006) but few have been conducted with primary or secondary students during the traditional school day, and fewer still in which the students are themselves designing videogames. That said, some empirical studies have been performed, primarily in the sciences. Baytak, Land and Smith (2011) investigated the ways in which fifth grade students utilized the design platform *Game Maker* to create games as educational artifacts that signified their conceptualization of

nutrition precepts. They found that these young game designers were able to develop complex representations of their learning while simultaneously contributing to their development of 21st century skills. Baytak, et al.'s (2011) study represents a multifaceted approach to educational game design in that the fifth grade students created these games specifically for a first grade audience. This added condition required the fifth graders to think beyond game development for its own sake and instead put themselves in the place of the much younger pupils who would be playing the games they had created.

Yang and Chang (2013) conducted a comparative experimental study investigating seventh grade students' understanding of biology concepts, with one group designing games and the other designing Flash animations. The game design group displayed significantly higher gains in several areas, including collaboration, motivation, autonomous learning, and self-efficacy. The researchers attributed these statistically significant increases in the game designers' group because

> ...game design offers several challenges that require the authentic application of subject-specific knowledge. Through activities such as creating conflicts, providing clues for game players, and imbedding *[sic]* challenges based on biological principles, DGA [Digital Game Authorship] offered participants more opportunity to authentically apply their biological knowledge and strengthen their memory of the learning content (p. 343).

Despite the existence of studies such as these, the general paucity of findings specific to the use of game design in the classroom setting serves as the catalyst for my dissertation research study.

Gamification

The third approach to videogame utilization in the classroom is gamification. The practice of gamification, originally hailing from the business sector, is one in which game-like elements (game mechanics) are applied to non-gaming environments in order to enhance their appeal (Gamification Wiki, 2010; Lee & Hammer, 2011), as for example with the fast food chain McDonald's, which periodically integrates concepts from the board game Monopoly into its sales promotions. The movement has since grown to permeate all forms of industry across the globe; game designer guru Jesse Schell (2010) has gone so far as to prophesize a great "Gamepocalypse" wherein the world as we know it has been overrun with gamification, from rewards for brushing one's teeth to exercise achievement points.

The educational industry is no exception to this trend. In a classroom setting, gamification is the integration of game-based principles into one's course design in order to motivate students to learn in much the same way as game players are motivated to play. For example, students might be awarded 'points' for correct answers to in-class exercises or be penalized for incorrect ones. A subset of gamification of key importance to this study is quest-based learning. Quests have been defined within the literature as "engaging curricular tasks that are connected to academic standards and[/or] social commitments" (Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005, p. 87). Quest-based learning, therefore, can be defined as a form of pedagogy wherein the students complete activities for the purpose of acquiring knowledge about a particular topic area, scaffolded through the use of leveled activities that incrementally increase in complexity and depth.

Lee and Hammer (2011) address the possibilities afforded by gamifying education as:

> Gamification projects offer the opportunity to experiment with rules, emotions, and social roles . . . When playing by these rules, students develop new frameworks for understanding their school-based activities. As suggested by Leblanc (2006), this can motivate students to participate more deeply and even to change their self-concept as learners. (para. 4)

As far as education is concerned, gamification runs in a spectrum; the *micro-scale* affects individual teachers and their classrooms. For example, teachers can use experience points (a measure used to quantify a character's progression through a game) instead of grades and assign quests in place of homework.

On the other end of the spectrum, the *macro-scale* can be seen with the New York City-based charter school, *Quest to Learn,* where the entire curriculum are constructed according to game design principles. The idea of deploying gamified alternatives to grades is unlike the "old wine in new bottles" conundrum because gamification is a double-edged sword. Social web developer Adam Loving (2011) explains:

> There is good gamification and bad gamification. Bad gamification is slapping extrinsic rewards (or a contrived story) on top of an interaction. Good gamification amplifies the intrinsic rewards of a particular behavior – to increase the feeling of fun, flow, or accomplishment of the player. Players know bad gamification when they see it, because it doesn't take their interests into consideration. Good gamification aligns the needs of both designer and player (Gamification is not Game Design, para 3).

To frame this explanation within an educational context, researchers Hwang, Choi, and Lee (2014) recently studied the possible implications for using a curriculum involving the Google program AppInventor. Hwang and colleagues noted that elementary aged students could easily utilize AppInventor to create applications for Android-based technologies (such as tablets and smart phones) on a topic of the students' choosing. If a teacher were to explore a problematic situation that could take place within a "real-life" context, then s/he could potentially use the AppInventor program to create an app that may resolve the issue.

Other empirical studies have been more explicit in discussing the effect of gamification on learning outcomes tied to 21st century skill sets, including: collaborative learning (Li, Dong, Untch, & Chasteen, 2013; Moccozet, Tardy, Opprecht, & Leonard, 2013), autonomous learning (Watson, Hancock, & Mandryk, 2013), enriched language learning (Abrams & Walsh, 2014), intrinsic and extrinsic motivation (Garris, Ahlers, & Driskell, 2002) and creative thinking (Barata, Gama, Fonseca, & Goncalves, 2013).

Why Gamification Matters

Lee and Hammer (2011) discussed three key areas in which gamification can serve as an intervention in educational settings: through cognitive, emotional, and social means. The area of cognition is explored in multiple ways through gamification. The authors indicated games give players immediate feedback, letting them know on the spot where they made an error, and allowing them to re-play the level in order to retry and eventually master the skill the player is attempting to accomplish. Gee (2003) refers to this as the Explicit Information On Demand or the Just-in-Time principle: . . . "[t]he

learner is given explicit information both on-demand and just-in-time, when the learner needs it or just at the point where the information can best be understood and used in practice" (p. 211).

Furthermore, Lee and Hammer (2001) intimated that gamification can challenge students to change their perspective on their education, questioning how they can master the game of school. By giving students smaller, more immediate, achievable goals, they will have a greater appreciation for the curriculum in the long run. Essentially, what the authors are saying here is that students may not always see where school fits into the bigger picture, but they will understand how earning achievement points will contribute to their overall grade, making the bigger picture more realistic. Maximum achievement points = mastery of the game; maximum points for completing projects, homework, participation, etc. = mastery of the class/grade/unit/subject, etc.

In terms of emotional competence, nothing affects players quite like the art of losing (Lee & Hammer, 2011). Failure is a very powerful motivator in games because of how it is built into the overall player experience—by failing repeatedly, one learns how to achieve success in the game. By utilizing low stakes (i.e., dying and being able to come back to life) the player does not feel intimidated by failing—he or she just attempts the level again. A parallel comparison in the classroom setting would involve the teacher correcting main ideas in drafts of an essay instead of giving a grade the first time it is submitted. Low-stakes = no grade the first few times around. This way, students do not feel as though they are going to fail the assignment (or the quest) the first time around. They have the opportunity to retry, rewarding their efforts for reattempting the assignment for the opportunity to earn a better grade (or higher achievement points).

Finally, videogames have a very socially active component to them (Lee & Hammer, 2011). By gamifying the classroom experience, students have the opportunity to embody roles (characters) they would not normally engage with in a traditional schooling scenario. The gaming realm allows them a safe-space in which to act out different identities (Gee, 2003, 2007a). Lee and Hammer (2011) explain the ability for students to adapt to a "school-based identity" can be difficult; gamifying the learning environment can afford students the ability to try out "the unfamiliar identity of a scholar" (para. 9). Ultimately, though the authors caution gamification is by no means meant to be a panacea for rectifying the issues with our nation's educational system, they conclude their prospectus with the notion that "[by] leading with research-based, theory-driven gamification projects, we can work to ensure that the impact of gamification is a positive one" (Lee & Hammer, 2011, para.4).

Constructivism Through Situated Cognition in Videogame Design.

Halverson, Shaffer, Squire, and Steinkuehler (2006) posit that situated cognition provides a meaningful framework for videogame [design] study in light of its ability to create authentic purposeful learning contexts while engaging game makers and players in a community of practice. Dede, Nelson, Ketelhut, Clarke, and Bowman (2004) argue that well designed videogames engage learners in a combination of learning principles including: guided social constructivist design (where students embark on a guided inquiry experience through the use of the game platform interspersed with whole-class discussion to interpret learning experiences), expert modeling and coaching (where students encounter expert others embedded within videogame play in combination with expert guides in the real life classroom setting [may be the teacher or an invited guest who is an

expert on the game]), and legitimate peripheral participation (where students work together as a community of learners practicing in the videogame environment to problem-solve, with the added assistance of more advanced participants in the game environment such as pre-programmed avatars). Within these various contexts, learners are afforded greater content mastery and knowledge application opportunities than those presented in traditional classroom settings (Dickey, 2005, 2006; Klopfer & Yoon, 2005; Lunce, 2006; Schrier, 2006).

Classrooms that include game design pedagogies by default support the constructivist approach to learning. Students have the opportunity to design their own playgrounds for learning experiences, and request their peers to interact with the resulting games, concurrently engaging in the iterative feedback loop process where their fellow students – and teacher – can provide guidance for improvement. A review of the literature suggests that learning how to design videogames by using well-designed videogames as models adheres to constructivist principles as described above (Corbit, 2005; Dede, Nelson, Ketelhut, Clarke, & Bowman, 2004; Dickey, 2005, 2006; Gee, 2003/2007a; Schrier, 2006).

Corbit (2005) studies the virtual realm SciCtr, in which students have the ability to construct their own natural habitats (rainforests, deserts, etc.) that other students can visit and explore. These constructed worlds, the paths to navigate through them, and the content embedded in them, are constructed by the developer/learner through meticulous research and thoughtful design.

The web-based program *Gamestar Mechanic* inhabits these same principles as students learn how to construct videogames through play (*Gamestar* modeling game-design principles in the process), then design and develop their own games for other users of the platform to critique in "Game Alley," a central locale where all games designed via Gamestar Mechanic are housed for others to play, rate, and provide feedback.

Learning Outcomes from Videogame Use and Design

The breadth and scope of the research emphasizes the positive learning outcomes associated with game-based learning. I have mentioned a variety of research studies supporting the pedagogical advantages of game design and gamification, but scholars have taken other approaches to these as well. The following sections highlight some of the main benefits of videogame creation and use in the classroom setting, including 21st century skills, deduction and hypothesis testing, and complex concepts and abstract thinking.

21st Century Skills. De Aguilera and Mendiz (2003) compiled a historical review of the research conducted on videogames, reporting that videogame use is conducive to the development of "…attention, spacial, concentration, problem-solving, decision-making, collaborative work, creativity, and, of course, ICT skills" (p. 8). More than a decade later, the *Assessment and Teaching of 21st Century Skills* (ACT21S) project has identified ten 21st century learning skills vital to graduating students who will ultimately become entry-level employees that will need to be prepared for successful enculturation into today's information-rich, digital, globally-diverse marketplace. Identified by the acronym KSAVE (knowledge, skills, attitudes, values, and ethics), ACT21S has

categorized the first cornerstone of these crucial 21st century "ways of thinking" as follows: creativity and innovation, critical thinking, problem solving, decision-making, and thinking metacognitively (Binkley, Erstad, Herman, Raizen, Ripley, & Rumble, 2011).

To foster the growth and development of these skills, educational environments need to support the types of activities fostering these skills in a manner that is highly engaging, motivational, leverages generational differences, ubiquitous, easily accessible, and appeals to a variety of learners and age groups. In line with De Aguilera and Mendiz's (2003) research review and Prensky's (2006) discussion of the digital native-digital immigrant paradigm, educators have the opportunity capitalize on the development of students' 21st century skill sets, by integrating videogame design and development within the curriculum for the purpose of strengthening students' decision-making and cognitive processing skills, in turn improving adaptability within [virtual] environments that may positively impact their behavior and performance in the "real world" (in and out of the classroom setting) (Gallagher & Prestwich, 2013). Providing a happy medium for the use of videogames versus the creation of videogames (as discussed later in this literature view) is the concept of game modding, which "…often calls for a whole range of skills, ranging from programming to graphic editing, storytelling, video making, sound recording, summarizing, conversation writing, [and] scripting" (Loh & Byun, 2009, p. 410).

Deductive Reasoning & Hypothesis Testing. A review of the literature indicates that videogame use, design and development support deductive reasoning and hypothesis testing skills among students (De Aguilera & Mendiz, 2003; Gee,

2003/2007a; Jenkins, Klopfer, Squire, & Tan, 2003; Klopfer & Yoon, 2005; Lunce, 2006; Salzman, Dede, & Loftin, 1999; Salzman, Loftin, Dede, & McGlynn, 1996). Videogames can simulate real-life learning environments that provide virtual spaces for students to strategize possible outcomes in a trial-and-error capacity, where it's "OK" to fail if a particular hypothesized scenario produces negative results or consequences. Squire and Barab (2004) analyzed students' content mastery and cognitive thinking skills via the use of the game *Civilization III* in an interdisciplinary history, humanities, and social studies course. They found that game play promoted deep learning, hypothesis testing, strategizing, and appropriating [historical] content as a tool for play. Game modding and game design afford students the opportunity to test their ability to create games/platforms, with a built-in peer feedback structure for additional scaffolded learning. Gee (2003/2007a) describes this formative learning process as a four-step cycle wherein players probe, hypothesize, re-probe and rethink about their designs. Garris, Ahlers, and Driskell (2002) articulate this judgment-behavior-feedback loop in a similar fashion when applied to the use of educational videogames. So, too, McFarlane, Sparrowhawk, and Heald (2002) found that game-play had the potential to impact decision making, design, strategy, cooperation, and problem solving skills, further bolstering the argument for videogame use and videogame design in classrooms in support of students' 21st century learning skills.

Complex Concepts, Computational Thinking, and Abstract Thinking.

Videogames containing simulations can provide a foundation for systems-based thinking, wherein students can visualize individualized parts that come together as a whole *system* to demonstrate how each piece of the structure is necessary for it to work successfully. In

Digital Weather Station for example, students can observe weather cycles in a three-dimensional format (Barab, Hay, & Duffy, 1999; Hay, 1999), while *SimEarth* provides learners the opportunity to experiment with climate variables to understand how changing elements within the Earth's atmosphere can alter the globe's temperature with disastrous consequences (Squire, 2003).

While systems-based thinking encourages students to focus on parts of the whole pictures, computational thinking requires a similar mindset of students. Per the International Society for Technology in Education's definition, computational thinking is defined as a:

> [p]roblem-solving process that includes (but is not limited to) the following characteristics: formulating problems in a way that enables us to use a computer and other tools to help solve them; logically organizing and analyzing data; representing data through abstractions such as models and simulations; automating solutions through algorithmic thinking (a series of ordered steps); identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources; generalizing and transferring this problem solving process to a wide variety of problems (CSTA & ISTE, 2011; on-line).

Further, social systems are observable via game-play as well (Squire, 2003). Games like *Civilization* provide a simulated environment, allowing students to manipulate time and space based on historical contexts, so that they are able to observe how these various elements impact the peoples they study in the classroom setting

(Squire, 2003). It is important to note here, however, the value of guided facilitation in the use of videogames and simulations for learning. Students must be given ample time for reflection on the concepts they encountered within the game. Instructors, therefore, "…play an important role in this process, fostering collaboration, promoting reflection, and coordinating extension activities (Hawley, Lloyd, Mikulecky, & Duffy, 1997)" (Squire, 2003, pg. 6).

It's Not *All* Fun and Games

Videogame play has had its fair share of bad press in recent years, having been cited in a number of controversies related to sexual themes (Dill, Gentile, Richter, & Dill, 2005), sexist portrayals of gender in videogames (Dill & Thrill, 2007; Ivory, 2006), a lack of LGBT characters within games (Greenberg, Sherry, Lachlan, Lucas, & Holmstrom, 2010; Shaw, 2009), portrayal of race, portrayal of countries, violence (Olson, Kutner, Warner, Almerigi, Baer, Nicholi, & Beresin, 2007), player health-issues (addiction) (Buono, Sprong, Lloyd, Cutter, Printz, Sullivan, & Moore, 2017; Stockdale, & Coyne, 2018), cyberbullying and online harassment (DeSmet, Bastiaensens, Van Cleemput, Poels, Vandebosch, Deboutte, & ... De Bourdeaudhuij, 2018; Li, & Pustaka, 2017), criminal activity (McCaffree, & Proctor, n.d; Cunningham, Engelstatter, & Ward, 2016), and religion (Braun, Kornhuber, & Lenz, 2016; Etchells, Gage, Rutherford, & Munafò, 2016), among others. According to Whitton and Maclur (2017), these detrimental views of videogames are further perpetuated by the media, and negatively influence adults' perceptions of digital games to such an extent that educators are less likely to attempt implementing GBL in their classrooms.

Moreover, the research does not universally support the pedagogical advantages of videogames in the classroom setting. Young, Slota, Cutter, Jalette, Mullin, Lai, et al. (2012) conducted a comprehensive review of the literature surrounding videogame activity in the classroom, and assert that "there is limited evidence to suggest how educational games can be used to solve the problems inherent in the structure of traditional K-12 schooling and academia" (p. 62). Further, Girard, Ecalle, and Magnan (2013) acknowledge the "impossibility of reaching any reliable conclusion concerning the effectiveness of [serious games and] stress the limitations of the existing literature" (p. 207). In consideration of these caveats about the effectiveness of including videogames and game-based learning in the K-12 classroom, researchers in the field of digital games based (DGB) education have begun to create more scientific forms of assessment for analyzing the validity of DGB use in formal learning environments (All, Nuñez Castellar, & Van Looy, 2016).

Additional reviews of the literature on videogames and their impact on learning also note the lack of educational assessment tools for the purpose of studying gaming and academic achievement (Perrotta, Featherstone, Aston, and Houghton, 2013), in addition to barriers that inhibit teachers from adopting games in their classrooms, beyond assessment constraints and learning outcomes. Professor and games researcher Sara de Freitas (2006) noted the following barriers to teachers' use of games in educational settings, including:

…access to the correct hardware including PCs with high end graphics video cards; effective technical support or access to suitable technical support; familiarity with games-based software; community of practice within which to seek guidance and support;

enough time to prepare effective game-based learning; learner groups who would like to learn using effective game-based approaches; cost of educational games software or licenses (p. 16). Despite the fact that de Freitas wrote this article over a decade ago, most of these barriers *remain* consistent roadblocks for teachers to overcome on the road to implementing game-based learning (GBL) practices in their classrooms. Access to the necessary technologies and high-speed internet continues to be problematic for educators, particularly those who teach at the K-12 level in rural areas (lacking Wi-Fi connectivity) (Thigpen, 2015) or at schools with students from underprivileged/low socioeconomic status backgrounds (lacking the technology necessary, including enough computers for pupils to use) (Hohlfeld, Ritzhaupt, Dawson, & Wilson, 2017). Moreover, even with the appropriate technologies necessary for implementing GBL, standardized testing requirements often inhibit teachers' abilities to enable more experiential forms of learning (i.e. game-based instructional activities) (Scogin, Kruger, Jekkals, & Steinfeldt, 2017; Yadav, Hong, & Stephenson, 2016).

Fortunately, with the advent of social media technologies including Twitter, at least one of these hurdles has been overcome to some extent. Teachers are more readily able to create their own personal learning networks (PLN) for the purpose of garnering peer support and mentoring for incorporating GBL methods to their lesson plans in meaningful ways (Tour, 2017). Those educators who are motivated to engage with GBL in their classroom settings will often take the time to connect with other educators embracing these forms of educational technologies (often via their PLNs) to learn about the ways in which their peers have successfully (or unsuccessfully) implemented more innovative forms of pedagogy in their classrooms.

As de Freitas (2006) asserted above, teachers do not often have the time to prepare effective game-based learning in their curriculum, but *planning* for such lessons, especially in combination with an effective PLN or mentor, can go a long way.

Planning Instruction

"Traditionally, planning has been a topic that we teachers tend to step over, taking for granted that those same-sized little boxes in the teacher planning books can adequately contain us all" (Bisplinghoff, 2012, p. 121). This suggestion that teachers avoid discussing the process of planning seems to be mirrored by the relative lack of recent research on teacher planning. In an attempt to bridge this gap in the literature, I chose to address teacher planning from a variety of viewpoints: knowing-in-action (Schön, 1984) and reflection-in/on-action (Schön, 1983); planning as it relates to teachers' decision-making processes (Borko & Shavelson, 1990; Datnow & Hubbard, 2015; Munby, 1982; Westerman, 1991) and how expert teachers approach decision-making and reflection in comparison to their less-experienced counterparts (Henry, 1994).

The act of planning requires one to think about one's actions and intentions before completing a task. Thinking about one's actions implies that there is a form of reflection taking place. Schön (1983) describes this process in two parts: reflection-in-action and reflection-on-action. Reflection-in-action refers to the process teachers engage in when they interpret, analyze, and provide solutions to complex and situational problems in the classroom. Reflection-on-action describes the process teachers engage in post-instruction, how they mentally reconstruct their practice for the purpose of analyzing

what took place during the experience. The concept of reflection-in-action is especially relevant to this study. On a daily basis, teachers take actions and make decisions that require little to no thought beyond engaging in the act; they simply *know* what to do in the moment. These types of actions tacitly imply our knowledge of how to do something, without our giving it much thought. Schön (1995) describes this phenomenon, juxtaposing our natural decision-making processes with those made by educational professionals, in the following excerpt:

> Our knowing is ordinarily tacit, implicit in our patterns of action and in our feel for the stuff with which we are dealing. It seems right to say that our knowledge is in our action. And similarly, the workaday life of the professional practitioner reveals, in its recognitions, judgments, and skills, a pattern of tacit knowing in-action (Turning the problem on its head, para. 3).

According to Schön, it is difficult to articulate how one innately knows how to do something, and a person who is particularly knowledgeable about something, or has a knack or talent for something, has proportionately more trouble being able to *accurately* describe the source of their ability. Although Schön (1983, 1984, 1995) does not refer to these knowledgeable others (more specifically, in the case of this literature review, teachers) as *experts*, their knowledge does translate in most cases to expertise.

Along these lines, I will now review the studies which explicitly focus on the decision-making processes of *expert* educators. While the research has wildly varying definitions of what an "expert" teacher is, Palmer, Stough, Burdenski, and Gonzales (2005) conducted a comprehensive review of the literature to identify the specific

characteristics researchers associated with what they believed to be qualifiers of expertise. They ultimately came to the conclusion that a two-step "gating procedure" should be taken into consideration when identifying an expert educator, as follows:

> First Gate Screening:
>
> Teachers should have: (a) three to five years of experience in a specific teaching content area and with a particular population of students, *and* (b) teacher knowledge as reflected in relevant certification and degrees that correspond to the field in which these teachers are currently teaching.
>
> Second Gate: Performance Indicators
>
> Recognition as an exemplary teacher by: (a) multiple constituencies, for example, fellow teachers, researchers, administrators, teacher educators, based on recent and relevant indicators of teaching effectiveness to include teacher knowledge and skills, *and* (b) should be confirmed with documented evidence of teacher impact on student performance (p. 23).

Similarly, Warren's (2000) review of the literature on teacher planning found that experience (Borko & Niles, 1982; Brown, 1988; Clark, 1983; Clark & Elmore, 1979; Clark & Peterson, 1986; Clark & Yinger, 1979a, 1979b, 1987; Kagan & Tippins, 1992; McCutcheon, 1980; Yinger, 1980), instructional materials (Borko & Niles, 1987; Clark & Elmore, 1981; McCutcheon, 1980; Sardo-Brown, 1990; Yinger, 1980), administrative scheduling constraints (Brown, 1988; McCutcheon, 1980; Yinger, 1980), and student interests/abilities (Brown, 1988; Peterson, Marx & Clark, 1978; Yinger, 1980; Zahorik, 1975) greatly impact teacher planning efforts. Unsurprisingly, teachers who have

minimal experience in the classroom setting (i.e. preservice teachers, first year teachers) have a tendency to plan lessons in accordance with the way they were taught during their undergraduate training. Teachers with extensive experience are apt to rely on prior experiences with former students, drawing from successfully implemented activities and discussions in planning future lessons (Brown, 1988). Teacher experience is by and large the dominant influential factor in terms of how teachers plan.

Martha Henry (1994) conducted a three-part study over two decades ago in an attempt to explicate the marked differences between experienced teachers versus teaching expertise. In the second pilot phase of her study, she explains that the first pilot she conducted "shows differences among teachers having varying years of experience, but does not explore differences among teachers with regard to their pedagogical development" (p. 9). Relying on the decision-making efforts of curriculum coordinators in her local school district, she explains that:

> Nominators reported using the following criteria in their determination of expertise: has knowledge of content, has the ability to work with all students, is nurturing, takes risks, is respectful, is interested in student's needs, participates in continuing professional growth, is self-confident and reflective, adjusts the context to the learners, is slow to close the learning process, makes multiple concept connections, enthusiastic, uses teachable moments, uses a variety of strategies, has good classroom management, and acknowledges own lack of knowledge. These factors reflect Berliner's findings regarding the Expert teacher's flexibility and reflexivity.

Henry continues, stating that of the 87 teachers that participated in her quantitative study, *expert* teachers were most concerned with *informal* student outcomes, teacher-strategy compatibility, and the teacher's interest in implementing it. Essentially, if the teacher will not enjoy teaching in a certain way, he or she is less likely to implement it. Henry further argues that *expert* teachers are not concerned with making instructional decisions based on what the administrators, board of education, or community at large think, nor do they rely on fellow faculty support for implementation. Moreover, expert teachers' instructional decisions are generally unaffected by how these decisions may benefit their positions within their schools; in other words, expert teachers' decision-making is not motivated by a desire for career advancement. In sum, "Foremost in [expert teachers'] thoughts… is how this instruction will *motivate* students and *enhance student understanding and enjoyment"* (p. 13, emphasis my own). On the other hand, *experienced* teachers, according to Henry (1994), are more likely to implement change if an outside other suggests that they do so, as opposed to making the decision because it was their own idea. Unlike *expert* teachers, *experienced* teachers have a tendency to be open to testing new instructional strategies. For the purposes of my study, this differential doesn't apply; my case study participant would fall into the expert teaching category, but is completely open to incorporating emergent technologies in new and exciting pedagogical formats for his students' benefit.

Routinization is another characteristic common among *expert* educators (Byra & Sherman, 1991; Leinhardt & Greeno, 1986; Leinhardt, Weidman, & Hammond, 1987; Yinger, 1979). The longer a teacher has been in the classroom, the more likely they are to have a number of routines in place, that can be adjusted on an as-needed basis (Byra &

Sherman, 1991). The ability for an educator to quickly make adjustments to their routines should any problems arise during active teaching time is one that comes with many years of experience (Taheri, 1982). The instructional activities an instructor plans set the tone for the routinization of the course. Yinger (1979) articulates in his study of teacher routines, that activities "could be considered the equivalent of "controlled" behavior settings, because not only was the behavior of the teacher signaled and controlled by the setting (the activities) but the *setting itself* was largely created and *controlled by the teacher*, ahead of time" (p. 165).

The notion of teacher-controlled activities is of particular relevance to my review of the literature and my dissertation study as it relates to gamified learning environments, where quests are activities pre-conceived by educators as part of their planning, organized to scaffold student learning (starting at a novice level and incrementally increasing in difficulty based on the student's progress throughout the quest line).

Pedagogical Scaffolding

The following section of this review discusses pedagogical scaffolding, beginning with a description of the term's roots (particularly as it relates to Vygotsky's Zone of Proximal Development). The section continues with a review of the scholarship on how scaffolding practices have evolved in educational settings over time, concluding with how computer-based scaffolding (i.e. quest-based learning) coupled with teacher-based scaffolding provides the greatest level of support for student learning (McNeill & Krajcik, 2009; Saye & Brush, 2002).

Twenty-first century learners are expected to acquire, hone, and develop a number of skill sets over the course of their education. These include: learning how to learn; accessing constantly-changing information (i.e. media literacy); applying what they've learned to various scenarios; and understanding how these skills can be applied to "real-life" situations beyond a controlled classroom environment. Research has shown that through the use of scaffolded instruction, teachers can maximize their students' learning potential by providing adequate support structures while promoting learner autonomy (Larkin, 2002).

Jerome Bruner coined the term "scaffolding" in 1975 with reference to Lev Vygotsky's research on young children's and adolescents' capacity to learn from expert others (adults) for the purpose of completing tasks they would otherwise be unable to complete independently (Bruner, 1975). A number of characteristics central to instructional scaffolding have been identified by researchers in the past few decades, and these have provided a general guideline for educators to follow in order to better support their students' learning. Hogan and Pressley (1997) surveyed the research, highlighting eight characteristics for successful implementation of scaffolding: (1) pre-engagement with the student and the curriculum; (2) establishing shared goals between students and teachers; (3) assessing student needs (where the teacher familiarizes him or herself with the students' background knowledge/schema); (4) providing tailored assistance to students (e.g. prompting, questioning, cuing, discussing content knowledge relative to the task, etc.); (5) maintaining goal acquisition (where the teacher encourages his or her pupils to remain on task); (6) supplying feedback (where the teacher identifies factors successfully impacting students' progress); (7) controlling the environment (making

students feel safe to take risks in their learning processes); and (8) nurturing students' self-regulatory behaviors (including support that leads to pupils' generalization of learning in a variety of contexts beyond the scope of the in-class activity).

Scaffolding comes in a variety of forms in the classroom setting as described by Ellis and Larkin (1998): teachers provide scaffolding by modeling the proposed task; the class comes together as a whole to provide supports, as teachers and students problem-solve together; group-work is prominent, as students in pairs, triads or other combinations work together to complete tasks; and individual students themselves scaffold by demonstrating their ability to independently complete tasks.

Puntambekar and Kolodner (2005) conducted a two-phase study using design-based research practices in order to create guidelines for designing scaffolding. As will be discussed below, the first phase of research greatly informed the second, providing further clarity on the notion of what the authors term "distributed scaffolding" for learning support in the classroom setting. This concept is similar to those outlined above (Ellis & Larkin, 1998), with more defined pedagogical application to the classroom setting.

Puntambekar and Kolodner (2005) contend that there is no one set scaffold that guarantees success in complex learning environments. The many moving parts of the classroom setting contribute to both the need for and successful implementation of multiple scaffolding constructs underpinning students' learning. The authors cite Vygotsky's (1978) concept of the zone of proximal development (ZPD) as central to successful scaffolding practices. A child's independent ability to complete a task versus

their potential development with the guidance of a more knowledgeable other (e.g. their teacher or more advanced students) is measured within the ZPD.

Brown, Rutherford, Nakaguwa, Gordon, and Campione (1993) assert that there are multiple ZPDs in play within a classroom environment at any given time. With this in mind, Puntambekar and Kolodner (2005) took on the challenge of identifying the ways in which scaffolding is implemented in the classroom setting. With a focus on design-based learning, the authors conducted a study exploring middle school students' understanding of environmental changes to an island off the coast of Georgia, a location within proximity to the students' school. By creating a design challenge unique to the students' "real-life" environment, the task provided a more relatable learning experience for these middle schoolers.

The first phase of the study was designed to set the stage for future iterations of the study. In the second phase of the research, Puntambekar and Kolodner (2005) tailored the environment and task to include more forms of support for scaffolding purposes. In particular, they included more specific prompts (for example, prompts to use resources and handouts, group discussion, and whole class discussion) so that the students could successfully master the tasks expected of them. With the new implements in place, the students were better able to understand what was expected of them for task completion, and in turn were better able to understand the applicability of the information they learned in class to other environments (beyond the initial island they were studying). While the teacher involved with both iterations of this study was unfamiliar with the task being given to the students in the first phase of implementation, the foundation this phase

allowed for the implementation of more support structures on her behalf, to the benefit of her students.

Puntambekar and Kolodner (2005) discovered that that the multilayer support structures put in place in the second study (particularly as compared to the first) created a greater number of opportunities for the students to take advantage of a variety of scaffolds to augment their learning practices. Further, the authors acknowledged the importance of redundancy in task completion. They found that the more often students engaged in specific strategies for learning, the more likely the scaffolds supporting learning were to be faded out, leading to complete independence in task completion. Ultimately, the authors emphasized that scaffolding is no longer solely dependent upon communication between people (e.g. students and expert others/teachers); rather, "...artifacts, resources, and environments themselves can also be designed as scaffolds (Palinscar, 1998)" (p. 213).

In applying the concept of scaffolding to the pedagogical construct of having students design videogames, it is important to address students' background knowledge of videogames (or, schema; e.g. information they've come across through gameplay) in addition to the guidelines that Puntambekar and Kolodner (2005) suggested. Repenning, Webb, and Ioannidou (2010) emphasized the importance of flow (Csikszentmihalyi, 1990) as it relates to the concept of scaffolding. Just as one experiences "optimal flow" during gameplay (when the player is so engrossed in play that hours seem to pass by in a matter of minutes), the same state of euphoria can be achieved in relation to videogame design by:

> ...balancing design challenges and developing skills by scaffolding the process with well-defined stepping stones based on increasingly complex computational thinking patterns [...] For instance, once a student understands how to conceptually represent a collision in one programming language, e.g. Java, then the student is more likely to be able to create a corresponding solution in a different language. (p. 3).

A student's ability to develop and then apply newfound knowledge from one educational context to another, as exemplified here with the programming language Java, directly influences their capacity for building on previously learned concepts for the purposes of demonstrating masterful content knowledge acquisition. In this context, then, scaffolding (aided by both teacher and technology use) provides students with the understanding necessary to build upon their knowledge bases in order to further hone and develop their newly acquired skill sets.

Conceptual Framework

This particular dissertation study looks to examine how an experienced videogame design instructor (henceforth referred to as 'Joe[2]') scaffolds student learning of both digital and non-digital game design principles and concepts (with a focus on the former); therefore, it will focus on the classroom context where student learning takes place. But, as I have discussed earlier in this document, teaching game design is a complex activity, including but not limited to the use of technological tools, the understanding of complex systems, and the recognition of and response to iterative

[2] All names of people and locations specific to this research study are pseudonyms.

feedback loops. In other words, there are many directions for researchers to explore, and a general understanding of the theories associated with videogame play and videogame design is necessary to form the basis for my topic of planning and scaffolding game design pedagogy. In order to place the topics that I have already discussed – especially Gee's principles, teacher planning, and instructional scaffolding – into their proper contexts, I will analyze them using a combination of lenses, namely the Technological Pedagogical Content Knowledge (TPACK) framework (Koehler & Mishra, 2009) and the P-21 framework (The Partnership for 21st Skills) in combination with Hannafin, Land, and Oliver's (1999) model for pedagogical scaffolding within open learning environments, or OLEs.

The Technological Pedagogical Content Knowledge Framework

In an attempt to ground the study of educational technology research within a more theoretically-based context, Punya Mishra and Matthew Koehler first introduced the Technological Pedagogical Content Knowledge Framework to the academic community at large in 2006. Building upon Shulman's (1986) work exploring teachers' "pedagogical content knowledge", Mishra and Koehler argue that their contribution to the research provides a lens for analyzing teachers' "knowledge required for technology integration in teaching, while addressing the complex, multifaceted, and situated nature of this knowledge" (Mishra & Koehler, 2006, p. 1017). Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all three concepts [content, pedagogy, and technology] individually. Instead, TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive

ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones.

In light of the above definition of TPACK, provided by Koehler and Mishra (2009), it is clear that the power of this framework for data analysis is at its strongest when technology, pedagogy, and content knowledge come together in synergy with one another. The heart of the framework -- the overlap on the Venn diagram below -- represents its culmination, the "truly meaningful and deeply skilled teaching with technology" that so many teachers strive for.

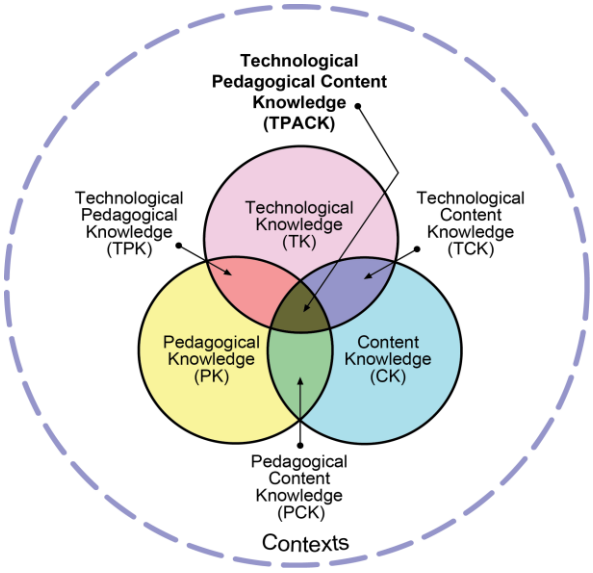

Figure 1. Technological Pedagogical Content Knowledge (TPACK) framework (http://tpack.org)

Discussion with colleagues regarding TPACK led to some fundamental insights regarding the strengths and weaknesses of this framework for my study. In particular, the development of codes to correspond with each area of the diagram (e.g. pedagogical

content knowledge, technology content knowledge, content knowledge, etc.) presented a number of challenges during the data analysis phase of this study. The majority of the actions, skills, and dispositions my case study participant Joe embodies as an educator and exhibits in his classroom could not be characterized merely as a single form of knowledge or one type of pedagogy. Rather, many (if not all) of his teaching techniques fell repeatedly into the center of the TPACK schematic. Initially, I found this to be a troubling aspect of the analysis process, questioning my decision to include this lens for scrutinizing my data to begin with. Nevertheless, upon further scrutiny of the model, I was able to discern the value of situating the majority of my study participant's instructional practices in the center of the TPACK Venn diagram: Joe in fact exemplifies teaching with technology as it is described within the context of this framework.

Where this framework falls short for the purposes of my study, however, is its teacher-centric nature. Certainly to identify Joe's exemplar teaching status is important in order to validate his pedagogical prowess. We know that Joe knows what he knows and teaches it well; the TPACK framework tells us as much. But the ultimate goal of teaching is to impart knowledge to one's students, and so the TPACK model is lacking in terms of identifying the specifics of Joe's pedagogy, particularly his scaffolding practices and how he implements them. TPACK evaluates the components and knowledge that are needed to be skilled at teaching with technology, but it fails to give direction as to *how* a teacher negotiates these variables in his classroom setting. In other words, scaffolding the development and application of knowledge from teacher to student is where this analytical lens is lacking for the purposes of my study. To address this need I have selected a second framework to aid my analysis of the data. Hannafin and colleagues'

(1999) discussion of open learning environments (OLEs) aids in exploring the development and application piece of my analysis at a more in-depth level.

Scaffolding Open Learning Environments (OLEs)

Hannafin et al.'s frame highlights a number of varied overlapping contexts associated with OLEs. The interplay among these five categories – pedagogy, psychology, technology, culture, and pragmatism – effectively complements the elements of the TPACK framework, which should come as little surprise given that technology, pedagogy, and content knowledge are all integral parts of an OLE. While Hannafin and his colleagues' (1999) research of OLEs predated Mishra and Koehler's (2006, 2008, 2009) augmentation of Shulman's PCK framework (1986, 1987), Hannafin et al.'s discussion of the foundations, methods and models of open learning environments failed to cite Shulman's seminal work in the field. I would contend that these two bodies of research not only inform and strengthen each other, but when considered together describe the conditions for an optimal OLE (as described by Hannafin and colleagues) run by an expert educator (as defined by TPCK).

Hannafin et al. (1999) articulate the following four components of OLEs, identifying a number of methodologies appropriate for operationalizing them: enabling contexts, resources, tools, and scaffolds. Each of these elements contributes to an effective OLE, but for the purposes of my dissertation study, I have chosen to focus on the final component: scaffolding. The authors describe scaffolds as "processes that support individual learning efforts," (p. 123) distinguishing between "scaffold types and functions" and "related methods and mechanisms," whereby "mechanisms emphasize the methods through which scaffolding is provided, while functions emphasize the purposes

served" (p. 131). Hannafin and his colleagues identify four specific scaffold functions – conceptual, metacognitive, procedural, and strategic – and suggest for each of them several methodological implementations. *Conceptual* support structures aid students in determining where to focus when they engage in a particular task (in the case of this particular study, videogame design); *metacognitive* supports contribute to the ways in which students manage the learning process; *procedural* scaffolds assist students in using the tools available to them for task completion; and *strategic* types of scaffolding focus on the strategies that students can use to approach the activity with which they are engaged.

Combining The TPACK Framework & The OLE/TELE

The analytical basis for this study lies at where the TPACK framework and OLEs overlap. At the very least, the technological and pedagogical aspects of the TPACK frame find counterparts in Hannafin et al.'s (1999) illustration of relationships among OLE foundations and values, two of which are explicitly labeled as "technological" and "pedagogical." The intersection of TPACK and the OLE becomes more pronounced with Kim and Hannafin's (2011) expansion upon Hannafin et al.'s (1999) initial conceptualization of scaffolding. While the 1999 OLE model addressed the four OLE scaffolding classifications mentioned above (conceptual, metacognitive, procedural, and strategic[3]), the 2011 revision reframes these four classifications by designating them as "purposes," and adding "interactions" (identified as dynamic or static) and "sources" (described as "peer", "teacher", and "technology" types). These various elements come

[3] More information about these scaffolding classifications, including specific definitions and examples relevant to my study, can be found in Chapter 4 of this document.

together to form the "Dimensions of Scaffolding Problem Solving Inquiry" (p. 408). In this conceptualization of scaffolding, Kim and Hannafin have addressed the component I initially found absent from Hannafin et al.'s (1999) work: the teacher. The additional classifications Kim and Hannafin made to Hannafin and his colleagues' (1999) frame further explicate the relationships between each scaffolding "purpose" (conceptual, metacognitive, procedural, and strategic), the conduits through which these scaffolding types can be produced (referred to here as "sources"), and the form that each scaffold purpose takes via "interactions", classified as either dynamic (such as cues or prompts provided by the instructor) or static (such as sources including technological tools or written instructions).

As cited by Saye and Brush (2002) in their study of the issues which impact scaffolding students' learning of social studies within inquiry-based learning environments,

> Hannafin and colleagues (1999) emphasize that a learning environment is unlikely to be effective unless its core foundations and values are consistent psychologically, pedagogically, technologically, culturally, and pragmatically. Ultimately, **it is the master teacher** who must align all elements of the learning environment into a cohesive whole" (p. 94, boldface emphasis my own).

From Saye and Brush's perspective, an expert instructor solidifies the strengths of an OLE. Although Kim and Hannafin (2011) have since acknowledged the importance of the sources of scaffolding support in "technology-enhanced learning environments" or TELEs, the identification of characteristics attributable to a "master teacher" can be

found at the epicenter of the TPACK framework – where the technological, pedagogical, and content knowledge (of an expert educator) meet. For the purposes of my study, I've selected the TPACK framework to give credence to Joe's teaching expertise, and the OLE (or TELE) model as a way of defining the optimal learning conditions for effective scaffolding practice in his classroom setting.

Conclusion

This literature review has explored the definition of games/videogames, examined what previous research studies say about the creation and use of videogames for education, reviewed the learning theories associated with videogame use and design, and articulated those theories that contribute to the theoretical framework of my dissertation study. Videogames have permeated all aspects of 21st century living, from the child glued to a hand-held console screen to media coverage of a particularly violent game. Although the public has seen its fair share of negative associations made with videogame play (Funk, Baldacci, Pasold, & Baumgardne, 2004; Griffiths, 1999; Scott, 1995; Sherry, 2001), there have been many more publications in recent years citing the positive effects of game-play (Gee, 2003, 2004, 2007a, 2010, 2012, 2014; Jenkins, Klopfer, Squire, & Tan, 2003; Squire, 2008; Steinkuehler, 2006).

This review has focused on three critical ways in which games can be included within the classroom setting: educational games, enlisting students as game designers, and gamification. The implementation of these methods has revealed that videogame use is conducive to the development of "…attention, spacial, concentration, problem-solving, decision-making, collaborative work, creativity, and, of course, ICT skills" (De Aguilera & Mendiz, 2003, p. 8). These methods, and videogame pedagogy more broadly, are in

turn grounded in four learning theories: constructionism, constructivism, situated cognition, and scaffolding. More specific to videogames and learning are Gee's learning principles and how they promote a student-centered approach to teaching.

In addition, this review contains a discussion of a conceptual framework based on the overlap between the TPACK framework and OLE/TELEs. In tandem, these two frames provide a lens for analysis of a study focusing on one expert teacher(-gamer)'s planning outlined within this review as it relates to the *scaffolding of* pedagogical practices associated with videogame design and development in the classroom setting.

In sum, we have a tremendous amount of learning to do in regards to how videogame play can impact educational settings and beyond. This literature review has provided the foundation on which such learning can be built.

CHAPTER 3

METHODOLOGY

Situating the Study

The purpose of this study is to shed light on the pedagogical (e.g. planning and scaffolding) practices associated with videogame design curricula in the classroom setting for underpinning students' 21st century skill development. Further, this study has explored the role played by pedagogical expertise in teaching game design and provide an introspective look at pedagogical challenges instructors face within the videogame design classroom. While the participant in this case study has multiple years of experience in his position, the constant technological changes in videogame programs available on the market to students (often at little or no cost to the school budget) require an equally constant shift in pedagogical practice on the part of the educator.

This chapter includes descriptions of the context and study participants, materials, and procedures related to data collection.

Research Questions

The research is designed to answer the following questions:

How does an experienced middle school teacher who teaches videogame design scaffold student learning of game design principles and concepts?

- How does the teacher plan his instruction to support a videogame design 8th grade course?
- Why does he make the choices that he makes when planning?
- How does the teacher scaffold student learning through this instruction?

Methodology and Design

The exploratory nature of this dissertation is grounded in the field of qualitative research. As defined by Miles, Huberman, and Saldaña (2014), qualitative research can be characterized as:

> a situated activity that locates the observer in the world. It consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recordings, and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of, or interpret, phenomena in terms of the meanings people bring to them. (p. 3)

Qualitative research seeks "answers to questions that stress how social experience is created and given meaning" (Denzin & Lincoln, 2005, p. 10). Several questions were especially relevant to my study: What techniques does an experienced middle school teacher who teaches videogame design employ when introducing a new videogame design program into his classroom setting? How does he scaffold student learning of game design principles and concepts? How does he plan his curriculum and instruction in his classroom setting? Most importantly, qualitative research offers the opportunity to explore the directions that the participant and his experiences may take, in addition to gaining deeper understanding of these experiences through natural interaction with his students and fellow colleagues: "[b]eing open to any possibility can lead to serendipitous

discoveries" (Merriam, 1998, p. 121). Further, as Miles, Huberman, and Saldaña (2015) point out, qualitative research has the "...strong potential for revealing complexity" (p. 11), thus affording the opportunity to optimize the concept of "data condensation" (p. 12). As data and themes emerged throughout the course of the study, the "data display" took shape, primarily in the form of "extended text" (p.12). The design of this study was meant to provide guidance in accomplishing the twelve major characteristics of qualitative research as outlined by Patton (2002):

- naturalistic inquiry (openness to what emerges from the data)
- emergent design flexibility (adaptive inquiry stance)
- purposeful sampling (insights specific to the phenomenon)
- qualitative data (yielding detailed "thick description" documentation)
- personal experience and engagement (personal insights critical to investigation)
- empathetic neutrality and mindfulness (understanding without judgment while maintaining full presence)
- dynamic systems (attention to process)
- unique case orientation (attention to case detail on an individualized level)
- inductive analysis and creative synthesis (full immersion in the data)
- holistic perspective (seeing the case as a complex system that is more than the sum of its parts)
- context sensitivity (places findings in a social, historical, and temporal context)
- voice, perspective, and reflexivity (authentically self-analytical, politically aware, and reflexive in consciousness)

As the research progressed, attention turned and returned to these elements in order to maintain steady progress, thus avoiding the traps of tangents, irrelevance, data mismanagement or disorganization, shallow interpretation, bias, and weak analysis.

Research Methodology - Case Study

This dissertation employs qualitative case study research as defined by Yin (2003) as:

> …an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident. […] The case study inquiry copes with the technically distinctive situation in which there will be many more variables of interest than data points, and as one result relies on multiple sources of evidence, with data needing to converge in a triangulating fashion and as another result benefits from the prior development of theoretical propositions to guide data collection and analysis (pp. 13-14).

My case study is bound by several contexts: the videogame design teacher himself and his experience in this position, his school and district, his students, and his interactions with these students. The study is situated within these interlocking contexts. Through qualitative research techniques and examination of the relationships and resulting interactions between the aforementioned contexts, I uncovered some of the pedagogical affordances and constraints of the scaffolds associated with this teacher's videogame design curriculum that impacted both his planning and practice. I in turn considered the

extent to which the videogame design instructor's experiences facilitated or hindered his pedagogical expertise to give it meaning.

The case study is written in a narrative format and is primarily concerned with providing the reader insight and understanding of the unique case or situation; according to Stake (1995), "Qualitative research tries to establish an empathetic understanding for the reader, through description, sometimes thick description, conveying to the reader what the experience itself would convey" (p. 39). The outcome of a rich narrative text describing the experiences of this videogame design teacher and his students was dependent upon my organized, flexible, and careful data collection.

Case Study Setting and Participant

James Anderson Middle School was the setting for this study. It is situated in a middle-to-upper-middle-class suburban neighborhood of Forrest Knoll, located in New Jersey. The school has limited diversity, with 74% of the students classified as White, 20% Asian, 2% Hispanic, and 4% unknown (Public School Review, 2016). Less than 1% of students are eligible for free lunch. This school was selected for study based on a survey that I previously distributed to individual teachers for the purpose of procuring willing participants to be a part of this fieldwork (see Appendix A of this document). This survey was distributed to teachers across the US, and I received about thirty responses. I then narrowed my focus to those respondents who taught in New Jersey so that I would be able to visit my chosen teacher's classroom in person. From this smaller pool (four teachers in total) I selected and reached out to Joe, a videogame design instructor at the above school, due to his being the closest in proximity to my location in

NJ, in addition to the fact that his principal was agreeable to his participation in my study (including allowing me to observe his classroom teaching). His replies to the survey provided me with an initial overview of his attitudes towards videogames, gaming, and the use of videogames in the classroom. In addition, his written responses provided additional material for the development of questions to be utilized during interview sessions over the course of the study.

Joe's eight years of experience teaching videogame design in this school district made him an ideal candidate for study, due to the fact that he has experience teaching game design on multiple platforms, that he has a solid foundation as part of his district, and that the district has programming which specifically hires instructors to teach game design classes full time as part of the students' elective programming, much as a language or drama class might be offered. The classes Joe specifically teaches at WAMS include: *Introduction to Digital Storytelling and Video Game Design and Development* (as part of the 7th grade Computer Cycle) where students learn about a variety of tools meant to spark student interest in creative problem solving through the use of technology; *Video Game Design and Development* (as part of the 8th grade Elective Cycle) described on Joe's website as follows:

> In 8th grade, students are provided with the opportunity to explore topics of interest on a much deeper level through our semester long elective program. In Video Game Design and Development, students use a variety of tools to create video games. The course focuses on all aspects of Game Desgin [sic] and Development including the creation of a game design document as the planning phase of the design process, creation of original graphics and sounds, and

> developing games using game creation software that teaches programming constructs in a user friendly environment. Students will have an opportunity to work in development teams as this is an important aspect of game design and development (James Anderson Middle School's website).

He also teaches this course through the online learning collaborative platform Virtual High School (VHS).

A More In-Depth Look at Joe

My first introduction to Joe occurred when he reached out to me via the social networking platform Twitter. He sent me a direct message regarding our similar interests in gaming and education – having read my profile page, Joe knew I lived and worked as an educator in New Jersey as well. I asked Joe if he would be interested in taking the survey I'd developed for my study. The fact that Joe has a Twitter account and tweets pretty regularly (a total of 5,556 tweets per his account profile on 4/21/13, 70,200+ tweets per his account profile on 12/30/17), typically about videogames as they connect to education, made him an ideal candidate for my research. I had originally begun following Joe on Twitter when he and I were both enrolled in the 3D Game Lab (3DGL) online teacher camp, run by Boise State. Participation in this particular camp affords registrants the ability to engage in year-round professional development opportunities through a research-based, quest-based-learning platform. 3DGL allows teachers from all over the world to come together online several times throughout the year to engage in camp activities and to network with other educators who are interested in the realm of quest-based learning. Joe is one of those educators.

Having begun his game-playing habits at the age of 7 due to the influence of a sibling, Joe's survey responses reflected his self-described "serious, hardcore gamer" persona. Playing anywhere between two and three games at a time, Joe engages in gameplay approximately 13 to 15 hours per week. The majority of this time is focused on online game play, massively multiplayer online role playing games (MMORPGs) like *World of Warcraft*. Joe articulated the definition of a gamer as "someone who has an active interest in games and seeks opportunities to play." He prefers playing action-adventure, adventure, role playing, and strategy games, with RPGs at the top of the list, "I like questing as well as the social aspect" of role playing games. While he doesn't have subscriptions to any game magazines or services, he does occasionally participate in online discussion forums, including Yoyogames, Battle.net, and Dash of Dans. He admits to using Internet searches to scour resources that will assist him with his gameplay. He will often consult others when deciding which game(s) to play.

In an effort to gain a more thorough understanding of Joe's personal gaming habits (how he identifies himself in terms of gaming), which may in turn influence his pedagogical practice, I poured over his survey responses, interview responses, and blog posts. Three themes emerged from this analysis: Joe's focus on the social aspect of gaming; the pervasive nature of (video)games and gaming on Joe's personal and professional life experiences; and the strong convictions Joe has in relation to how games can positively influence people's lives. Each of these points is inextricably linked to Joe's identities-in-practice (Hull and Greeno, 2006), as a gamer and as an educator.

Data Collection

Data collection occurred primarily during the Spring of 2016. Previous data was collected utilizing the same methods articulated in this chapter during the Spring of 2013. The data collected at that time was for the purpose of completing my pilot study relative to both my coursework requirements and in preparation for carrying out a more in-depth study for my dissertation. All data gathered from participant resources was collected with explicit permission from the participants and in full compliance with Institutional Review Board (IRB) guidelines.

In accordance with qualitative research tradition (Denzin & Lincoln, 2005; Miles, Huberman, & Saldaña, 2015; Stake, 1995; Yin, 2003, 2015), multiple data sources were collected. Data used in this dissertation includes: interview data, which is comprised of four, approximately 30 minute to hour long audio semi-structured interviews with Joe; textual artifacts (lesson plans, classroom materials, and reflective blog posts); observations and field notes (a minimum of ten field-based observations); and other resources including copies of district, state, and national curriculum guidelines (Common Core; PARCC; NJCCCS). Though interviews and classroom observations were the primary tools for data collection, the use of other methods provided me with a comprehensive understanding of the participant's videogame design pedagogical scaffolding practices. Such an involved approach at collecting data helped me to develop a more rich understanding of the pedagogical practices of this teacher-gamer and the ways in which he scaffolds student learning in various contexts by means of various game design programs and platforms.

I enumerate my data collection methods below in the order I obtained the data. Classroom observation enabled me to gain access to the students Joe teaches, to learn about how they behave, and how Joe interacts with them. I conducted 4 interviews, which provided me with in-depth understanding of Joe's gamer identity, his knowledge and beliefs about teaching game design, and how these variables impact the planning and scaffolding of his pedagogy, enabling me to contextualize his pedagogical practice.

In addition to the general overview of my data collection methods above, I now provide detailed descriptions of these methods:

Observation: In Class. I observed a total of twenty-one class periods (lasting approximately 40 minutes each) specific to one gaming unit that Joe developed for his students over the course of the class cycle (a period of eight weeks in the school year). Eleven of the twenty-one class period observations took place in March and April of 2013, approximately at the midpoint of the semester. In preparation for this dissertation study, I wanted to observe *all* the various courses Joe taught at the school. I was originally undecided with how I would approach classroom observation within this study; it wasn't until I completed several rounds of observation and interviewed Joe for the first time that I realized his 8th grade *Video Game Design and Development* course would be the best fit for my dissertation. Through these observations, I gained insight into the culture, dynamics, and constructed roles among Joe's students, which assisted my understanding of how he organizes his classroom for optimal game design learning conditions. This method enabled me to see how Joe's students and Joe himself work within a classroom setting, and provided me with data to which I then referred to during my interview sessions.

In 2016, I visited his classroom at the start of a new unit, which begins at the start of a "class cycle" - an eight week stretch in the marking period (four marking periods comprise a school year). Joe's course consisted of multiple "units" within a class cycle that he completes with his students. My initial intent was to capture an entire "unit" from start to finish in his class. Due to timing constraints, I was unable to observe a class unit in its entirety, but I was able to observe enough classroom periods at the start of a class unit (in 2016) and in the middle of a second class unit (2013) that I could make sense of Joe's general approach to teaching videogame design. There was little difference in the way that Joe ran the classroom between the first and second set of visits I conducted over the course of this study. His student-centered, peer-collaborative approach to teaching and learning was a marked characteristic of each observational period (2013 and 2016, respectively). This consistency in his approach to instruction speaks to his qualifications as an experienced pedagogue; routinization of one's teaching methodologies exemplifies one of the characteristics of expert educators (Byra & Sherman, 1991; Leinhardt & Greeno, 1986; Leinhardt, Weidman, & Hammond, 1987; Yinger, 1979).

Initially I maintained a passive presence in the classroom setting, taking field notes; however, by the third day of observation, I began to engage in conversations with the students, sometimes assisting them with their work (with Joe's permission), as a way to access an "insider" perspective (Robson, 2002). Any audio recording that took place within the classroom setting was done by myself only after obtaining consent as required by IRB protocol. Joe often records his students during the class period and frequently posts videos of them engaged in coursework to his blog, Twitter, and/or his class YouTube channel. In addition to having access to those multimodal social media

snippets, I personally audio recorded each class for the specific purpose of being able to jog my memory in order to more fully develop my analytic memos after each observation. Although I took copious amounts of notes at the start of each class (when Joe spent the most amount of time using the direct instruction technique), I wanted to be sure that I caught as much of his actual phrasing as possible. Further, by taking notes and recording his explicit directives/communication with his students, I would be able to triangulate my data for validity purposes (in connection with the other forms of data I collected throughout the study period).

Interviews (See Appendices B & C). For this dissertation, primary data collection included 4 semi-structured interviews that varied in length (between 30 minutes to 1 hour). My first interview with Joe took place in the Spring of 2013, while three additional interviews occurred over the course of the Spring 2016 semester, with a central focus on learning about Joe's pedagogical practice and if and how his gaming experiences influence his classroom instruction (particularly with regards to planning for and scaffolding student learning). In preparation for each interview, I looked for settings that provided a quiet, yet public space where I was able to speak with Joe with minimal distraction, while ensuring the authenticity of his responses and the research. In this vein, all interviews took place in a semi-private room/space. My initial interview (March 2013) took place in the cafeteria after the student lunch period rotation completed. The second and third interviews (February 2016) I conducted with Joe took place in his classroom. The final interview (February 2016) took place in the library media center.

After securing permission to conduct observational visits from the district in which Joe is employed, I promptly scheduled an initial visit to conduct my first and

second interviews with Joe on his own turf. I explained to Joe that I would be using two different protocols to guide each interview. The first "Gaming Protocol" was developed by Cindy Selfe and Gail Hawisher for inclusion in their edited collection text, entitled *Gaming Lives in the Twenty-First Century: Literate Connections*, and published in 2007. While Selfe and Hawisher (2007) emphasize the importance of describing one's individual gaming experiences through biographies based on a simple interview protocol, they acknowledge the inability to generalize results obtained from this form of data collection. Their ultimate goal for completing this research was to highlight the "…ongoing life stories of people living in a particular period of history—in great detail and in personal terms" (p.6).

These interviews provided me with an in-depth understanding of how Joe's pedagogical and gaming experiences -- his textual knowledge and assumption of teacher-gamer identity -- inform or are informed by other pedagogical and gaming encounters. These interviews encouraged reflection and discussion of information he remembered from both his personal videogaming experiences as well as his prior teaching experiences. The questions encouraged him to make connections between his prior pedagogical (and gaming) experiences and revealed whether or not Joe seemed cognizant of the connection. Finally, I conducted a debriefing interview as a means to clarify and/or confirm questions and themes that arose during data collection, as well as to solicit additional reflection on his pedagogical and gaming practices.

In the Spring 2016 semester, Joe taught until 12:09 pm every day. An email exchange with Joe that took place back in January of 2016 confirmed that the best observational class period for the purposes of this study, particularly based on his

schedule, would be from 11:29am-12:09pm. Debrief sessions took place at the conclusion of the class period, once Joe was done teaching for the day.

These interviews were audio-taped, and I maintained a running record as well, both of which were transcribed soon after the completion of the interview in order to ensure that the documented data was complete and thorough. Because the "general interview guide approach" (Patton, 1990) allows for flexibility, the direction of the interviews was contingent upon the discussions that ensued. Questions that "guided" each interview were designed to access the following[4]:

- The instructor's personal connection to videogames (which speaks to his identity as both a teacher and gamer as well as the Discourses he uses in the classroom with his students.
- What the instructor already knows and/or learns from his personal videogame-play habits and how these impact his videogame design pedagogy
- The instructor's previous experiences with teaching videogame design
- How the instructor plans his videogame design and development course instruction
- How curriculum requirements by the district impact the instructor's planning
- How the instructor's plans change over the course of the semester/year
- What scaffolds the instructor believes he uses to support student learning
- Evidence or portrayals of the instructor's scaffolding strategies
- How the instructor varies his pedagogy based on student performance
- How and when the instructor engages 21st century skills in his classroom
- Why the instructor implements various scaffolds throughout student instruction

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[4] Although my research questions are specific to modes of scaffolding within the classroom setting, Joe's responses to the questions focused on the points above spoke to his attitudes, knowledge background and skilled activities associated with the various pedagogical practices highlighted within my conceptual framework for this study. This information laid the groundwork for analyzing his scaffolding practices.

Although there was a set of questions guiding each interview, “the interviewer remains free to build a conversation within a particular subject area, to word questions spontaneously, and to establish a conversational style--but with the focus on a particular subject that has been predetermined” (Patton, 1990, p. 283).

Document Analysis. Bowen (2009) articulates five specific reasons for utilizing documents for the triangulation of data in qualitative-based research studies, including: (a) providing context for the study (e.g. situating data obtained during interviews); (b) presenting questions to be asked (e.g. documents collected throughout the research process may provoke questions that can be brought up during the interview process); (c) providing supplementary research data (e.g. filling in the blanks drawn from other forms of data collection such as classroom observations or during interview sessions); (d) tracking progress (e.g. changes or developments that take place over the course of the study); and (e) verification of resources (e.g. documentary evidence should be “corroboratory” rather than “contradictory” to other findings addressed within the study) (p. 30).

Documents relative to this study included the collection and analysis of: resource handouts, supplementary instructional materials, lesson plans, game design pedagogical guides developed by the software manufacturers, Joe’s personal notes related to his instruction, and blog posts written by Joe.

Data Analysis and Validity Procedures

"Data analysis is not off-the-shelf; rather, it is custom-built, revised, and "choreographed" (Huberman & Miles, 1994)" (Creswell & Poth, 2017, p. 185). Creswell and Poth (2017) assert that the processes of data collection, data analysis, and the articulation of results are "interrelated and often go on simultaneously in a research project" (p. 185). The authors compare data analysis to a "spiral"[5], where one engages in a cyclical analytic process that starts with a variety of multimodal artifacts (e.g. interview audio files, blog posts, images, video, etc.) and culminates in the form of a coherent narrative. With the latter in mind, for the purposes of this study, I examined the data for examples of scaffolding and planning at work. I approached the first step (or, "loop in the spiral") of the analysis process – management and organization of the data (Creswell & Poth, 2017, p. 185) -- looking to arrange the data in the most coordinated format possible. In this vein, I maintained virtual folders for my participant's survey responses, individual interviews/transcripts, and observations/field notes within Microsoft Word. This approach helped me to compare the data, recognize patterns, and use my participant's responses to formulate interview questions. From the moment I began data collection, I approached analysis in the following ways:

Observations*:* Following each observation, I transcribed my field notes, using my jottings (Emerson, Fretz, & Shaw, 2011) as a baseline for constructing analytic memos. According to Miles, Huberman, and Saldaña (2014), "[a] jotting holds the researcher's fleeting and emergent reflections and commentary on issues that emerge

[5] I found it interesting that Creswell doesn't cite Ian Dey's 1993 description of a "Circular Process" for qualitative analysis, inclusive of three steps: describing, classifying and connecting. Kalla (2005) describes Dey's 1993 work as a process functioning much like a "spiral" (also not cited).

during fieldwork and especially data analysis" (p. 94). Further, Miles et al. (2014) suggest that "[j]ottings can strengthen coding by pointing to deeper or underlying issues that deserve analytic attention" (p. 94). All "Observer's Comments" ("OCs") (Bogdan & Biklen, 2007) became an integral part of my data analysis process. Keeping in mind the advice of Glaser and Strauss (1967) in concert with Miles, Huberman, and Saldaña's experience, I prioritized jotting (and later memoing) when conducting field observations for the purpose of being able to associate my interpretations of the setting in concert with what I was sentient of; and, kept my memos organized in such a way that they were easily able to be retrieved as necessary (primarily through the use of Dedoose).

Survey*:* In an attempt to better understand Joe and his gaming habits and how they may or may not have informed his pedagogical planning, design, and scaffolding practices, I reviewed his survey data a number of times, noting patterns and themes relevant to my research questions. I looked at Joe's survey responses as an introductory foray into the mind in charge of the world which I'd become a part of over the course of my study (via class observational periods, interview sessions, informal conversations, etc.). Instead of coding Joe's survey data in Dedoose, I used the responses he provided in the questionnaire to establish a baseline of understanding of his knowledge and beliefs in regards to gaming; more specifically, how his personal gaming practices may or may not have impacted his professional practice. I then created additional interview questions based on his survey responses. As such, Joe's responses became a part of my initial interview transcript, which was analyzed within Dedoose through multiple rounds of coding.

Interviews*:* In a similar vein to the process I conducted proceeding each class observation (described above), after each interview, I transcribed the conversation and wrote analytic memos (taking into consideration those OCs and jottings I'd written during the course of each chat). I looked at the analytic memo writing process as a sort of rest area along the data analysis route. With each memo, I checked in with my internal dialogue regarding the analysis process; I ruminated over the data in a very routinized manner. Again, formal coding of all interview transcripts was completed using the qualitative software program Dedoose.

The iterative process of collecting, transcribing, reviewing, and reflecting on the data, forging connections in and among the various forms of data I collected over the course of my study, paralleled the process Joe had his students engage with when designing their videogames (creating a game plan, designing the game within their chosen software, prototyping their games, playtesting their games, and having their fellow students playtest their games for garnering feedback).

Organization of Data and Data Reduction

I entered my interview transcripts into the qualitative analysis software platform Dedoose in preparation for coding the data. Keeping in mind the wisdom of Merriam (1988) who explains that "there is no standard format for reporting case study research" (p. 193), my approach to coding varied over the course of my analysis process. Once my transcripts were uploaded, I reread them within the context of the coding software, to both reorient myself to the Dedoose platform while recalling my discussions with Joe. As Creswell and Poth (2017) suggest, I reviewed each transcript, in search of code

segments that could be used to represent "expected information" (the sort of research information one would hope to find in a study); "surprising information" (those data nuggets which would be unexpected when engaging with the data); and "conceptually interesting or unusual information" (or, the type of information that researchers, participants and/or audiences may find interesting and/or relevant to the study) (p. 193). After reviewing each transcript, I began to deductively code according to the following categories, formulated on the basis of the aforementioned category types ("expected," "surprising," and "conceptually interesting" information): 1. Forms of Game Use in the Classroom; 2. Learning Theories Associated with Videogames; 3. Teacher and Gamer Identity; 4. Learning Outcomes from Game Play/Design; and 5. Games and Pedagogy. While searching for information related to each of these categories, I also found myself developing in vivo codes (some of which overlapped with those codes I'd created on the basis of my review of the literature). After an initial round of coding the data, in an attempt to better organize my approach, I created several charts to illustrate how certain codes could be condensed and/or re-categorized. These were eventually condensed into one finalized code book that I used for subsequent rounds of data analysis.

I broke my codes out into two separate lines of thought; through use of the TPCK framework, as well as in accordance with my research questions. With regard to the TPCK framework, I took my initial list of codes (see below) and began categorizing them based on the terms outlined via the Venn diagram illustrated below[6]:

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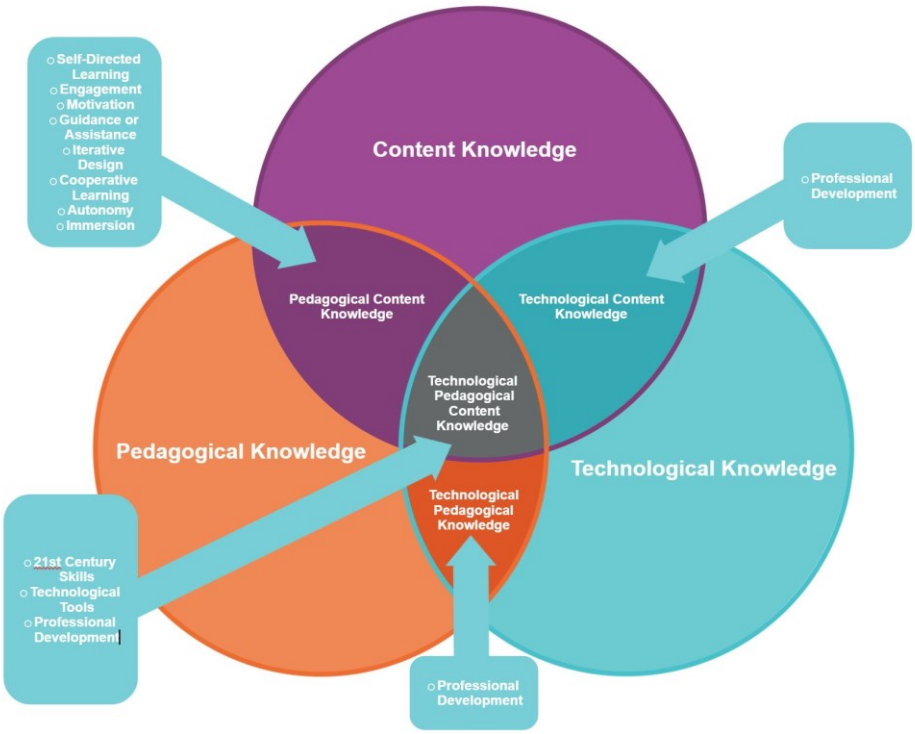
[6] Note that this diagram is incomplete; it does *not* contain all of the initial codes I began with at the start of this study. This illustration was taken from my initial analytic memos and embedded here to give the reader insight into my code creating process.



I found it difficult to separate Joe's content area knowledge from his pedagogical knowledge, because this dissertation is specifically geared towards "videogame design pedagogy"; the two are inextricably linked to some extent here. As a result, there weren't a lot of situations where I was able to code Joe discussing his content knowledge in isolation. This was especially the case with regards to Joe's technological content knowledge. Teaching game design inherently draws on Joe's technological knowledge. As a result, the majority of my codes fall under "pedagogical content knowledge" or "technological pedagogical content knowledge." Although I was initially perplexed by this finding, I came to realize the importance of such a conclusion; Joe's approach to pedagogy in regards to videogame design often falls into the overlapping "TPACK" category of the Venn Diagram, thereby categorizing him as a teacher with advanced technological pedagogical content knowledge as far as this lens of analysis was concerned.

Before I realized the implications of Joe's frequent placement in the center of the TPACK diagram, I felt more successful with another analytical approach: organizing my code book based on my research questions, then breaking down and categorizing the data accordingly. Beforehand, I had already tried to determine which research question each code answered, so I gathered the codes altogether, grouping them according to question, and then found similarities within each subcategory.

In regards to the question "How does the teacher plan his instruction to support a videogame design 8th grade course?", I developed three categories, organized hierarchically. The "Tools of the Trade" category covers codes that emphasize Joe's planning process, specifically what strategies and platforms he uses to engage his students in the learning process. The "Beyond the Classroom" category covers the data collected on Joe's classroom activity planning based on his professional engagements with other educators (e.g. inviting researchers into the classroom with technology equipment to "test" such as the VIVE, a VR device). Joe's skillsets round out the categories associated with his planning process -- these are all a part of TPCK which was discussed on the previous page.

The Planning Process -- How?

Categories	**Tools of the Trade**	**Beyond the Classroom**	**Joe's Skillsets**
	Learning Activity	Professional Development/Seeking Outside Resources	Content Knowledge

Codes	Technological Tools	Research	Technological Knowledge
	Crowd Sourcing		Pedagogical Knowledge
	Iterative Design		Technological Pedagogical Content Knowledge
	Self-directed Learning		
	Instructional Content		

In regards to the question, "Why does he make the choices that he makes when planning?", I created four hierarchical categories as follows: "Intended results" which speaks to the goals that Joe has for teaching game design to begin with; "Bringing the Students on Board" which covers the techniques Joe can employ to encourage authentic and purposeful student-centered learning; "Theoretical Underpinnings" which again relate back to TPCK and "Reasons for Revisions" which refers to the reasons why Joe would change his curriculum/planning process in future iterations of the course.

The Planning Process -- Why?

Categories	**Intended Results**	**Bringing the Students on Board**	**Theoretical Underpinnings**	**Reasons for Revisions**

Codes	21st Century Skills	Engagement	Content Knowledge	Iterative Design
	Intended Learning Outcomes	Immersion	Technological Knowledge	Feedback
	Development and Application of Learned Skills	Motivation	Pedagogical Knowledge	
		Situated and Authentic Learning	Technological Pedagogical Knowledge	
		Rewards	Technological Pedagogical Content Knowledge	

The final question, "How does the teacher scaffold student learning through this instruction?", targets the scaffolding aspect of my dissertation study. Here I articulate the ways Joe designs his classroom assignments to support student-driven learning (Giving Students Agency); his reciprocal relationship with his students (Teacher's Relationship to Students); how he adapts his pedagogy to support various student learning styles (Accommodating the Students); and finally, the ways Joe assesses his students' progress in the course ("Measuring Student Progress").

Scaffolding

Categories	**Giving Students Agency**	**Teacher's Relationship to Students**	**Accommodating the Students**	**Measuring Student Progress**

Codes	Autonomy	Assistance	Incremental Learning	Iterative Design
	Cooperative Learning	Interaction	Accommodation to Learning Styles	Assessment
	Reflection			Game Achievement (Immediate Feedback for Students)
	Learner Control			Intermittent Feedback

The finalized version of my codebook contains codes from each of the charts above, in addition to many more that were obtained from the inductive and deductive analysis I completed on each piece of data I collected over the course of the study. Excerpts from my "final" code book can be found below[7]:

Code[8]	Definition	Example[9]
21st Century Skills ● Collaboration and teamwork ● Creativity and imagination ● Critical thinking	Definition in research: "More than technological expertise, 21st century skills refer to content knowledge,	(INTERVIEW TRANSCRIPT) Me: So, what skills do you feel your students are learning as a result of participating in your class

[7] See Appendix D for a more extensive version of this code book

[8] Each bullet point represents one (possible) code based on the P-21 Framework; multiple sub-categories emerged from these bulleted terms as well (again, based on the frame).

[9] Emergent codes are identified in bold-faced type.

● Problem solving ● Information, Media and Technology Skills ● Flexibility and Adaptability ● Initiative and Self-Direction ● Social and Cross-Cultural Skills ● Productivity and Accountability ● Leadership and Responsibility	literacies and proficiencies that prepare individuals to meet the challenges and opportunities of today's world" Kamehameha Schools report, An Overview of 21st Century Skills. As it relates to my study (1B): - Joe's planning - Joe's pedagogy - When Joe un/intentionally cultivates these skills in his students	Joe: Okay, well the **iterative design process** is huge. Um, and learning in that I don't think they're so accustomed to being really ingrained in that process so there's a whole lot of kids thinking they're just gonna set out and build a game and then all the sudden realize how much they have to go back and iterate on their game and get feedback that was unexpected to them and have to build that in and stuff – so that process – it's a **design thinking** – iterative design thing is like huge. **Collaboration** is huge in the design teams that they work in – um, and again it's, ya know – So again, I participated in the Game Jam this weekend and that was a great opportunity for me to put myself in the shoes of a typical student in my class in a sense, and just being part of that – a design team – and just seeing what that's like – trying to communicate with the artist and saying "Well we need this for the game" and I keep working on one aspect and then I wait and bring it over to the game – the same thing happened with the sound – so I think there's a lot of that – and definitely **computational thinking** – um, ya know, they're learning how to learn by **being empowered** in the learning process, uh, which is a really valuable skill, um, ya know, we don't need to memorize things but we need to know **how to find information and learn on our own or on demand**, so I think my kids are getting all of those kind of skills… um, and then ya have, ya know, on the outskirts you have kids that take a slightly different path and are **choosing**

		to learn art and become the graphic person and they're learning art and animation, or like the sound engineer type thing or learning literacy in terms of writing and storyline and narrative and descriptions for games and things like that – so a lot of **both hard and soft skills**…
Professional Development	Definition in research: "Professional development shall be comprised of professional learning opportunities aligned with student learning and educator development needs and school, school district, and/or state improvement goals" (NJDOE, 2014). As it relates to my study (1A): - When Joe enriches his planning process by participating in and/or running PD activities	(INTERVIEW) "when I took the… teacher camp for 3D Game Lab I learned about their quest-based system and that's what kinda taught me about that approach so I guess that was incredibly valuable to learn."

Validation of the Data

Creswell and Poth (2017) recommend that researchers establish validity by applying no fewer than two distinct strategies to their analyzed data sets. The authors suggest that the process of validation requires data analysis through three distinct lenses; that of the researcher, the participant(s), and the reader/reviewer. In an attempt to be as

thorough as possible in validating my claims, I sought to employ at least one strategy identified by Creswell and Poth within each of these prospective lenses.

From the perspective of the researcher's lens (my own), I applied the *triangulation of data* approach to my work. "When qualitative researchers locate evidence to document a code or theme in different sources of data, they are triangulating information and providing validity to their findings" (Cresswell & Poth, 2017, p. 260). One specific application of the triangulation technique to my data set was varying the types of materials which I collected for analysis, including: a combination of interview transcripts, field observations (with subsequent notes written during each classroom period), and blog posts written by my study participant.

Lincoln and Guba (1985) assert that that *member checking* is "the most critical technique for establishing credibility" (p. 314). Creswell and Poth (2017) identify this approach as specific to the participant's lens category for the purposes of validating one's data. Stake (1995), too, emphasizes the importance of involving participants in the validation process. In fulfillment of this crucial engagement with my research participant, I engaged with Joe readily and often to clarify any interpretations of the data that appeared unclear to me throughout the course of both the data collection and analysis phases of this study. Further, I exercised the strategy of maintaining "prolonged engagement and persistent observation in the field" (Cresswell & Poth, 2017, p. 262) by visiting Joe's classroom multiple times within a three-year period, in addition to maintaining email and personal communication (via conference participation) with him when not observing his classroom practices.

Finally, in an attempt to validate my data from the "reader's or reviewer's lens" (Creswell & Poth, 2017), I had two colleagues[10] engage with me in *peer debriefing sessions* (Lincoln & Guba, 1985) throughout the analysis process to "keep [me] honest; ask[ing] hard questions about the methods, meanings, and interpretations; and provide[ing] [me] with the opportunity for catharsis by sympathetically listening to [my] feelings" (Creswell & Poth, 2017, p. 263). Some debriefing sessions took place face-to-face; most occurred online using the platforms GoToMeeting or Zoom. A majority of these meetings took place with all three of us present. Three meetings occurred between my cohort colleague when we met to discuss the coding of our data and checking for inter-rater reliability. A typical debrief session with all three of us present would consist of the following:

1. **Follow up from the previous meeting.** "What have you done since we last met? What are you proud of with what you've completed thus far? Any challenges that you came across between then and now?"

2. **Review of new materials.** Our advisor always asked for any new/updated work to be submitted at least 24 hours before each meeting. Once follow-up from the previous meeting ended, we would go into our advisor's review of the new content. This is when she would explain why she made the

[10] The first colleague was my dissertation chair and academic advisor, an Associate Professor in the Department of Learning and Teaching for the Graduate School of Education at Rutgers University. The second colleague was a member of a doctoral research cohort my advisor put together, focused on multimedia and online learning. She is currently an Ed.D. candidate in the Graduate School of Education at Rutgers University, studying educators' use and understanding of multimedia in their classroom settings as impacted by the Common Core State Standards (CCSS).

comments she did within the document. Most comments focused on the need for additional information, such as "Why did you code this excerpt the way you did? I interpreted the excerpt to mean…so I'm curious as to why you felt this data should have been labeled differently."

3. **Live coding.** In two of the meetings we had as a triad, we would "test code" on the spot. This activity would involve us selecting a particularly relevant piece of data, sharing it with the team, and then explaining our thought process aloud, much like a "think aloud" protocol[11] in literacy education. By asking us to explain our thought process when we encountered each data set, our advisor was able to see and hear in a very tangible way what we would be thinking about the data we came across.

4. **Recap.** After each of us went through our successes and challenges, reviewed notes from our advisor, and (in some cases) engaged in the live coding process, we would go over any aspects of the meeting that may have needed additional follow-up questions not yet covered. If there were no questions, we would set goals for our next meeting date, plan a date and time that would work best for all parties (which may or may not have come to fruition), and articulate what we expected to have finished for next time.

[11] The think aloud method consists of asking people to think aloud while solving a problem and analysing the resulting verbal protocols (Someren, Barnard, & Sandberg,1994, p. xi).

CHAPTER 4
FINDINGS

The purpose of this qualitative case study was to shed light on the pedagogical practices associated with scaffolding videogame design curricula in the classroom setting for underpinning students' 21st century skill development. Further, this study explored the role of pedagogical expertise in teaching game design and provides an introspective look at pedagogical challenges one instructor faced within the videogame design classroom. This chapter presents findings on how this instructor, an experienced videogame design teacher at the middle school level, scaffolded pedagogy in his classroom setting.

The following research question informed this study: How does an experienced middle school teacher who teaches videogame design scaffold student learning of game design principles and concepts?; along with the following sub-questions as follows: How does the teacher plan his instruction to support a videogame design 8th grade course?; Why does he make the choices that he makes when planning?; How does the teacher scaffold student learning through this instruction? I have divided this chapter into three major headings: the first describes the participant's extensive gaming background (which largely contributed to my interest in studying his teaching methods to begin with) and how it undergirds his pedagogical expertise in the content area he teaches; the second heading is dedicated to the planning aspect of the research participant's pedagogy; and the third is dedicated to the scaffolding aspect of his teaching practice. Within these headings are multiple subsections identifying the prevalent themes that emerged from the analysis of data collected over the course of the study.

Driven by my research questions in combination with my theoretical framework, I provide an extensive review of the data, exploring the participant's candidacy for the study. More specifically, this section includes his personal and professional interest in videogames, his extensive experience teaching videogame design and development, in conjunction with his pedagogical behaviors, inclusive of his scaffolding methodologies for supporting his students' learning in (and out of) the classroom setting. By articulating the knowledge and beliefs the study participant shared with me, I first describe the participant's life-long dedication to videogames, initially as a hobby that grew into a professional career, and how this behavior plays into his teaching. I then juxtapose these thoughts with the participant's actual teaching behaviors as demonstrated in (and out of) the classroom, paying particular attention to the various ways he taught his students in whole group, small group, and one-to-one interactions. Finally, I discuss the participant's perceptions of content knowledge, technological knowledge, and pedagogical knowledge, as revealed in a number of interview sessions and informal conversations. This discussion elucidates the pedagogical practices Joe engages in regarding the planning and scaffolding of his students' learning.

Meet Joe

Analysis of the data indicates that the participant's perspectives on both his "teacher identity-in-practice" and his "gamer identity-in-practice" (Hull & Greeno, 2006) were shaped primarily by his belief systems, years of experience teaching, familiarity with technology, exposure to high quality professional development programs and interpersonal relationships (specifically with those educational professionals that he developed through his Web-based PLN). While the survey data he completed online

encouraged him to textually reflect on his current gaming habits, Selfe and Hawisher's (2007) Gaming Protocol required Joe to verbally articulate his gaming practice in thorough detail. The Player Biography piece allowed Joe to visually depict how specific games and gaming experiences influenced various times in his life, from birth to present day.

"I'm a gamer"

One of the most prevalent aspects of this research study was Joe's personal and professional commitment to games and gaming, in and out of the classroom setting. He articulated his identity as a "gamer" multiple times throughout the data corpus. I selected a few instances of this below.

From my Teacher's Personal Videogame Use survey (Question 19), Joe answered "How do you define yourself as a gamer?" with the first of three optional responses: "I'm a serious (hardcore) gamer." The other options Joe had to choose from were "I'm not really a gamer" or "I think I'm somewhat of a gamer." Joe clearly identified himself as a gamer on five specific occasions within his blog to date (2012-2018), in addition to inferring it in the language he uses as someone who plays games.

Social In-Game Networking

Many of Joe's posts include discussion about gamers, and he often encourages his readers to share their entrée into the world of gaming. Joe writes to his readers as though having a conversation with them (as many bloggers do); this dialogic form of writing elicits participation from others, particularly those in his personal learning network (PLN), as he often references them within his posts. I emphasize this particular point

because Joe often cited the "social" aspect of gaming as one of the reasons he's so enthusiastic about being a gamer and identifying himself as such. The excerpt below was taken from one of Joe's blog posts dated February 22, 2013, titled "Move over Twitter, my PLN is levelling up!" [sic]

> I have always liked games. I teach video game design. I am working on my doctorate in game based learning. Apparently, there are many other educators who like games! They are out there and using games to encourage learning opportunities as well as networking with other like minded [sic] educators. Interestingly, I have come to find that many members of my in game PLN were not always gamers.

This post goes on to discuss Joe's "in-game PLN" and how social interaction through affinity groups within World of Warcraft (WoW) encouraged him to "get back in the game" so-to-speak.

> I played World of WarCraft for years and stopped playing because I felt I did not have time to play. Perhaps a bigger part of the reason was that the idea of an affinity group was lacking. Last summer I met +Laurence Cocco at #ISTE12 and then I met +Peggy Sheehy, +Knowclue Kidd, and +Lucas Gillispie at the Games in Education Symposium. They clued me in to the Cognitive Dissonance guild and I knew it was time to get back in the game. After all, I devoted a lot of time to cultivating and nurturing my PLN on twitter, EdWeb.net, and Educator's PLN. The idea of networking with like minded [sic] educators in game was more than appealing. I joined Cognitive Dissonance and Inevitable Betrayal and can't

> emphasize enough how happy I am to have found my 'tribe' as many people in the guild refer to our affinity group. Everyone in both guilds is so nice, helpful, and welcoming to new members. If you are an educator and interested in gaming, I encourage you to join our in-game (and out) PLN.

These sentiments were very much in line with what Joe had explained to me during the first interview I conducted with him utilizing the Gaming Protocol by Selfe and Hawisher (2007). When asked what games he liked best and why, Joe responded:

> Okay, well, Starcraft over the years—one of my all-time favorites—and that was because when we were playing—ya know—multiplayer with people that I knew—was really a lot of fun and ya know—a real competitive kind of spirit. Nowadays, World of Warcraft and Guild Wars II because they're pretty big games but they have a real social component also—ya know—with the guilds and stuff like that—cause even like, yeah, right now—this game Clash of Clans that I'm playing a lot—it has that "build your base and upgrade your army and send them out to fight—ya know—get that feeling of victory from a successful battle—that kind of thing. I like quest-based games… I also play sports games—again—when I'm playing against a real person that I know—like a friend—that to me brings up a fun—competitive…
>
> Me: So you like the social aspect of games but you prefer knowing the people you're playing with?
>
> Yes—one way or another—the people that I play with online now—I'm leaning towards and growing my personal learning network with educators and those are

> the people I want to be playing with because we have interests—and we're interested—when the topic of the conversation goes off the game it's what I want to be talking about…

Joe's personal experience with learning from his network of educational professionals within his in-game PLN constitutes an example of how one can learn through legitimate peripheral participation within a community of practice (Lave & Wenger, 1991).

Joe's position as a teacher of the course *Video Game Design and Development*, which he personally developed for the middle school with which he is employed, affords him the ability to live and breathe his gamer identity-in-practice concurrently with his teaching identity-in-practice. His teaching responsibilities marry these two aspects of his identity; he educates students on how to develop the very thing he is so deeply passionate about: gaming and game development.

Experiences like Joe's first foray into the WoW guild confront Joe with the very challenges his students face when participating in his Video Game Design and Development course. Just as the students may have considerable experience *playing* videogames, more often than not, they have little knowledge of game design beyond the rudimentary skills to which they were introduced in their seventh-grade Computers elective course. Much like Joe's initial introduction to his WoW guild, his students' identities-in-practice as gamers (outside the classroom setting) collide with their identities-in-practice as apprentice game designers; it is one thing to be able to play videogames as a hobby, it is another to learn how to expertly craft a game worth playing.

Further paralleling Joe's introductory guild experience is his students' apprenticeship into the videogame design classroom (a guild in itself, of sorts). Here, Joe is the master practitioner, insofar as his students believe him to be, conveying his knowledge of videogame design practices to his trainees.

Joe's pedagogical style encourages students to explore and learn on their own as often as possible. Although he provides content via the gamified questing system he has created for the students to complete, he also demonstrates to his students how to find information and work-arounds, as opposed to simply feeding them the answers. In many cases, Joe has revealed to me that he doesn't actually know the answers to his students' questions, and so he models how he himself would attempt to solve any problems he comes across when designing games. This facilitative approach to pedagogy is the very crux of Joe's teaching methodology.

In line with his practice of participating in a PLN via social networking tools, Joe requires his students to create a number of media accounts on various platforms, including: YouTube, Twitter, and Blogger, among others. Further, Joe often shares his students' work with his PLN via these same channels, not only to demonstrate his pride in their accomplishments, but also to provide examples of creative game-design projects for learning with his colleagues in cyberspace.

"Battling" Gender Stereotypes

Joe has made it his personal mission to engage more of his female students in his classes, with hopes that they will consider pursuing a career in the STEM fields. His dedication to this effort extends beyond the auspices of his classroom setting. Joe

explained to me in the first interview I conducted with him that prior to his current teaching position, he and his wife had owned a storefront where children could come and learn about game design and play MMORPGs together on the weekends. This business was a shared passion for both him and his wife. This kindred enthusiasm has taken hold of his children's extracurricular time as well. In moderation, Joe and his wife allowed their two young daughters to play videogames. His daughter Leila took a particularly strong interest in gaming and videogame design; she has accompanied him on multiple conference presentations sharing her experiences with learning through play.

Tangentially related to his daughters' gameplay, Joe expressed his concern multiple times throughout the study about the stereotype that gaming is a predominantly male activity. Within the initial questionnaire he completed for this study, he answered, "It completely bothers me" from four options; the other three included: "It doesn't bother me"; "It somewhat bothers me"; or "I didn't even know this was a stereotype of gaming" (Question 25, Appendix A). He also addressed the gender typecasting associated with gamers within his blog. He posits multiple questions about what ways the gaming industry can do more to support women within the field:

> Is the issue more related to the age old stereotypes - boys play with guns, girls play with barbie [sic] dolls? It sounds like there is an overarching attitude that women are not perceived as gamers, or certainly not the 'cool hardcore gamers'. Again, I am not supporting any of this, just posing questions. Many of the #1reasonwhy tweets yesterday pointed out that women were definitely not taken seriously in the industry, were not considered to be interested in AAA games, but rather cutesy social games, not to mention the way women are depicted in games.

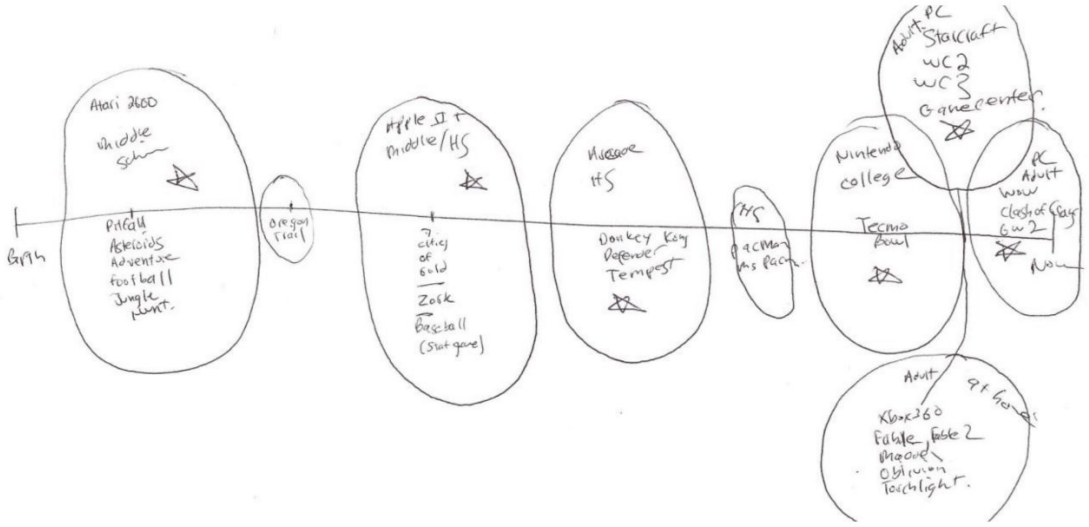
> I would like to think that I am on the right track in believing that if we increase the presence of women in the game industry we can reduce this bias, but how difficult would it be to get to that point? How many women have to suffer along the way? Clearly, this is only one small aspect of the problem, but the problem must be addressed on a larger scale, hopefully before I succeed in sending more and more women into the industry.

This blog post is deeply, emotionally charged with Joe's frustration over the way women are regarded within the gaming industry. The last sentence of his post articulates not only his personal crusade to encourage his female students to enter the field, but also his insistence that those who do so be treated equally to their male counterparts. Although Joe may not be able to impact the industry as a whole, within his classroom he *can* impact the attitudes his students have towards female game developers. His dedication to female videogame designer inclusion is reflected in his efforts to have more 8th grade girls enroll in his Video Game Design and Development elective.

Joe's Player Biography

In an attempt to capture Joe's gaming experiences in a chronological fashion, I employed Mitgutsch's (2011) Player Biography technique in our second interview together. In this way, Joe was able to literally (create a) picture (of) which games impacted his playing habits over the course of his lifetime. For this particular task, I explained to Joe that he should draw a timeline of his life, including videogames that were most meaningful to him. The more meaningful the game was to him at a particular

point in his life, the bigger he was supposed to draw the bubble around the game's name. Joe's player timeline is illustrated below:



After Joe constructed this timeline, I had him explain his thought process as he created each bubble. His graphical depiction of his gamer biography reflected the sentiments he expressed when I conducted the first interview with him utilizing Selfe and Hawisher's (2007) Gamer Protocol. Joe drew stars indicating where games were extremely impactful on his life. For example, the star that is in the large circle on the top right of the page was a pivotal time in his life, because the games listed there (Starcraft, Warcraft II and Warcraft III – the latter two being the precursors to World of Warcraft) were those that drove the gaming center he and his wife were running at the time. The star located in the circle closest to the end of the timeline represents his present gamer identity. Where Warcraft II and III were pertinent to his occupation running the game center, his current personal gameplay in World of Warcraft is fueling the development of Joe's PLN. The two educator guilds he belongs to provide an "affinity space" (Gee, 2007) that Joe was craving.

Planning Instruction

Investigating Joe's personal gaming experiences and uncovering his definition of one's gamer identity enabled me to enrich my understanding of his in-school pedagogical practice, which is inextricably linked to his out-of-school interests and gaming practices. Joe has been teaching for almost two decades in the middle school setting. His approach to lesson planning is akin to the behavior Berliner (1994, 2004) attributes to an "expert" teacher, described as one who "[d]isplays automaticity in accomplishing goals; sensitivity to the task demands and social situation when solving problems; is opportunistic and flexible; recognizes patterns quickly and accurately; perceives meaningful patterns; and uses personal sources of information to solve problems" (Laverick, 2006, p. 247). Having taught the course *Video Game Design and Development* for eight years (to the present), Joe has developed the inherent ability to decide what will happen within his classroom on a daily basis, without hesitation. When asked how he *learned* to plan, Joe indifferently referenced how he "took teacher education classes and all that" before going into the differences between the way he taught his course(s) before and after attending 3DGameLab boot camp. The following subsections address specific factors that impact Joe's planning process as it relates to his pedagogy.

Planning for Student Outcomes

When first asked the question of how he learned to plan his instruction, Joe hesitated for a moment, stammering, "You mean like teacher prep in college?" The act of planning (in the context of "decision making" as it relates to course prep) is one that comes naturally to expert teachers (p. 491, John, 2006). While he doesn't sit down and write lesson plans on a daily basis, Joe has a general idea of what content he will cover in

his courses from day to day, without sitting down for hours constructing lesson plans in advance for each period he teaches. Depending upon what he covered in class during the preceding days or weeks, Joe is readily able to determine what activities will take place in subsequent classes. There are extenuating circumstances which occur on occasion, such as a fire drill or assembly, but Joe takes these in stride. By synthesizing Joe's perceptions of his teaching as related to student outcomes, I identified five fundamental influences on his planning: (a) developing his students' 21st century skills as outlined within the P-21 framework; (b) considering his students' motivational needs; (c) avoiding cognitively overloading his students while engaged in (learning about) the videogame design process; (d) improvising within his lesson plans as necessary; and (e) preparing for overcoming (un)expected obstacles that may impact his teaching.

P-21 framework: The 4Cs. What are the 4Cs? Although Joe may not have consciously planned for the inclusion of 21st century skills in his course, his traditional "teacher education classes" more than two decades ago educated him on the importance of adhering to the national, state, and local standards set forth by the Department of Education (DoE), the State of New Jersey (NJDoE), and the school district's curriculum guide when implementing lessons in his classroom. More recently, additional criteria have been adopted by the DoE and NJDoE, including the Common Core State Standards and the New Jersey Student Learning Standards (NJSLS), respectively. Joe's content area of expertise fits efficaciously into Standard 9: 21st Century Life and Careers of the NJSLS, whose mission is described as follows: "21st century life and career skills enable students to make informed decisions that prepare them to engage as active citizens in a dynamic global society and to successfully meet the challenges and opportunities of the

21st century global workplace" (State of New Jersey Department of Education, n.d.). This standard complements the Partnership for 21st Century Skills learning framework, which identifies both desirable student outcomes and support systems necessary to facilitate mastery of P-21 skills. Although Joe doesn't articulate the P-21 framework and corresponding state/national standards as being the centerpiece of his planning, they have a considerable influence on his pedagogy, as the following sections will demonstrate.

Communication and collaboration. By default, any collaborative efforts in Joe's course require communication among all parties involved; this is especially true of design teams arranged for the purpose of creating videogames in the course. Joe's plans are strongly influenced by his desire to have his students actively communicate with each other in a variety of formats, with particular emphasis on socially mediated interactions (see the discussion of Joe's email to the parents of students enrolled in the course for more). Consequentially, he weaves throughout his lessons the use of educational technology tools like Twitter, blogs, and YouTube, so as to further contribute to students' 21st century skill development as articulated in the P-21 framework.

Students in Joe's classroom unsurprisingly spend a great deal of time working collaboratively, not only to design games, but to assist each other in completing quest lines, playtesting each other's work, and crowdsourcing ideas for project development, among other tasks. Joe consciously includes these types of activities in his lessons, under the assumption that the students will benefit from actively communicating with one another. Joe further encourages collaborative behavior by allowing his students to freely interact with each other during the class period – there is a loud hum about the room more often than not when observing Joe's class in action, and this is the product of an

intentional planning choice on his part. Further, the design aspect of the course requires students to come together to create games that inherently play to the strengths of the students in each team, as Joe describes in a blog post, detailed below:

> Game development could potentially be the most authentic approach to interdisciplinary learning. There's really something for everyone. The activity lends so well to the creation of design teams with roles including storytelling/narrative, graphic design, animation, sound engineering, project management, and programming.

This sentiment encapsulates Joe's mindset as he is planning, and underpins the very foundation of the P-21 framework; the activity of videogame design and development hones not only communicative and collaborative practices, but also creative and innovative approaches to learning, as Joe plans for his students to think critically about the best ways to develop and perfect a well-conceptualized game that their players will enjoy engaging with.

Creativity and innovation. The creativity and innovation skills associated with the P-21framework are characteristics inherent to videogame design and development pedagogy. According to the framework, thinking creatively entails using "…a wide range of idea creation techniques (such as brainstorming) [to] create new and worthwhile ideas (both incremental and radical concepts)," and to "elaborate, refine, analyze, and evaluate their own ideas in order to improve and maximize creative efforts" ("Framework for 21st Century Learning," January, 2016). Joe consistently includes within his curriculum 20% time 'passion project' assignments, which allow students to devise projects on a topic of their choosing and encourage them to pursue their individual

interests in a creative way. Joe introduces the 20% Time Project to his students at the start of the semester. This assignment has been a part of his curriculum for several semesters, after its inaugural success with students enrolled in his course in October of 2015. He describes its inception within his blog as follows:

> The conversation with my students continued to discuss some of google's [sic] products and how 20% time is part of their work culture. We talked about google glass, google cardboard, gmail, google expeditions and more. I shared some examples of projects students have completed in the past. You can find many of them on our class youtube [sic] channel. As [sic] I explained the project eyes started to light up. Questions started to come at me. Can I create an MMORPG? Can I use the raspberry pi? If I make an app can I sell it and make money? Can I create a visual novel? The questions kept coming. The answer was essentially the same. Yes, accompanied by the caveat that I did not claim to know how or where to start.

This last statement holds particular meaning in order to understand how Joe plans, or in this case intentionally doesn't plan. Instead of researching and planning to anticipate the countless possible questions from his students, Joe gives them agency; by claiming that he is the furthest thing from an expert in making their visions become a reality, Joe gives his students total creative control of their project's destiny. This sentiment also requires the students to think critically, as it forces them to form creative solutions to challenges they have created for themselves. Joe intentionally responds to his students in this manner – his wording is planned, deliberate; he knows from experience with students in

previous semesters that by "playing dumb" when responding to students' inquiries, they will have no choice but to achieve their goals by thinking creatively.

Critical thinking and problem solving. The P-21 framework defines critical thinking and problem solving as a combination of: (a) being able to evaluate situations using inductive or deductive reasoning in an effective manner; (b) using systems thinking to conceptualize how individual elements of a structure work together to contribute to a whole construct; (c) making judgments and decisions based on a thorough analysis of the situation; and, (d) solving problems in an innovative way, asking for clarity when necessary in order to better dissect the issue at hand. Videogame design and development require students to engage in each of these processes so as to develop a successful end-user product. Joe's pedagogical planning takes into consideration the importance of these skill sets; in particular, he often refers to the iterative design process (a form of computational thinking) when discussing how he plans.

Developing computational thinking through iterative design. An important P-21 goal of Joe's planning process is to develop his students' computational thinking skills, and iterative design is the strategy through which he aims to accomplish this goal. When Joe's students engage in game design, they go through a series of steps, scaffolded by the platform in which they are creating their work, in combination with Joe's guidance throughout the process. Computational thinking encourages students to envision the big picture. Requiring students to create a videogame from scratch (or *in* Scratch) challenges them to conceptualize the task at hand – to think like computer programmers – not just to complete coding activities.

When I spoke with Joe about which skills he felt his students were getting as a result of taking his videogame design course, he informed me that:

> …the **iterative design process** is huge. Um, and learning in that I don't think they're so accustomed to being really engrained in that process so there's a whole lot of kids thinking they're just gonna set out and build a game and then all the sudden realize how much they have to go back and iterate on their game and get feedback that was unexpected to them and have to build that in and stuff – so that process – it's a design thinking – iterative design thing is like huge (emphasis my own).

The iterative design process falls under the umbrella of P-21 framework's Learning and Innovation Skills (otherwise known as the 4Cs – critical thinking, communication, collaboration, and creativity) ("Framework for 21st Century Learning," 2007). Understanding this concept in the way that Joe teaches it through game design in his classroom illustrates a form of critical thinking in action. Further, the students will often discuss with one another the quests they are working on in class, or collaborate with one another to co-create games as their design skills progress over the course of the semester.

Joe repeatedly emphasized the importance of the iterative design process in almost every conversation I had with him regarding his students' learning. Upon entering his classroom, which had been converted into a student-centered media "play" space, a number of signs adorn the walls. Among the traditional fire drill policy, occupancy limit, and other school-related forms, there are also several large posters with slogans from inspirational leaders like Mark Zuckerberg and former President Barack Obama. The

largest poster along the left-hand wall of the room is dedicated to the "Iterative Design Process." It illustrates the cyclical process that students must complete in order to design high-quality videogames. Joe even went so far as to make the connection between how he plans his curriculum and this design process:

> I teach **iterative design I keep my planning that way too – it's iterative** – so certain quests, ya know, stand the course of time and have remained relevant for years and others have not and are replaced or eliminated or something new might come in and that might, kind of – the kids have a lot to do with that, too. Like, I'll add the quests, the kids are gonna choose which ones they're excited about, and that's gonna drive the direction that a lot of things go… (emphasis my own).

The iterative design process requires the students to go through an extensive review whereby their fellow students play-test the game in order to provide feedback for improvement. The students then tweak their games based on the feedback, and continue to have their peers play-test the design until they achieve the most desirable results – developing a game that provides an enjoyable gaming experience. This cycle encompasses the skills associated with programmatic thinking, which is one of many aspects of computational thinking (Wing, 2006).

In summary, Joe's approach to planning for student outcomes consisted of lesson development based on successful experiences with teaching through iterative design in prior classes. The iterative design process embodies many of the characteristics of the P-21 framework that are considered key to underpinning the successful development of the "…knowledge, skills, and expertise students should master to succeed in work and life in the 21st century" (Partnership for 21st Century Skills, 2016).

Planning for Motivation.

From the very first day of class, Joe plans for motivating his students to learn. Through the use of a gamified learning platform, 3DGameLab, he can reward students' successful completion of activities through the use of badges and experience points. Although the gamification of in-class activities may not motivate *all* of his students, Joe has found that, more often than not, the 3DGameLab platform has been an asset to his planning activity. Joe wants his students to want to learn and to enjoy the process, not just complete the work for the sake of getting an A in the class. He explains to them from the outset how the course's grading system works:

> This class is quest based -- choice based; you have many opportunities and options to earn points. What path *your* learning takes – will support *our* overall mission. When you hit 700 points you are a ninja! That's an A+ for 'typical' folk out there.

There are a number of ways to earn points in Joe's course throughout the semester, many of which come from completing various activities via the gamified questing platform 3DGameLab. In the case of the excerpt of class dialogue above, Joe went on to say that he's had students work "overtime" outside of class to earn as much as 1200 XP points "just cause." Even this casual mention of former students earning extreme amounts of experience points can subconsciously impact his current students; the desire to acquire the most XP available is in itself a motivating enterprise for many. This example is also a self-referential nod to the very goals he wishes for his students to achieve in designing their games, namely developing a rewarding play experience for the gamers who play it. He continues to describe the way points are ascribed to assignments with a sample

activity eligible for grading. Here Joe explains to the students one of the ways they can earn up to 20 XP (experience) points:

> There's a Twitter chat tonight – Twitter isn't necessary but if you can have one – it's one path through the course – using Twitter. This is an *inaugural* chat, kickstarting the Twitter chat [called] #MinecraftEd. What's really exciting about this chat for me is that one of the moderators will be a *student*! There are three co-moderators of the #MinecraftEd Twitter chat – consisting of two adults (teachers) and one student on a weekly basis. The way that you can earn your XP for this quest is to write a blog post discussing takeaways from the chat. We're going to talk about the ways you can use Minecraft effectively tonight!

There are multiple forms of motivational activity taking place in the description above, all of which Joe has consciously included in his plan for the lesson. These include: (1) agency supportiveness – Joe affords students choice in which learning activities they'd like to pursue for credit in the course through the use of quest-based learning on a gamified platform; (2) encouraging parental response – Joe's introduction of Twitter as one form of participation for credit in the course was addressed with the students' parents via teacher email prior to their children starting the course, since parents who support agentive behaviors contribute to students' self-regulatory behavior and subsequently their in-school achievement (Deci, Vallerand, Pelletier, & Ryan, 1991); and (3) the development of an extrinsic rewards system – Joe creates awards in the form of badges, to be bestowed upon students for exceptional performance on quests, in addition to experience points for said participation. The presence of these kinds of structures and

activities in Joe's class makes it clear that his planning process is designed with the motivation (both intrinsic and extrinsic) of his students in mind.

Planning to Avoid Cognitive Overload.

The agency Joe allows his students in the classroom setting can be overwhelming to some students, especially those who have become accustomed to the structure and rigidity of more traditional classroom settings. Making decisions about what to work on without being told what to do and how to do it may feel more challenging than the tasks themselves. In spite of these challenges, as students develop greater agency in their own learning, they will eventually feel less overwhelmed (Brinckerhoff, McGuire, & Shaw, 2002; Field, Sarver, & Shaw, 2003; Mellard, 1996). Having taught this course for more than eight years, Joe has become attuned to the needs of his students and has learned over time what works best for which students. When I asked Joe about how he negotiated his planning time across the semester (two marking periods), he responded:

> I mean, that's a challenge because I always have ideas in my mind about things I wanna, either, add in terms of quests, so sometimes that's a matter of sitting down, it's almost like planning something new…sometimes I wanna reorganize the way the quests are released because […] **I don't want them overwhelmed with the available quests** so sometimes if there's a slight shift, for instance right now we're doing a lot of virtual reality stuff – this is very different so these two weeks have been a very different start to the semester than usual – so **I've been gearing quests towards that** so I'm just trying to manage and not have them working necessarily on what they'd normally be [doing at this time in the semester] – although they're still accessible so at home the kids seem to be doing

> more of those other quests which is fine, but yeah, ya know, I mean I wanna spend my time evaluating the kids' quests that are submitted, ya know, **creating new opportunities**… (emphasis my own).

As this quotation suggests, Joe devotes considerable planning time to curating, adjusting, and creating quests to meet the needs of his students in any given semester. An important reason for this, he says, is to ensure that the students do not become "overwhelmed" by large numbers of preexisting quests which are in some cases not directly connected to the material he is teaching.

Joe is willing to make these types of changes to his plans in order to take advantage of unique opportunities that make themselves available to him. Joe's relationships with other educators and educational technology agencies afford him the ability to become involved in a number of high-tech pilot projects. During the semester in which I observed Joe's course, he had the opportunity to let his students use one of the newest virtual reality learning systems to be released on the market, called the HTC VIVE. In the example above, Joe talked about how he anticipated creating some quest lines around virtual reality applications because he knew his students were going to be participating in this particular project. Having that equipment for the students to explore for a couple of weeks laid the groundwork for additional quest-lines to be built into his curriculum in 3DGameLab. While Joe is excited at the prospect of being able to incorporate new quest lines and have his students invest time in new technological tools, having too many quest lines to choose from can be an issue, one of which he is keenly aware. The 3DGameLab platform allows Joe a good amount of flexibility in his planning process, giving him the ability to pick and choose which quest lines he wants to make

available to students and when, to avoid them becoming overwhelmed with options. Joe essentially adopts a 'less is more' philosophy in situations like these.

Planning not to plan: Extemporaneous instruction.

Joe's approach to pedagogy is based by and large on his past classroom experiences that daily instruction doesn't always go as scheduled. There are a number of interruptions that occur throughout the day, requiring redirects and work-arounds in order to accomplish the goals he's set for his students to achieve over the course of the semester. Berliner (2001) contends that expert teachers "…are more flexible, are more opportunistic planners, can change representations faster when it is appropriate to do so" (p.464) in comparison to their novice counterparts. Joe continuously monitors the students' behaviors within his classroom setting affording him the ability to take inventory of current successes and/or challenges his pupils are encountering, assessing their needs in real time. By getting a sense of the students' "state of mind" (Berliner, 2001), Joe is more readily able to determine what strategy may best scaffold their learning. Stough and Palmer (2001) emphasize that "planning" as an instructional strategy is less frequently identified as a method for enhancing student learning outcomes. Part of Joe's success with extemporaneous planning is due to his length of time spent in the profession. Having taught almost two decades in a classroom setting, eight of which have been spent teaching videogame design and development, Joe has a great deal of experience with situations that require him to quickly change gears without deliberation. Having a routine established for the students to follow on a daily basis also contributes to his ability to make changes fluidly; the routine frees Joe from the need to

focus on typical instructional decision-making so that he is able to concentrate on immediate issues that may arise.

Planning for Overcoming Un/expected Obstacles.

Regardless of the content being taught, teachers who have been in the profession long enough are well aware of the possible interruptions that can take place over the course of the school day; professional development obligations, institutional disruptions, technical difficulties, and the lack of equipment and/or funds to facilitate instruction are all difficulties Joe has encountered time and time again. The categories of data analysis below speak to the reasons *why* Joe makes the decisions he does in relation to planning for overcoming un/expected obstacles.

Professional development "obligations." Joe is a member of several educational technology organizations, travelling regionally, nationally, and internationally to present at conferences and conventions throughout the world. The more actively involved Joe becomes in the development/modification of videogames for classroom use, the more conferences he needs to attend. Although the thought of a teacher being absent for extended periods of time over the course of a semester sounds disruptive to student learning, Joe's approach to pedagogy conforms to such disturbances. Due to the flexible nature of quest-based learning, Joe's students have a consistent stream of activities to complete, which contribute to the continuity of his instruction, even when he isn't present in the classroom setting.

One way Joe works around his professional development scheduling conflicts is by participating in conferences and presentations that occur online, in addition to traveling during the summer months when the students are on break. The majority of

Joe's professional development activity is self-selected. He fulfills the state mandated PD requirement (100 hours every five years) by participating in programming that he enjoys. In fact, the use of 3DGameLab for quest-based learning in his classroom would never have been a part of his pedagogy had he not participated in an online teacher boot-camp hosted by Boise State University (the home of 3DGameLab).

Institutional disruptions. Compulsory standardized tests are nothing new to education. All public schools in New Jersey at the time of the study were required to conduct PARCC testing during the spring semester. These tests are taken on computers, which means all computer labs in the building are needed to serve the whole student population. Fire drills and lock-down practice runs are also par for the course in the K-12 sector. These are just some of the disruptions Joe encounters during his work day, as all teachers experience from time to time. While school administrators may give teachers a shorter warning period alerting them to fire-drills and lock-downs that will take place during the school day, Joe's approach to teaching is extremely fluid, so smaller institutional disruptions like these have little impact on his instructional plans. Testing periods are an annual event, so Joe has enough notice in advance of that time in which to make the appropriate modifications to his lesson plans. On one of the occasions I conducted an observation of his classroom teaching, testing was scheduled, and he had his students use a laptop cart of netbooks in order to work on their game designs. While the screens are smaller, the Wi-Fi can be spotty, and the netbooks have a tendency to break much more easily than the desktops the students are used to working on, they were still able to complete their work in class as regularly scheduled.

Technical difficulties. "It's a common sense sort of thing," Joe responds in answer to my question regarding planning for technical difficulties in a videogame design classroom. "Whenever you have technology involved, there's bound to be a hiccup here or there. I have about twenty students in this class [the videogame design course] right now, but as you can see [he motions to the typically unoccupied seats towards the back of the room] we have spares in case of any glitches that take place during class." Joe is fortunate enough to have an abundance of technology in his classroom setting, a luxury not all schools/districts can afford. Without a media lab like Joe's room, it would be difficult to host a course like this during the typical school day. Libraries or a singular computer lab in a school are typically where teachers have students work on any technology-based projects. A laptop cart is a nice addition, but Chromebooks, iPads, or even Surface Pros aren't going to have the kind of hard-drive and RAM necessary to run the programs these kids use for game design. Further, Wi-Fi is NOT a reliable source of connectivity for a large number of students to be working off of all at the same time – the system is bound to run substantially slower with each additional user logged on. Downloaded software programs to be used offline are beneficial, but again, the amount of space that some of these applications require is too great to successfully run on a smaller processor, as found in portable electronic devices. Essentially, Joe prepares for possible technological troubles by having back-up plans ready for those "just in case" scenarios. By planning to have at least one extra computer or laptop for students to use, or by having students pair up to use one device during class (taking turns or working on a project together), Joe attempts to ensure that the class will run more efficiently in the long run.

Lack of equipment/funds. Despite the fact that Joe is fortunate enough to have a media lab for a classroom, the constant developments of new technologies on the market can be financially draining on even the wealthiest of school districts. In addition to the connections Joe has made via his PLN (as discussed in the Professional Development subsection of this chapter), he has had to get creative with funding some of his classroom projects, which sheds light on another distinct aspect of his planning. A sizeable source of support for him has been the website DonorsChoose.org, a non-profit crowdfunding platform that allows individuals and companies to donate to public school classroom projects. DonorsChoose[12] has been the subject of at least six of Joe's blog posts in the past few years, and he has articulated in great detail which donations from the site have contributed to the development of his "studio-style" classroom setting. He describes the information he shared with possible benefactors via the website, provides details about the equipment he is requesting, as well as a detailed breakdown of the costs associated with each piece of hard/software, and offers a rationale as to why these tools are necessary for his instruction. Joe explains this process as follows:

> My class is quest based and there is a quest line based on the Empowering Learners theme. Students will start by reading a blog post about the donor's [sic] choose grants and the idea behind the project. They then consider what they would like to pursue for their passion project. Students respond to the first quest

[12] The following projects were fully funded using the DonorsChoose platform: *Virtual Reality in the Classroom: The Next Frontier!* – $2,471; *Empowering Learners in the Maker Age: Take 3* – $1,792; *Empowering Learners in the Maker Age Take 2* – $1,141; *Game Design: Analysis and Deconstruction of Non-Digital Games* – $801; *Empowering the Learner in the 'Maker Age'* – $1,397; Total amount of funds donated: $7,602

> with a general idea regarding what they would like to work with and how they feel about the learning being put in the students' hands. I am big on reflection and want the kids to consider why (or even if) they see this as a valuable proposition.

To further entice donors, Joe also includes student testimonials, driving home the direct impact contributions will make on their learning. One student testimonial states:

> We are highly motivated WAMS technology students with vivid imaginations and amazing ideas. With some help of course and experience, I think that we can show people how valuable game design is and how the games can help the students in our classroom learn and better our knowledge and education for brighter futures. I think that we can help make this project work because we can come up with ways to persuade people to donate, and we can make the project fun and interesting!

This excerpt is particularly powerful in demonstrating not only how Joe plans to overcome financial difficulties associated with obtaining necessary equipment for student project use, but also how he includes *his students* in the planning process as well. By enlisting the help of his students, the very people who will benefit from the results of the fundraising, Joe legitimizes his planning process.

In sum, Joe engages in a multi-faceted process of planning for instruction: he takes into account student outcomes as informed by the P-21 framework in combination with technology-based standards; he takes inventory of students' motivational needs for completing assigned tasks; he avoids overloading his students cognitively by allowing them to make choices about how to fulfill course requirements with reasonable

expectations; he remains at the ready for extemporaneous instruction whenever needed; and he prepares to overcome obstacles that he may or may not know about in advance of his day-to-day teaching practice. This process has been refined over Joe's twenty-five years of experience in the classroom, eight of which include teaching this course, and this experience has invaluably contributed to his overall knowledge of how to best plan videogame design instruction.

Scaffolding Instruction

Introduction

Much of Joe's pedagogical success can be attributed to the ways in which he scaffolds his students' learning. A carefully structured semester plan consisting of three base units undergirds his teaching methodology. The introductory unit for the semester introduces the students to videogame design and development through the use of quest lines to be completed in 3DGameLab. These initial quests[13] are required for all course participants; follow-up quest lines are then selected by the students based on their interests in the activities which they have encountered within the gamification platform. The second unit the students complete is anchored by the online videogame design program GameMaker, a platform with which Joe has extensive experience; he has in fact co-authored a book about its use in classroom settings. GameMaker has its own

[13] The complexity of each task increases with quest completion, meaning, the first quest in any given chain is much more simplistic than those that follow it. For example, the first quest simply asks students to read two paragraphs discussing the introduction of games and game culture to civilization. The second quest requires students to set up some social media tools (a Twitter account, a YouTube account, a blog) to document their journey through the course, and so on.

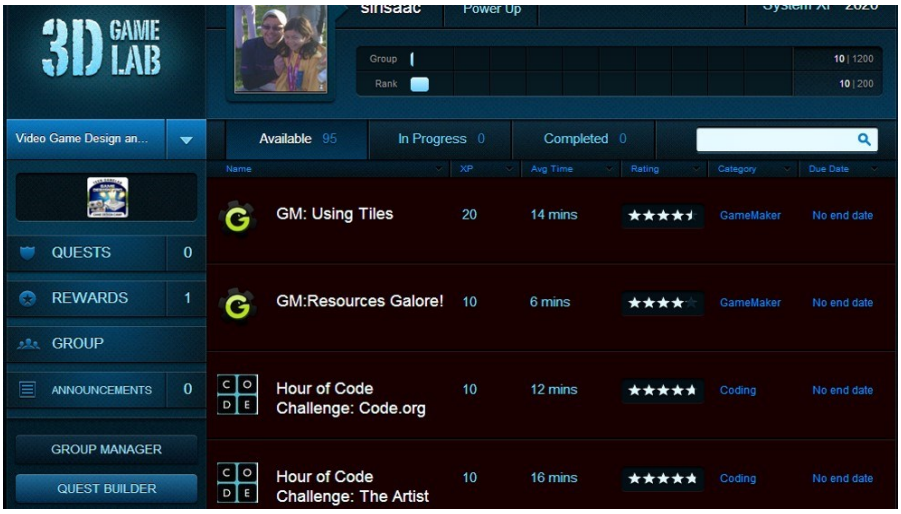
programming language, identified by the acronym GML that students learn to use through the GameMaker platform to design and develop games specific to the GM platform. The introductory approach to coding that GameMaker takes, prior to the use of GML, is a drag-and-drop approach to videogame design. The drag-and-drop interface is a considerable asset to the GameMaker platform, as students do *not* need to know how to code in order to create videogames. Should students choose to develop videogames using GML (after mastering the drag-and-drop configuration approach to game making, they are more than encouraged to do so with Joe's permission). The third and final unit of Joe's course is focused on a videogame design team challenge project, wherein all of the skills the students have been honing and developing over the course of the semester culminate in the creation of a collaborative game construct.

The following sub-sections of this chapter explore scaffolding as it applies to four distinct pedagogical practices: (1) the implementation of quest-based learning (in Joe's case, through the gamification platform 3DGameLab); (2) the assignment of "passion projects" (Joe's version of "Genius Hour"[14] also referred to as "20% Time"); (3) the use of the web-based platform GameMaker to introduce students to game design; and (4) encouraging student collaboration during the process of videogame design.

Scaffolding and Quest-Based Learning

[14] "Genius Hour is student-driven, passion-based learning. Very simply, it is a time when learners are asked what they want to learn, and the teacher gets out of their way" (Juliani, 2014, p. 49).

Joe establishes a semi-regimented routine at the start of the semester to get students used to the classroom flow from day one. Quest-based learning, a form of gamification as discussed earlier in this study, helps to set the stage for this habitual behavior. More specifically, Joe creates quest chains for his students, a tiered series of quests that specifically focus on one area of learning – for example, learning how to use a particular educational technology tool in a variety of ways. As Holmes and Gee (2016) explain it, "[i]n such a design [a quest chain], players begin with a clear goal (find the quest giver, accept and complete the quest) and with a limited set of initial quest offerings, players are not overwhelmed by too many options or unclear progression pathways" (pp. 9-10). For Joe's course in particular, Joe is the quest giver, and the students complete activities on themes associated with videogame design and development. Introductory quest chains focus on the history of games and gaming in Joe's course; later quest chains address topics like machinima, mobile learning, app development, Minecraftedu, among others. The web-based platform called 3DGameLab houses the quest lines that Joe's students complete for credit in the course.



The gamification of the course in this way allows for students to be introduced to new

tools and programs that can be used later in the second half of the course as a basis for more advanced game design projects.

Given Joe's concerns with overloading his students cognitively, the quest-based learning method of instruction also scaffolds their learning by structuring tasks so that they have limitations on how many quest lines they can choose to pursue at once, and how many individual quests they have to select from at any given time (Hmelo-Silver, Duncan, & Chinn, 2007). Too much choice can lead to the learners feeling overwhelmed. The quest-based learning system prevents them from getting in too deep. Although in the image above there are a number of quest lines depicted, this is because the screenshot was taken from the perspective of the teacher (Joe's view); his students, meanwhile, are only able to unlock quests in a particular quest chain one at a time. While they may have access to multiple quest chains, no more than one quest per chain can be completed at any given time. This way the students can feel as though they have agency within the shell, when in fact the instructor (Joe) has ultimate control over the total number of quests available to them. One such quest chain, entitled "Empowering Learners" introduces students to the idea of working on a passion project (of their own creation) as part of their participation in the course. Each quest in the chain scaffolds the students' process of brainstorming, planning, creating, and reflecting on the project experience. The details of this process are articulated in the next sub-section of this chapter.

Scaffolding Passion Projects

As mentioned earlier in this chapter, Joe's students participate once per week in "20% Time Tuesdays", working on "passion projects" that they design in consultation with Joe. At the start of the semester, Joe explains what "20% Time" is all about; how it came to fruition, its outcomes, and how it has impacted his students' learning experiences in the past. Joe described this initial process in the blog post already quoted in my discussion of creativity and innovation, and Joe his reflections shed light on an important aspect of Joe's approach to scaffolding, namely how he allows his students to assist with the development of their own learning goals (Hogan & Pressley, 1997). By kickstarting the class with the story of how the 20% Time project began at 3M, Joe provided a real-life example to spark the students' interest and encourage their own creative thinking. This anecdotal evidence of how 20% Time inspired authentic, practical inventions (e.g., Post-It Notes) during typical "working hours" for use in the "real world" further supported the students' learning and 21st century skill development (i.e., critical thinking and problem solving).

Once the students have been introduced to the task's requirements, Joe asks that they use their personal blog sites to brainstorm ideas for the projects they'd like to pursue on 20% Time Tuesdays. Joe provides the students with feedback on their blog posts through a combination of email follow-up and one-on-one in-class discussion. This feedback serves a variety of purposes: to encourage the students' ideas; to redirect those ideas that may be too grandiose in scale for the amount of time allotted over the course of the semester; and/or to assist those students who aren't quite sure what their "passions" are in the first place.

Joe shared with me that the majority of the feedback he provides is to encourage his students to flesh out their brainstorming efforts. Often the students will write one or two sentences to describe what they'd like to do, but fail to provide enough detail about what specifically they'll be creating, which multimodal tools they'll be working with, which program(s) they might use to complete the task, etc. While the students are still new to the course and the 20% Time project process, Joe addresses these concerns with them during class time as well, reiterating what he has already shared via electronic feedback; this way, individual students are aware that they aren't the only ones struggling with fleshing out their ideas. Joe's whole group discussion of his expectations provides a form of verbal scaffolding, as he encourages the kids to share their thought process in developing their projects, in combination with suggesting ways to enhance their written descriptions of their ideas.

Once the students have completed their posts successfully (meaning, Joe has approved both their projects and their written posts describing their ideas), then they can proceed to the second step in the process: completion of the "Watch It, Build It" quest in 3DGameLab. This quest belongs to the "Empowering Learners" quest chain, which, as discussed in the previous section, further scaffolds students' skill growth and development as they create their passion projects. The combination of Joe's verbal scaffolds with the text-based visual scaffolds -- the quest lines themselves -- provides additional support for students who are uncertain of how to proceed with the task. The "Watch It, Build It" quest in particular requires the students to search for resources such as video tutorials and instructional guides that will instruct them in how to use the program or tool with which they intend to create their projects. The final step of the

project planning process requires the students to create a full-blown design plan that gives greater insight into the vision each student has for his or her passion project. The students find that the tutorials in conjunction with their design plans provide additional scaffolds for supporting their videogame design and 21st century skillsets.

An observation of the "20% Tuesday" periods in Joe's reveals a swift increase in the students' enthusiasm within the first few minutes of class, and the environment soon becomes one of controlled chaos. The students are slightly confused at first, unsure of how to proceed and unaccustomed with being able to make their own decisions about how to spend class time. Joe notes how frenetic this process is to endure on his blog:

> We are only in week 2. There is still a bit of confusion and this is not an approach to learning students are accustomed to in school. It can be messy and appear disorganized. You quickly see how some students are incredibly independent and self driven [sic] and others require a lot more attention. This will be part of the process and while it left my head spinning at times I believe it is an important growing pain to endure.

To keep the chaos organized, Joe has enabled a system whereby the students are required to put their name on the whiteboard when they have a question about a task. Joe spends the majority of the class period floating around the room in a facilitator capacity. Often there will be three or four new names up on the board by the time he moves to the next name on the list. Joe expects his students to productively use the time in which they are waiting for assistance; ideally, the students will ask their peers for support, or they can proceed with a quest within 3DGameLab until he reaches them. On many occasions, I

found that students readily accepted help from the students sitting next to them – either by requesting it or when their neighbor noticed them struggling. Joe actively encourages the students to rely on one another to solve problems, or to figure out things themselves, before asking for help. He emphasizes the importance of letting the students take control of their own learning in the following blog post:

> It's very interesting to truly put the learning in the students [sic] hands. There is an inclination for students to want (dare I say expect) a lot of attention when they don't know exactly what to do. The true humor (after the fact) comes in watching them fumble because they cannot figure out how to turn on the TV or set up the right input on the TV to connect to the device they are working with. It literally took a pair of students 20 minutes (and a few hints from me although I was VERY stingy in giving assistance) to get the raspberry pi connected and showing up on one of the TVs in the room. Ultimately a third student came to their aid. It was little things like the TV input, needing to take the HDMI cable out of the Xbox360 to use it with the pi, but the best was the fact that they tried to plug the mini usb into the Ethernet port in the raspberry pi and wondered why it wasn't powering up. **This is one of those moments when you really want to help them but need to let go and embrace the learning that is taking place through the process.** After all, if these kids got a raspberry pi in the mail they would be sure to figure out how to get it hooked up at home without my assistance (emphasis my own).

Throughout each interview I had with Joe, in combination with observing his teaching and reading his blog posts, he repeatedly referenced the importance of choice in student

learning. He consistently refers to himself as a facilitator as opposed to a teacher or instructor, and his responses to the questions I had for him were always focused on the learners (his students). Joe's student-centered approach to teaching is a fundamental aspect of his pedagogy. The students are *required* to take control of their learning – they won't be successful in the course if they don't make explicit choices and explain the reasons behind their actions via blog posts or YouTube video reflections on their experiences.

Joe acknowledges that not all students are immediately able to accept the reins on their own learning; they require additional support, which Joe is able to (albeit hesitantly) provide. The reluctance to assist the students is almost certainly not laziness or indifference on Joe's part; rather, he prefers that the students feel empowered by the learning experiences taking place in his classroom as opposed to intimidated by them. He has been practicing this form of pedagogy for a number of years, which affords him the ability to recognize when the students are truly struggling with a task versus reverting to the traditional forms of learning they're used to (i.e. having the teacher tell them what to do and how to do it).

Joe gains further insights from the students' blog posts, particularly from those students who are more hesitant to admit they're struggling in the classroom. He provides prompts for the students to respond to, further scaffolding their learning (Alibali, 2006), as follows:

1. What product / tool are you working with?
2. Share what you have learned so far through the experience.
3. What progres [sic] have you made so far?
4. What is your plan for moving forward (next steps and big plan)?

5. interesting a ha moments you have had through the experience of taking ownership of your learning (Issacs, 2015).

When Joe initially wrote this blog post, he stated that having the students reflect via personal blogs was considered extra credit; they were only required to submit a quest response (via 3DGameLab). More than a year later, while observing his classroom, blog posts have become a required part of the task; students are required to submit a link to their blog posts as part of the quest requirement. This additional step in the process contributes to the students' development of their 21st century skills; more specifically, their information, media, and technology skillsets.

Modeling with Game Maker

Joe's introduction to the second unit of the semester (focused on the program *Gamemaker: Studio*) begins with a whole class discussion. Joe focuses on the variables that comprise a game ("rules" "feedback system" "goals" and "gamer participation"), prompting the students to recall what they have already learned about games and game design through their quest adventures so far. This class discussion bleeds into an introduction of the program *Gamemaker: Studio*, which Joe describes on his blog as follows:

> If you know me, you know I am a HUGE fan of GameMaker as a tool for teaching game design and development. GameMaker studio makes game creation easy thanks to it's [sic] intuitive drag and drop approach. However, as an introduction to computer science, students grasp the concepts in a concrete manner that is true to the coding constructs represented based on the required syntax. Students learn key programming concepts including conditional

> statements, variables, and loops. The logic involved translates seamlessly to any programming language, including the built in GameMaker Language (GML). Some students will stay with the drag and drop approach, but others will slowly (or quickly) gravitate toward the use of code (Isaacs, 2014).

Joe's dedication to GameMaker is so extensive that he has not only designed online tutorials to get educators and students alike interested in using the program for videogame creation, but he has also co-authored an entire textbook dedicated to its use in the classroom. His co-author was a former student of his, whose interest in writing about GameMaker stemmed from his use of the software in Joe's class as part of the GameMaker unit and his 20% Time project.

Reflecting on the learning process the students engage in via the use of GameMaker, Joe elaborates via the educational review platform CommonSense.org:

> Students build their games over a period of time and seek support from their peers and from me as needed. Students may work in design teams and specialization begins to evolve naturally. Some students find that they especially like creating graphics using the built in sprite and animation editor, others find their niche is in level development, and others gravitate toward developing the game mechanics. During the development process we stop at check points for students to give and receive peer feedback. Students evaluate each others' [sic] games and provide constructive suggestions. After each round of feedback, students continue to work on their game with a focus on incorporating feedback.

Joe's review of GameMaker Studio (above) describes his pedagogical application of the platform in his classroom. This articulation of his methodology for incorporating GMS into his course curriculum provides prospective GameMaker Studio users a glimpse into Joe's teaching perspective as a whole – he consistently refers to himself as a *facilitator* of his students' learning as opposed to an instructor commanding his pupils' attention.

Joe's facilitation process for scaffolding of student learning throughout the GameMaker unit in his *Video Game Design and Development* course can best be described as the structured supports undergirding students' learning within open learning environments (Hannafin, Land, & Oliver, 1999). Joe's consistent emphasis on student-centered, agentive learning aligns closely to that of an OLE: it "…support[s] the individual's efforts to understand that which he or she determines to be important" (Hannafin, Hall, Land, & Hill, 1994, p. 48). In Joe's classroom, he provides the resources that his students need to succeed, but as opposed to implementing direct-instructional methods, he engineers his classroom so that "…scaffolds are provided, but they do not typically impose or restrict the content or interpretations of learning sequences" (Hannafin, Land, & Oliver, 1999, p. 120). Hannafin, et al. (1999) describe four specific classifications for scaffolding in an open-ended learning environment such as Joe's classroom setting: *conceptual*, wherein the students are guided through the task with a focus on "*what to consider*" (p. 132), such as when Joe provides prompts for his students; *metacognitive*, in which students are guided *how* to think throughout the learning process, such as when Joe requires the students to create a design plan for the development of their projects and reflect upon the process in their blogs; *procedural*, whereby the instructor provides assistance with the technological tools and resources

available to the students, such as when Joe suggests a particular program to his students for achieving their project goal(s); and, *strategic* scaffolding, defined as guiding the "…analysis, planning, strategy, and tactical decisions…" of the task at hand, such as when Joe redirects students who may be having trouble with a particular facet of their project.

As part of the GameMaker unit in the course, Joe requires his students to create *at least* four different types of games on the platform: a simplistic style maze game, an adventure-based game, a platform-based game, and a scrolling shooter type of game.

By way of reinforcing his belief that students should be in charge of their own learning, Joe introduces his 8th graders to the gaming platform in a whole-class discussion format, using the three large screens hanging on the front wall of the classroom to demonstrate how to get started. GameMaker Studio (GMS) has built into its platform a number of tutorials pre-created to assist students (and learners of all ages) with creating games, which effectively provide *procedural* scaffolds for students (Hannafin, et al., 1999). Joe utilizes these introductory videos in combination with direct instructional methods (i.e. modeling how various aspects of the system work via the flat-screens posted on the front and back walls of his classroom) to facilitate his students' introduction to the platform.

Once the students have a handle on the basic commands of the system, Joe's role in the classroom undergoes a self-described transformation – he shifts from instructor to facilitator, guiding and supporting his students as needed. Joe has found over the course of teaching with GMS for the past eight years that students often seek support with

specific aspects of the program. In such situations, instead of having the students review the GMS-provided tutorials, which give extensive overviews of various components of the program, Joe has created a collection of screencasts demonstrating particular elements of GMS that his past pupils have tried to master. By supporting his students with an additional tutorial bank targeting specific challenges former students experienced within the system, Joe provides them with *conceptual* scaffolds, or "…a set of approaches that could be used should assistance be sought in initiating or continuing efforts…" (Hannafin, et al., 1999, p. 137) in developing their games. These videos could be identified as conceptual due to the fact that they address *possible* problems the students may come across, and are readily available for use should the students choose to review them – they present an array of variables these young designers may select for inclusion in their games.

An additional form of scaffolding Joe presents to the students comes in the form of requiring a game design document; this metacognitive support tool functions as a way for students to plan ahead, to determine what they will need to successfully complete their game creations, and to determine what specific goals they would like to achieve over the course of the game-making processes. While Joe's learning objectives for the students guide both his planning and his scaffolding of their learning, the students' stake in their own learning is equally important to the process.

In sum, Joe's self-described role as facilitator in his classroom setting is further cemented in his pedagogical process with the introduction of GameMaker Studio. He continues his process of allowing the students more agency through their ability to select which games they'd like to create, within the pre-determined goals of the unit (to create

four specific types of games). He provides scaffolding for the students in a variety of formats throughout this unit, with the greatest amount of emphasis on the pre-recorded screencasts demonstrating specific elements of game design within GMS. The required design plan students develop in advance of engaging in the design process further supports their learning on a metacognitive level. Finally, he offers one-to-one instructional support when the students have exhausted all other avenues of creatively solving whatever problems they may have encountered throughout the game design process.

Students Designing Games Collaboratively

It should also be noted here that collaboration *is* a crucial component of the P-21 framework, and is in and of itself one of the skills identified within the frame. Within Joe's pedagogy, the collaborative videogame design process effectively and organically scaffolds the development of these 21st century skills. In Joe's blog, he writes:

> Game development could potentially be the most authentic approach to interdisciplinary learning. There's really something for everyone. The activity lends so well to the creation of design teams with roles including storytelling/narrative, graphic design, animation, sound engineering, project management, and programming. It is also very important to note that game design taps so nicely into the realm of 21st century skills (Isaacs, 2016).

From the excerpt above, it is clear that Joe identifies two specific assets of a game design curriculum as inherently valuable to his pedagogy: (1) the collaborative aspect of game

design through the use of "design teams," and (2) the 21st century skillsets that are honed and developed as a result of this collaborative activity.

As was the case with each previous unit Joe introduced to his students, he kick-starts the collaborative videogame design project with a whole-class discussion, refreshing the students' memories about what constructs define a game, and which skills they have been introduced to through their experiences with the 3DGameLab quests and their *GameMaker: Studio* creations. He explicitly highlights for the students the importance of the iterative design process, and describes how they embody this process when creating and playtesting their own and each other's games. He especially drives home the cyclical nature of iterative design: "…prototyping, testing, analyzing, and refining a work in progress. In iterative design, interaction with the designed system is used as a form of research for informing and evolving a project, as successive versions, or iterations of a design are implemented" (Iteration Iteration, para. 1, Zimmerman, 2003). In this vein, Joe reminds the students of how their GMS projects improved with each iteration of their designs, a process much like the one "real-life" game designers go through when creating games for the marketplace. This is yet another example of Joe consistently reminding his students that their interests in game-design can be transposed to real-world career paths if they develop a passion for working in such a field.

Once Joe has reviewed the students' prior learning in the course, he asks them to break themselves into groups (no larger than five students per group) to work on a collaboratively designed game. The platform that students use for their designs is entirely up to them. Again, Joe emphasizes the importance of student choice and providing as many opportunities for agentive learning within his classroom as possible.

As Joe instructed the students to do with their *GameMaker: Studio* games, a design plan must also be co-constructed for the collaborative project before the prototype building begins. Dependent upon the goals the students have for their creations, outcomes for finished projects will be somewhat individualized and may reflect varying levels of completion. Some students, for example, may want to create an entire game level in the program *Portal 2*, but they may not be able to complete the task prior to the conclusion of the semester. Joe does *not* penalize such students for non-completion of projects; rather, he does what he can to encourage students to scale down their plans and/or customizes his assessment based on the progress each student made over the course of the unit.

As described in the quote at the beginning of this sub-section, students' roles in this project are customizable based on their interests and skill strengths. "Students will often gravitate to their strengths," Joe informed me during one interview session. "It's rare that they fight with one another over who will accomplish what task in any given group; there's always something for everyone to do!"

The processes students engage in for the collaborative game design project are broadly similar to those they used during the *GameMaker: Studio* unit of the course, in that they must work to create a game, or in some cases a "world," as in Minecraft, where the object of the platform is to develop and recreate spaces that may or may not resemble real-life locations and/or those that students read about in books (Lucci, Abrams, & Gerber, 2016). At this point the students have learned the skills necessary to produce a project considerably more advanced than they would have at the start of the semester, given that they have obtained, honed and developed these skills continuously from the onset of the course. A key difference between the GMS assignment and this one, beyond

collaborative efforts through small group work, is that each student is tasked with a specific role to make the project successful. Each student needs to contribute whole-heartedly in order to make the game (level, world, etc.) function as professionally as possible. Although the roles may vary substantially for each team member, the amount of work each student contributes to the project "evens out for the most part" according to Joe. The students are required to articulate in a project document how each contributed to the project, in addition to evaluating their team members' efficacy and impact on the team's overall compatibility and performance.

Joe's scaffolding techniques for this final unit project do not differ from the prior supports I have described in other sections of this chapter. The students are expected to lean more heavily on each other, employing more cooperative problem-solving strategies than they may have in earlier assignments. Working within their zones of proximal development (ZPD) (Vygotsky, 1978), the students are able to build upon their knowledge bases, in combination with Joe's *occasional* guidance. At this stage of the game, Joe has little impact on the students' decision making throughout the project design and creation process. While he will interject when absolutely necessary, these sorts of situations are rare; students often take it upon themselves to work out their differences and solve their problems with little involvement on Joe's part. This agentive behavior on the part of the students speaks to the effectiveness of Joe's student-centered, teacher-as-facilitator, approach to pedagogy. The primary goal of scaffolding student learning is to meet the students where they are, with the intent to augment their knowledge of a particular skill, within the boundaries of their ZPD. With the proper support systems (initially implemented by Joe), the students have been gradually weaned

from the use of these scaffolds until they are able to complete the task without the instructor's guidance. It is for this reason that Joe's final unit of the semester culminates in the form of a collaborative project that fosters such individualized educational growth. The reciprocal form of scaffolding (Holton & Thomas, 2001) that takes place among the students within their respective design teams affords Joe the ability to "fade" into the background. My use of the term "fade" is two-fold in this context: for one, the literature on scaffolding refers to the process of fading, whereby the presence of the adult "expert" who initially guides the students' learning (through scaffolds) is slowly withdrawn over a period of time during which the learner is able to independently internalize the understanding of the task being conducted, thereby no longer requiring the presence of the expert other; in addition, Joe prefers the role of "facilitator" of student learning as opposed to "instructor" or "teacher" because he wants the students to take complete control of their own learning and problem-solve of their own volition in order to achieve their personal goals in the course (other than to pass the class or earn an A for the semester).

On the whole, Joe's pedagogical approach to his students' learning in this final design team project was in alignment with the natural progression of the scaffolding process when implemented in an open-ended learning environment (which Joe himself characterizes as a "media lab space" more than a "traditional classroom" setting). The assistance he provided to the students was primarily procedural, where students would ask him if they were "allowed" to complete various aspects of the task in a certain way; or, technical, where students would ask for assistance with (for example) malfunctioning hardware. Depending upon a particular student's interest in any given aspect of the task,

a more in-depth query about the ways in which a problem could be tackled took place, but this was more of an exception than a rule. The students' intrinsic motivation to work on projects of their own design, which they were legitimately interested in, contributed to their higher level of interest in understanding the ins-and-outs of the projects being created. As Herrington and Oliver (2002) reported in their discussion of designing scaffolding opportunities in authentic learning environments, the ability to collaborate with peers in the classroom is vital to successful student learning and as a result "…students benefit from the opportunity to articulate, reflect and scaffold with a partner, and that they will seek these opportunities covertly if they are not available by design" (p.21). My observations of Joe's pedagogical behaviors, through which he not only required design teams to complete this culminating project, but also encouraged the students to rely on one another for problem-solving strategies, led me to the same conclusion as Herrington and his colleague.

Summary

The findings of the study presented in this chapter are based on my analysis of a combination of resources, including: interview transcripts, memoranda and field notes based on many hours of classroom observations, survey data, as well as blogs and other social media postings. Findings were delineated into three major headings to better organize the data collected. Data in the first section of the chapter focused on the case study participant, Joe, highlighting his knowledge, skills, perceptions and beliefs as they relate to his personal identity as a videogame player and how each of these impact his profession as a videogame design educator.

The second section of the chapter focused on how Joe plans his instruction. Data was analyzed and grouped into five categories: (a) the planning of student outcomes, (b) planning for student motivation, (c), planning to avoid students' cognitive overload, (d) extemporaneous planning of instruction, and (e) planning for overcoming unexpected obstacles that may hinder Joe's instruction.

The third section of this chapter focused on scaffolding student learning, or more specifically how Joe embeds support structures within his instruction to bolster his students' knowledge acquisition. A review of Joe's *Video Game Design and Development* course curriculum, broken into three units of study, provided the structure for this subsection of the chapter. Particular emphasis was given to Joe's implementation of routines for establishing expectations of student behavior during each class session. The review of data that followed focused on a more in-depth presentation of Joe's unit organization, including: the gamification of his instruction through the platform 3DGameLab (implementing quest-based learning), the implementation of a student "passion project" (i.e. 20% Time), the use of *GameMaker: Studio* for game design in the classroom, and a culminating group project requiring the students to collaboratively construct their own videogames and game-based elements (e.g. a level in a game, a "world" within a game platform like Minecraft, etc.). Within each project or unit description, varying degrees and methods of scaffolding were discussed. The methods that Joe uses in his classroom include, but are not limited to: providing students with exemplar projects, clearly explaining to students the purpose and goals of each activity he has them complete, providing ample opportunities for peer to peer instruction, and working with students on an individual, as-needed basis to ensure that they are cognizant

of the task requirements. By building upon students' foundational knowledge prior to starting new unit projects in the course, Joe strives to adequately prepare them for the forthcoming tasks, applying supports (as described above) where necessary, in order to accommodate their acquisition of new knowledge.

Although scaffolding is traditionally defined as the support of knowledge acquisition through the guidance of an expert other, there are a number of varying factors that impact the specific constructs that support student learning. To that end, Chapter 5 discusses the themes that emerged from this study as well as recommendations for future practice and research.

CHAPTER 5

DISCUSSION, RECOMMENDATIONS, AND CONCLUSION

The purpose of this study was to shed light on the pedagogical practices associated with the classroom implementation of videogame design curricula as a means of promoting students' 21st century skill development. The research questions that framed this research focused on how an experienced videogame design instructor plans and scaffolds student learning of game design principles and concepts. The research questions were answered by themes that emerged from the data collected and the results were reported in Chapter 4.

Research was conducted through semi-structured, multiple face-to-face interviews, twelve classroom observational periods spanning forty-five minutes each, and the review of more than three dozen blog posts written by the case study participant spanning the years 2012-2017. The researcher also composed memoranda based on informal conversations with the study participant. This chapter discusses the analysis and interpretations of the data collected in order to present (in light of the relevant literature) the findings of this study. The chapter also outlines the implications of these findings for educators interested in expanding students' 21st century skill development in their own classrooms, and illustrates the ways in which student learning can be supported through a variety of scaffolding techniques as highlighted in chapter four. The chapter concludes with suggestions for further research.

Discussion

Planning Student Instruction

This study has found that a number of elements impact the planning of Joe's instruction in his *Video Game Design and Development* course for eighth graders. Contributing to his planning measures are a combination of focusing on student outcomes through the lens of the P-21 framework (or more specifically, the 21st century skills students hone and develop as a result of designing videogames), developing students' computational thinking skills, and cultivating a more thorough understanding of the iterative design process.

When planning his instruction, Joe also considers the motivational factors that impact students. More specifically, Joe strives to develop a learning environment wherein his students have a great deal of agency: he allows student choice on assignments when completing quest lines; he permits them to select what platforms they would prefer to work on throughout the semester in completion of their course requirements; and he assigns a passion project (a.k.a. 20% Tuesdays) through which students can devote an entire class period (on a weekly basis) to learning more about the technology tools and/or game platforms that are of specific interest to them.

Joe's instructional plans also incorporate ways to prevent students from becoming overwhelmed by the material he is presenting. Videogame design involves a number of higher order thinking skills; computational thinking involves analytical and evaluative problem solving skills, and engaging the iterative design process for game creation requires students to demonstrate "creation," the highest level of Bloom's Digital

Taxonomy (Common Sense Media, 2015). In order to stave off increased student anxiety levels, Joe introduces content through the use of the quest-based learning platform 3DGameLab, which lays the foundation for his students to further hone and develop their game design skillsets in an organized way, one task (quest) at a time.

In some cases, Joe's plan is *not* to plan by instructing extemporaneously. Expert teachers often engage in this form of pedagogical behavior (Palmer, Stough, Burdenski, Jr., & Gonzales, 2005); they know based on what was covered (or missed) the day before whether they will need to adjust their schedule in order to make up for any unwillingly omitted content. In this same vein, Joe does his best to prepare for the various obstacles to his instruction that he may or may not know about in advance, such as institutional disruptions (e.g. fire drills, other faculty members using his media lab for PARCC testing, lock-down drills, etc.); professional development opportunities (e.g. being accepted to participate in conference presentations); technology difficulties (e.g. non-working computers or software); and/or the lack of equipment or funds for additional technologies. Joe's solution to overcoming the last of these challenges has been to post appeals to philanthropic individuals and companies interested in sponsoring teachers' classroom requests via the not-for-profit website DonorsChoose.org.

Joe's unfettered approach to planning is directly influenced by his status as an expert teacher, given that an expert teacher's beliefs feed directly into his or her decision making, which in turn shapes his or her planning process. A comprehensive review of factors that can identify teacher expertise by Palmer, Stough, Burdenski, Jr., and Gonzales (2005) indicates that "years of experience," "social recognition," "professional or social group membership," and "performance based criteria (including normative and

criterion-based selection)" were the four most prominent characteristics of "expert" teachers (p. 13). On the basis of Palmer and his colleagues' recommendations, Joe undoubtedly fulfills each of the criteria that qualify an educator as an expert.

In reference to one's teaching experience, Palmer, et al., (2005) propose that "at least three of a teacher's most recent years of experience be in the same instructional context in which the teacher is being identified as an expert" – in Joe's case this would be videogame design and development, to which he has dedicated no fewer than eight years in the middle school setting, with several additional years spent teaching this specific content outside of the classroom.

Social nomination and recognition (Agnew, Ford, & Hayes, 1997) comprises the second criterion on Palmer et al.'s (2005) list of expert teacher identifiers. Although the research is somewhat conflicted on the most appropriate way to use this category as a classification (self-nomination is very different from being recommended by one's peers), Joe has multiple award credits to his name, including 2016 ISTE Outstanding Teacher of the Year, state lead PBS Digital Innovator for 2016-17, #EdTechBridge Twitter chat co-founder, Microsoft Innovative Education Expert, Common Sense Certified EdTech Coach, Brainpop Certified Educator, and a global Minecraft Mentor, all of which clearly align with the validity of the claim that Joe is indeed an expert teacher in his field per Palmer and colleagues' recommendations.

Teaching performance is the third indicator on the list; again, its definition is subject to conflicted interpretations within the research surveyed by Palmer and his associates. Since Joe teaches *Video Game Design and Development* as an elective

course, some of the pre-existing questions surrounding the qualifiers of this particular category do not apply to him or his teaching. Taking into account the fact that student outcomes vary by content area, Joe's work could be judged on his pupils' abilities to develop and apply the knowledge and skills they acquire in his classroom to other facets of their education, social outcomes, self-regulated learning skill sets, as well as their creative and analytic thinking aptitude (Sternberg, 2003). Although analysis of Joe's students' success within these categories is subjective to some extent and falls outside the scope of this study, one might argue that student enrollment in this particular course alone indicates some success, which can be attributed to Joe's pedagogical methods. In seventh grade, the students are required to take an abbreviated computer game design course in order to get a feel for the subject area; in eighth grade, students must choose from more than half a dozen electives. If Joe's teaching were not up to par, the students' self-interest in gaming would only go so far to drive course enrollment. Further, the culminating assignment required for the course involves the design and development of a game (or level of/within a game); the very creation of these projects lends itself to the credibility of Joe's effective teaching (and planning and scaffolding) methods. A more specific example of the impact Joe has made on his students' learning is the fact that one of his pupils authored a text based on his experiences within Joe's 8th grade elective (on the instructional use of *Gamemaker: Studio* as articulated in Chapter 4); this is a true testament to Joe's impression upon his students and his ability to further cultivate their interest in the subject material (beyond being "gamers" and enjoying videogame play in their free time).

Professional and group membership rounds out the quartet of characteristics attributable to expert educators as defined within the research. Again, Joe is an exemplar for this category. His investment in the field of videogame design and development spans far beyond his actual classroom. He is involved in a number of professional organizations that support his dedication to his craft, including ISTE, Minefaire (a global Minecraft initiative for educators and gamers), Games4Ed, and Microsoft Innovative Education.

It is important to note here that the literature suggests the notion of being "highly qualified" according to national standards (i.e. having certifications making one eligible to teach specific content areas in one's particular state) is also considered an important aspect of this category. Again, because of the nature of Joe's field, there is no certification by the State of New Jersey that documents his ability to teach videogame design and development in alignment with common standards identified by the Department of Education (or any other entity). Joe's credentials as an educator include his standard teaching certificate as required by the State, in addition to the hundreds of professional development hours he accumulates annually by participating in dozens of conferences and workshops throughout the year, including the summer months.

Scaffolding Student Instruction

Joe's course is divided into three main units: quest-based learning; using *Gamemaker: Studio* to design videogames; and a collaborative group project involving a platform of the students' choosing. This curricular structure allows for a natural scaffolded progression of students' videogame design skills. The students are introduced

to the gamified learning environment (3DGameLab) on the first day of the course; the students must complete a specific number of required quest lines by the end of the semester, but they are encouraged to (and often do) engage in as many additional quests as they would like for extra credit towards their final grades. Multiple content areas pertaining to the history of gaming and game design are addressed in the various compulsory quest lines that Joe has set up for the students to complete. The introductory quests provide a steady foundation upon which the students build their knowledge of game design and development. The quests also acquaint the students with an array of educational technology tools and gaming platforms which they can then use in conjunction with their passion projects and/or their collaborative group projects later in the course.

Joe's approach to videogame design pedagogy naturally lends itself to scaffolding student learning. Quest-based learning is inherently scaffold-based; students must complete one quest in order to gain access to further avenues of learning exploration. The more students forge ahead in any given questline, the more difficult the tasks become, requiring more advanced skillsets that have been introduced in prior quests. Students cannot elect to jump ahead – the path is predetermined, and Joe has ultimate control of the students' learning paths; he is the one who grants the students permission to move on from one quest to another (via the quest submission/approval process). Even so, the platform gives students the feeling of agency as they select which questlines they will engage. Gamified learning environments such as these facilitate a fruitful interaction between scaffolded learning paths and a built-in extrinsically motivating rewards system.

Joe's second unit introduces his students to the platform *GameMaker: Studio*. Joe has more than a decade of experience teaching students how to design videogames, and he has had many opportunities to test out different programs that might be useful for teaching students how to design videogames. Despite all of this playtesting, Joe has remained steadfastly committed to using the *GameMaker: Studio* program with his students. This is in part due to his wealth of experience with the platform – he has, of course, co-authored a textbook on its use in the classroom. But he is also convinced of its superior accessibility: the entry-point for students is much more "user-friendly" than other game design formats. Joe is still open to using alternative platforms should something "better" come along, but *GameMaker: Studio* seems to have outlasted the competition time and time again.

Joe's scaffolded approach to his instruction leads students on a design journey that culminates in a collaborative group project, the third and final unit of his course. Students are granted the most agency with this assignment in particular, because they have been given enough supports over the course of the semester to know how best to approach their final task: the students have completed a number of quest chains, participated in game design using *GameMaker: Studio*, and been afforded the freedom to work on a personalized project most meaningful to them. With this final project, the sky is the limit. Joe intentionally has the students work together on the final project because it mimics the productivity typesets commonplace in the videogame design industry. Just as individual videogame designers on a team in the real world focus on the work they are best at, here Joe's students have the opportunity to fill roles that are most comfortable for them: those with artistic talent may be most interested in designing backgrounds that can

be uploaded to the game; musicians can design a soundtrack for the project; students with a natural aptitude for coding can work on combining all aspects of the game that others have contributed in order to bring the piece to life.

Ultimately, Joe's perspective on teaching is that the more power the students have over their own learning, the better the(ir) learning experience. The students enjoy having a stake in their educational opportunities, although they are hesitant to take charge of their learning paths at first; students are simply not used to having the amount of freedom that Joe gives them. This approach to knowledge construction grows on them, however – they adapt to the student-as-researcher/designer mindset with trepidation at first, but within days they seamlessly ease into the flow of the classroom's quest-based format.

The idea of allowing students to direct their own learning is not a new one (Cornelius-White, 2007; McCombs & Whisler, 1997), as the notion of students being "authors of their own understanding and assessors of their own learning" is essentially the central tenant of constructivist pedagogy (p. 746, Cook-Sather, 2002). This is particularly the case within the fields of problem-based, inquiry-based, project-based, and game-based learning. However, a majority of teachers continue to reject this form of instruction time and time again (Cuban, 1982, 1983; Windschitl, 2002). This is due in part to the overwhelming demands placed on educators to conduct themselves based on standards that place a target on their backs if their students fail to perform adequately on mandated national and state tests, such as those in alignment with the Common Core State Standards (in New Jersey, these would be the PARCC assessments). Joe is lucky in this regard, given that his course is an elective and thus not subject to testing standards as is the case with other educators in his district. Further, the students that attend Joe's

school are well off socioeconomically, which directly contributes to their educational performance (White, 1982).

In some cases, counter to Joe's teaching philosophy, educators (regardless of grade level) are uncomfortable with the idea of having their students take control of their own learning, simply because they wish to be the omnipotent receptacle of knowledge in their classrooms. As opposed to taking a teacher-as-facilitator stance towards pedagogy, some teachers prefer to be the gatekeepers of knowledge, telling the students what to do, how to do it, and when to do it, as opposed to relinquishing control in order to let the students take the reins and approach their own learning as they see fit (Cicchelli, 1983; Friere, 1970; Hancock, Bray & Nason, 2003). This teacher-centric approach to instruction is directly tied to the instructor's beliefs (Windschitl & Sahl, 2002). Conversely, if a teacher believes that the implementation of high-level-ordered technology-based skills and student-centered pedagogy are useful strategies for obtaining student outcomes, then they are more likely to engage in these practices. These beliefs are often tied to their experiences; teachers who have tried new things in their classroom and seen positive results are more likely to continue making changes in the hopes of sustaining student success rates (Ertmer, 2005).

Unfortunately, teachers' philosophies do not always solely govern their behaviors, as Ertmer (2005) asserts:

> Ertmer et al. (2001) reported that teachers' visions for, or beliefs about, classroom technology use did not always match their classroom practices. Despite the fact that most of the teachers described themselves as having constructivist

> philosophies, they implemented technology in ways that might best be described as representing a mixed approach, at times engaging their students in authentic, project-based work, but at other times asking them to complete tutorials, practice skills, and learn isolated facts. Teachers' explanations for these inconsistencies often included references to contextual constraints, such as curricular requirements or social pressure exerted by parents, peers, or administrators (p. 29).

My pre-dissertation study fieldwork bore out the findings of Ertmer and colleagues (2001); I found that there are still many educators in the K-12 sector who believe that videogames are purely recreational and do not add any tangible educational benefits to their classrooms. Others see gaming as a reward for good behavior, a form of positive reinforcement for the completion of traditional classwork, but not in itself a tool for learning. While I understand that teachers hesitate to incorporate videogames into their pedagogy because of their unfamiliarity with the technology or lack of access to necessary equipment, it is nevertheless important that they consider the bigger picture, and in particular what their students will need in order to succeed beyond the high school (and college) setting. Students who are being skilled and drilled in preparation for standardized tests, for example, may fail to develop the critical thinking skills needed to compose an essay that goes beyond the traditional five-paragraph formula. The P-21 framework was developed in part to address these concerns, given that the future of our global economy lies at the intersection of technology and innovation. A student cannot learn to be innovative without being permitted to explore his or his passions and creative outlets; game-based learning provides invaluable opportunities for such exploration.

Joe is a model of this approach to learning, and he is able to engage his students in *authentic*, purposeful constructivist learning activities through the process of videogame development and design, thanks in large part to his school's administration (including a very supportive principal, Parent-Teacher Organization, and district Board of Education). Again, the fact that his course is an elective also permits him to create his own curriculum for the course; he is not confined by the restraints associated with national or state testing standards.

Recommendations as a Result of This Study

Joe's approach to planning his curriculum and scaffolding his students' learning is one that would benefit any classroom environment, regardless of the content being presented or the affluence of the district. As student-centered pedagogy becomes more accepted in K-12 educational settings, our nation's youth will reap the benefits of expanding their 21st century skills through more agentive approaches to their learning. When students feel that they are able to make decisions and have an impact on the way the classroom functions, they feel empowered, and in turn, may become more engaged in the learning process (Warschauer, Turbee, & Roberts, 1996). Although Joe's students are of high socio-economic status and consequently have many advantages over less well-off school districts, the importance of encouraging students to have a stake in their own learning should not be overlooked in any classroom. Likewise, even though Joe's students have elected to enroll in his course and thus already have an innate desire to learn the material he is presenting, even teachers who are instructing students in required courses or in different socio-economic environments can benefit from implementing some of Joe's strategies for planning and scaffolding learning.

It is important to emphasize again at this point that Joe enjoys many advantages when it comes to teaching game design – in particular, his district is affluent and his course is an elective. Educators in situations very different from Joe's, whether they teach non-elective, core subject areas or in disadvantaged schools, may not be afforded the same opportunities as Joe, and so some aspects of this study are inevitably difficult to apply to their circumstances. Despite these inherent limitations, however, such educators can still learn from Joe's example. Joe initially began his foray into videogame design and development elective courses through the development of an afterschool gaming club. As the club became more popular, Joe considered the possibility of including videogames in the computer courses he taught during the school day. With support from his administration, he was able to revamp the traditional computer courses he had previously taught to include game design and game-based learning applications for the students to work on. This evolution, from computer class to game design elective, took some time and effort on his part, but was well worth it to Joe in the long run.

Although he works in a wealthy school district, the tiered approach Joe took to incorporating game design in his middle school elective courses is not all that different from findings reported within the research *regardless of* the district's socio-economic status (SES). My review of the literature on the topic of games-based learning in relation to urban, low SES communities found that students enrolled in these school districts were often able to find exposure to GBL opportunities through afterschool clubs. Mitch Resnick describes the environment of the Computer Clubhouse in his most recent work, *Lifelong Kindergarten* (2017), where students in disadvantaged communities are afforded the ability to access technologies that may not otherwise be available to them in their

school districts. There are over 100 Computer Clubhouses throughout the world. Resnick's clubhouses are not the only club environments for impoverished students to attend. Kurt Squire's (2003) dissertation discussed his study of using the history-based commercial-off-the-shelf videogame titled *Civilization III* in three separate contexts, including an afterschool club, a classroom at a charter school "designed to help inner-city and at-risk students learn academic skills through creative expression with media and technology" (p. 144), and a week-long camp consisting of a sub-set of students who were previously working on the *Civ III* unit at the charter school. For those teachers interested in implementing GBL concepts into their classroom settings, a unit guided by lesson plans developed by teachers who have previously made the attempt can be an extremely useful tool for getting started (c.f. Baek, 2017; Beavis, Dezuanni, & O'Mara, 2017; Becker, 2017; Caldwell, Osterweil, Urbano, Tan, & Eberhardt, 2017; Hébert, & Jenson, 2017; Kellinger, 2017).

Affording students opportunities to participate in game-based learning and educational technologies through afterschool clubs either created within their own school districts (as Joe did) or modeled on preexisting clubs in other districts is yet another way to expose students to the type of experiential learning that contributes to their long-term 21st century skill development.

Joe's planning, however much it may be informed by his years of experience, is characterized by a key quality that any teacher can adopt: flexibility. An educator will inevitably encounter the unexpected in his or her classroom, whether in terms of interruptions, negative student feedback, or absence of resources. Like Joe, educators would do well to take these challenges in stride and adjust their plans accordingly,

without disruption to the overall flow of their teaching. Of course flexibility in planning need not be restricted to adapting one's lesson plans to various circumstances, but can also be exercised in how the students learn. As this study has shown, educators can reap tangible benefits from encouraging their students to take the reins of their own learning – to make their own decisions about how they will spend their time learning. In Joe's case, this agency is exemplified through quest-based learning. Other educators might take similar approaches through the use of quest-based learning platforms like 3DGameLab, by gamifying their classroom activities (see Farber, 2017; Kapp, 2012; and Sheldon, 2011), or applying game-based principles to their pedagogy (see Boller & Kapp, 2017; Sansing, in press). The videogame design content Joe teaches does not preclude others from using these pedagogical approaches in their own content area specializations.

Of the ways in which Joe scaffolds student learning, his encouragement of collaboration emerges as an especially valuable practice, one that all educators would do well to imitate. While the children in Joe's classroom start out learning agency through quest-completion, he integrates collaborative learning practices over time, encouraging the students to ask questions of one another before raising their hands to ask him about how to complete tasks. Collaboration is further emphasized through the *Gamemaker: Studio* unit where students need to engage with the iterative design process, having their peers playtest their games and provide feedback to one another about how best to improve on their designs. Having the semester conclude with a group project further hones and develops the students' collaborative skillsets, while simultaneously preparing them for real-world occupational situations in which they will be required to work in teams to complete work assignments. Again, regardless of the content being presented in

the classroom, developing these skillsets is useful in any educational environment. Students need to be prepared for a digitally-driven, globally interconnected workplace upon graduation from their respective high schools, colleges, and universities.

Of course, collaboration is just one of the 21st century skills that Joe promotes in his classroom; problem-solving, critical thinking, creativity, educational technology use, and effective communication skills are all central to students' successful productivity in and out of the school setting, particularly once they graduate and apply for jobs. To provide just one example, many members of the LinkedIn communities to which I belong complain of the lack of creativity and critical thinking skills they encounter in those applying for positions at their companies. According to their potential employers, these applicants are more apt to respond with the answer they think the interviewer is looking for than with their own interpretation of the question they have been asked. This is due in part to the 'programming' that the applicants underwent as students: they were trained to regurgitate information as it was delivered to them. Any K-12 teacher can and should instead 'program' their students to embrace 21st century skills and in so doing prepare for a successful future.

Of particular importance in the context of this study, however, is the way in which Joe incorporated these skills within his classroom setting. The use of gamification and game-based learning practices afforded his students choice (even if it was only the *appearance* of choice, as Joe ultimately created and/or modified these quest lines built by other educators). This perceived notion of agency among his students directly (in many cases) impacted their desire and willingness to engage with the material. Joe often reported that his students were completing hours of "homework" associated with his

Video Game Design and Development course, when in fact, the students were "assigning" themselves with the work – often going above and beyond the requirements of the course. How many teachers can report their students opting *in* to work outside of class time?

Joe recognizes the importance of students' educational technology tool use, and requires the creation of blog posts (for promoting reflective practices by having students review their work in consideration of *why* they made the choices they did), YouTube videocasts (to demonstrate their ability not only to create and upload videos, but also to share their work with the public in order to garner feedback on their creations from an audience beyond their classrooms) and Twitter profiles/handles (to take part in larger educational conversations among students, teachers, and educational technology professionals). Joe instills these habits in his students in the hopes that they will continue to explore their creative passions outside of class (which does often happen, according to Joe's conversations with me). At the very least, the students will have authentic exposure to the educational technological world at large, and will be able to contribute to it in an effective way thanks to Joe's pedagogical practices. Educators would do well to take a page out of Joe's playbook by encouraging their students to engage in the use of educational technology tools within their classroom settings.

Limitations of the Study

Methodological Limitations

This study was completed as a qualitative case study analysis of one middle school videogame design teacher. Although case studies can be completed on an

individual basis while still contributing to the research in the field, the limited sample size of this particular research query must be acknowledged as a methodological limitation. This study could have benefited from having additional videogame design teachers at the middle school level (or any educators teaching this content at the K-12 level) for cross-case analysis purposes. Further, additional visits to the participant's classroom (particularly in 2014-15) or shadowing him (both in and out of school) could have provided additional insights into the evolution (or further routinzation) of his pedagogical planning and scaffolding practices.

There also exists a large body of additional evidence from which this study could have benefited, namely Joe's social media activity and in particular the more than 70,000 Twitter posts he has made since 2010. Many of these posts shed light on his pedagogical practices, but I consciously chose to exclude this large body of data (which could serve as the basis for a project by itself) in order to keep a manageable data set for the purposes of this study. As I will discuss below, future research would do well to examine social media as a means of understanding an expert educator's planning and pedagogy.

In addition, I had some difficulty with obtaining data relevant to Joe's planning practices. Lesson plans are traditionally part of a teacher's routine, particularly at the K-12 level. In the case of my research study participant, Joe was not required to submit formal lesson plan documentation to his administrative colleagues. Joe's course is an elective, which allows him more freedom for planning than his peers who teach core content area subjects that students are required to take. This lack of artifactual data could be seen as a limitation as well. I attempted to compensate for this absence by relying heavily on the closest thing to lesson plans Joe does produce, namely quests and quest

chains on 3DGameLab, and gleaning whatever indirect planning evidence I could from his interviews and blog posts.

Limitations of the Researcher

As previously discussed in the introduction to this dissertation, the impetus for completing this project stems from my desire to study educators like myself who consider themselves to be gamers and attempt to incorporate this personal interest into their professional practice. Further, I have gotten to know Joe on a friendly level over the years spent researching this study (and still to this very day in April of 2018), which introduces an implicit bias to my interpretation of the research that I have conducted on his pedagogical practices. Although it is necessary for me to acknowledge the possibility that my favorable perceptions of Joe's teaching may have subsequently impacted my analysis of the data, I mitigated this likelihood by engaging in proper validation and reliability measures as described in the methodology chapter of this document. Further, in hopes of counterbalancing any unconscious bias on my part, I made a conscious effort to address views contrary to my own (such as the negative effects of videogames on learning) throughout my literature review and findings.

Recommendations for Future Research

This study has shed light on the planning and scaffolding practices of one expert educator teaching video game design and development in a suburb of Northeast New Jersey. Results from this study demonstrate that the use of teacher-led scaffolding (via a combination of Joe's expertise in the field of using videogames for learning which in turn influenced his planning activity associated with his classroom practice) in combination

with computer-based scaffolding (through Joe's use of a quest-based learning platform that provided the students 24/7 Internet access to their course work) afford students the greatest opportunity for deeper 21st century skill based learning. Although the literature indicates that there are not many educators at the K-12 level teaching Joe's content during the traditional school day, educators who are engaged in gamification and game-based learning practices do exist. This is a call for future research focusing on the affordances of including videogame design, gamification, and game-based learning practices in the classroom, particularly at the K-12 level. I emphasize the importance of studying middle and high school grades specifically, because a large amount of the literature in this field reflects studies conducted on students at the university level. While there is a body of research dedicated to the study of games and learning at the K-12 level, much of the data analyzes after-school clubs and organizations that conduct activities outside of a classroom setting.

On a smaller scale, there is a need for additional case studies of teacher-gamers like Joe who engage in gameplay outside of their classrooms in addition to gamifying their curriculum through the use of game-based learning and teaching strategies. What more can we learn from educators like Joe who identify as gamers? What, if anything, can we glean from their personal gameplay habits and interactions with other likeminded teachers? Studies of teacher-gamers' connectivity via social media platforms like Twitter, Facebook, YouTube vlogs, and personal weblogs can further expand the research landscape about the areas where teaching and gaming practices (in and out of the classroom) intersect. There is a wealth of educational and scholarly terrain yet to be explored in the field of videogames and learning.

The general dearth of research on classrooms like Joe's is due in part to the current conditions of the educational environment; in other words, classrooms like Joe's are few and far between. Having a media lab with enough functioning computers for students to use during the school day can be an expense some schools cannot afford. Moreover, the emphasis on standardized testing presents obstacles for teachers wishing to include games and gaming in their curriculum.

In sum, additional studies focusing on the benefits of videogame design and development, game-based learning, and gamification of traditional content areas would further the field of educational technology scholarship as a whole.

Conclusion

This study contributes to the ever-expanding field of videogame use in educational settings. Teachers often cite time limits, inadequate preparation, lack of experience, and not knowing how to start as the reasons why they are hesitant to bring educational technologies into their classrooms (Ertmer, 1999; Hew & Brush, 2007). Videogames and programs for gamifying or designing games are just another subset of these tools for learning. By reviewing and attempting to emulate Joe's approaches to both planning and scaffolding teaching with these technologies, teachers (particularly at the K-12 level) can gain access to valuable resources for the development of 21st century skills in their classrooms.

This dissertation asserts that all teachers, regardless of content area, can benefit from the use of Joe's planning and scaffolding practices in their classroom settings. Further, game-based learning and game design principles can be layered over teachers'

current curriculum plans to further students' 21st century skill development, while simultaneously providing a source of engagement for students who consider themselves gamers or derive motivation from external rewards provided through the use of gamification practices.

Ultimately, today's young learners will be best served by those teachers who effectively embrace educational technology tools in their classrooms through the use of student-created blogs, videos and screencasts, Twitter chats, website creation, coding activities, app development, and similar practices. Well-thought-out lessons incorporating a combination of teacher-/peer-based and computer-mediated support structures can enhance students' knowledge construction, contributing to their deeper understanding of the material being presented to them.

Further research within K-12 classrooms that make use of gamified learning environments, particularly those that encourage students to use educational technology tools and social media platforms to disseminate their classwork, would be beneficial to the teaching and educational research community at large. By studying classrooms similar to Joe's, we can get a clearer sense of "what works" in an educational-technology-enhanced learning environment, and in so doing we can better prepare today's learners for tomorrow's workplaces.

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Appendix A
Teachers Personal Video Game Use Survey

This survey was designed for teachers who consider playing video games to be a personal interest outside the classroom setting. If you play video games in your spare time, as a hobby, etc., please feel free to continue taking this survey. If you do not play video games or know little about video game play, you may have difficulty completing this survey, and may prefer not to complete it. Thank you.

What is your gender?

- ❍ Male
- ❍ Female

What year were you born?

- ❍ (Options given were 1920-2000)

What is the highest level of education you have completed?

- ❍ Less than High School
- ❍ High School / GED
- ❍ Some College
- ❍ 2-year College Degree
- ❍ 4-year College Degree
- ❍ Masters Degree
- ❍ Doctoral Degree
- ❍ Professional Degree (JD, MD)

Employment Status (Mark all that apply) Are you currently...

- ❑ Employed for wages
- ❑ Self-employed
- ❑ Out of work and looking for work
- ❑ Out of work but not currently looking for work
- ❑ A homemaker
- ❑ A student
- ❑ Retired
- ❑ Unable to work

Do you work...

- ❍ Part-time
- ❍ Full-time

If you're currently teaching, do you work for a...

- ❍ Public institution
- ❍ Private institution

Grade level you currently teach (Mark all that apply)

- ❑ Elementary
- ❑ Middle
- ❑ High School
- ❑ Undergraduate
- ❑ Graduate

What is your race?

- ❍ White/Caucasian
- ❍ African American
- ❍ Hispanic
- ❍ Asian
- ❍ Native American
- ❍ Pacific Islander
- ❍ Other

How long have you played games? (When did you start playing?)

What consoles do you own?

Number of hours spent playing online and console games per week:

- ❍ Less than 1
- ❍ 1-2
- ❍ 3-4
- ❍ 5-10
- ❍ 11-15
- ❍ 15+

Hours spent on non-online (console) video games:

- ❍ Less than 1
- ❍ 1-2
- ❍ 3-4
- ❍ 5-10
- ❍ 11-15
- ❍ 15+

Hours spent on online games (WoW, Everquest, etc.)

- ❍ Less than 1
- ❍ 1-2
- ❍ 3-4
- ❍ 5-10
- ❍ 11-15
- ❍ 15+

How many games do you play at a time?

- ❍ 1
- ❍ 2-3
- ❍ 4-5
- ❍ 5+

When you like a game, are you:

- ❍ Very likely to replay it
- ❍ Likely to replay it
- ❍ Unlikely to replay it

If you are likely/very likely to replay the game, do you:

- ❍ Play as the same character
- ❍ Play as a different character
- ❍ Take turns playing different characters

How do you define the term "gamer"?

How do you define yourself as a gamer?

- ❍ I'm a serious (hardcore) gamer.
- ❍ I'm not really a gamer.
- ❍ I think I'm somewhat of a gamer.

What sorts of genres do you like when playing video games?

- ❑ Action
- ❑ Shooter
- ❑ Action-Adventure
- ❑ Adventure
- ❑ Role Playing
- ❑ Strategy
- ❑ Life Simulation
- ❑ Vehicle Simulation
- ❑ Other _____

Select your favorite video game playing genre (from above). Why is it your favorite?

Do you play any games that require avatars?

- ❍ Yes
- ❍ No

If you do play games requiring an avatar, what is your avatar name? (If it changes depending upon the game you are playing, please explain.)

Do you usually play as a female or male character? Please explain why.

What do you think about the stereotype that gaming is a predominantly male activity?

- ❍ It doesn't bother me.
- ❍ It somewhat bothers me.
- ❍ It completely bothers me.
- ❍ I didn't even know this was a stereotype of gaming.
- ❍ Other _____

What age group do you think games are marketed toward?

- ❍ 10-18
- ❍ 19-25
- ❍ 26-36
- ❍ 37+

What gender do you think games are marketed toward?

- ❍ Male
- ❍ Female

How did you get into playing games?

- ❑ Parent
- ❑ Sibling
- ❑ Significant other
- ❑ Other _____

Why do you play video games?

Do you have any subscriptions to game magazines?

- ❍ Yes
- ❍ No

Do you have a subscription to a gamer service (Ex: Gamefly)?

- ❍ Yes
- ❍ No

Do you belong to any online forums?

- ❍ Yes
- ❍ No

Which forums do you belong to?

How often do you participate in these forums?

- ❍ Never
- ❍ Less than Once a Month
- ❍ Once a Month
- ❍ 2-3 Times a Month
- ❍ Once a Week
- ❍ 2-3 Times a Week
- ❍ Daily

Do you often search for information online while playing games (cheats, glitches, etc.)?

- ❍ Yes
- ❍ No

Do you use game guides when you play? (Complete guide to Skyrim for example)

- ❍ Yes
- ❍ No
- ❍ Depends (Please explain) _____

Do you seek/listen to others' suggestions about what to play?

❍ Sometimes

❍ Often

❍ Never

How often do you play games with:

	Sometimes	Often	Never
Your friends	❍	❍	❍
Your family	❍	❍	❍
Online players who are not your friends	❍	❍	❍

How would you describe video games (Check all that apply):

❑ Fun

❑ Good for you

❑ Bad for you

❑ Addicting

❑ Entertainment

❑ Waste of time

❑ They're okay

How much money do you think you spend on video games in total per year?

_____ Games

_____ Consoles

_____ Guidebooks, subscriptions, etc.

If you would be willing to participate in a phone interview, please complete the information below. I will contact you via email to schedule a time that is convenient for you.

Name

Address

Address 2

City

State

Zip Code

Country

Email Address

Appendix B
Gaming Protocol (Selfe & Hawisher, 2007)

This protocol was taken from Gaming Lives in the Twenty-First Century (Selfe and Hawisher, 2007). Please complete this inventory to the best of your ability, with the most thorough answers possible. Your answers will be discussed in an interview following your completion of this survey.

Name:

Occupation:

Nationality:

Race:

Ethnic heritage:

Real-world gender/orientation (e.g. heterosexual, gay, lesbian, bisexual, transgendered, other--only if you are comfortable answering):

Gaming gender/orientation (e.g. the gender you use in gaming situations):

Religion/denomination (only if you are comfortable answering):

Immediate family members and ages (Please list individuals and ages):

Income level (e.g., working class, middle class, upper middle class, something else):
Growing up?
Now?

Parents'/guardians' educations and professions:

Place and date of your birth:

Where do you live? (Please list each place where you have lived and the dates you lived there.):

Schooling history (Please list each school you have gone to and the dates you attended--or at least every school you can remember)

Elementary Secondary College Other

What was your first introduction to computers and gaming?

What kinds of computer/video games does your family play? Other kinds of games?

Briefly describe your family's attitude toward playing electronic games.

Can you tell us about the computer games you have played at different ages?

What games have you liked best and why?

What literacy skills and understanding did these games demand?

Can you tell us about how you learned to approach or solve gaming problems? To react to gaming situations?

Can you tell us about how you learned to respond to other gamers? To develop or interact with other characters in games?

Have computer games taught you anything about "writing" and "composing"? (Think of "writing" character descriptions, profiles, MOO/MUD descriptions. Think of "composing" rooms, characters, images, scenarios.) If so, please explain.

Have games taught you anything about learning new technologies or environments? If so, please explain.

Can you tell us how you learned to access gaming rules? Have these rules taught you anything about problem solving? If so, please explain.

Has gaming taught you anything about how to compete or collaborate with other people? If so, please explain.

Can you tell us stories about the people who you played games with at various times of your life (provide dates) and why you played with them?

Have you encountered a "grammar" of gaming? A set of shared conventions that structure most games that allow you to "read" them efficiently, even when they are new to you? What are the rules of this grammar?

Did gaming help you develop any other kids of skills and understandings? If so, please explain.

Can you think of anything that computer gaming has helped you understand? Learn? If so, please explain.

What computer games do you have at home? Who owns them? Who bought them? Where do you keep them?

Does your family have any rules about gaming? Games?

What kinds of educational games do you play in school and at home?

What did your friends think about computer gaming at school? About your participation? Do you have any stories you can tell us that would illustrate what your friends think about computer use or attention to computer gaming at school?

What did your teachers/the school think about computers and computer gaming? Do you have any stories you can tell us that would illustrate what the educational system thinks about computers or attention to computer gaming?

Are there any rules that your school has about educational gaming? About playing other kinds of computer games in school?

Do these games or the playing of these games reveal or demonstrate any differences having to do with gender? What can they teach us, if anything, about gender, computers, and gaming?

How/when/where/why do you see yourself gaming in the future?

Anything more you would like to say about gaming and computers?

Appendix C
Interview Protocol

Personal Experiences Influencing Teaching

What are some of the programs you've used recently with your students?

What made you select these programs for videogame design as opposed to others?

Have you used these programs yourself to learn how to use them/teach with them in advance of introducing them to the students?

Do you only introduce programs that you've worked with thoroughly in advance for students to use, or is it a trial-and-error type of thing?

What is the most valuable professional development experience you've had that influenced the programming you bring into your classroom? Why do you see it is being the most valuable?

Perceptions of Student Experiences with Videogame Design

How have the students reacted to using X program?

How did you introduce X program to the students?

How did X program compare with other programs you've used in the past?

What do you do differently to introduce a new program that you haven't yet taught with?

How do you facilitate student learning when they're having trouble with the program you're using?

Specific Examples of Student Experiences with Videogame Design

Describe a scenario you've encountered where a student was having issues using a particular program. How did you assist this student?

Describe a scenario you've encountered where you felt the students were at peak "flow" and fully engaged in their game design efforts. (Flow is the concept where someone is so thoroughly engrossed in the activity they're completing that nothing else can distract them from their being on-task. Joe will know what this term means in relation to videogame play.)

Scaffolding Student Videogame Design Experiences

What strategies do you introduce to the students to get them to support each other's learning?

What skills do you feel your students are learning as a result of participating in your classes?

Advice for Prospective Teachers Interested in Videogame Design Instruction

What advice would you give a teacher new to videogame design instruction? What would be your first recommendation for them just getting started with teaching videogame design?

What advice would you give to teachers who want to implement videogame design into the curriculum but are being met with resistance by administrators, other teachers, and/or parents in their district?

Parental Concerns

What would you say to a parent who think videogames are a waste of time? How would you encourage a parent who was hesitant to allow their child to take your class?

Appendix D

Code Book (Selected Excerpts)

The research is designed to answer the following questions:

1) How does an experienced middle school teacher who teaches videogame design scaffold student learning of game design principles and concepts?

1A) How does the teacher plan his instruction to support a video game design 8th grade course?

1B) Why does he make the choices that he makes when planning?

1C) How does the teacher scaffold student learning through this instruction?

P-21 Framework Codes

Code	Definition	Example
21st Century Skills ● Collaboration and teamwork ● Creativity and imagination ● Critical thinking ● Problem solving ● Information, Media and Technology Skills ● Flexibility and Adaptability ● Initiative and Self-Direction ● Social and Cross-Cultural Skills ● Productivity and Accountability ● Leadership and Responsibility	Definition in research: "More than technological expertise, 21st century skills refer to content knowledge, literacies and proficiencies that prepare individuals to meet the challenges and opportunities of today's world" Kamehameha Schools report, An Overview of 21st Century Skills. In this study (1B): - Joe's planning - Joe's pedagogy - When Joe un/intentionally cultivates these skills in his students	(INTERVIEW TRANSCRIPT) Me: So, what skills do you feel your students are learning as a result of participating in your class Joe: Okay, well the **iterative design process** is huge. Um, and learning in that I don't think they're so accustomed to being really ingrained in that process so there's a whole lot of kids thinking they're just gonna set out and build a game and then all the sudden realize how much they have to go back and iterate on their game and get feedback that was unexpected to them and have to build that in and stuff – so that process – it's a **design thinking** – iterative design thing is like huge.

		Collaboration is huge in the design teams that they work in – um, and again it's, ya know – So again, I participated in the Game Jam this weekend and that was a great opportunity for me to put myself in the shoes of a typical student in my class in a sense, and just being part of that – a design team – and just seeing what that's like – trying to communicate with the artist and saying "Well we need this for the game" and I keep working on one aspect and then I wait and bring it over to the game – the same thing happened with the sound – so I think there's a lot of that – and definitely **computational thinking** – um, ya know, they're learning how to learn by **being empowered** in the learning process, uh, which is a really valuable skill, um, ya know, we don't need to memorize things but we need to know **how to find information and learn on our own or on demand**, so I think my kids are getting all of those kind of skills… um, and then ya have, ya know, on the outskirts you have kids that take a slightly different path and are **choosing to learn** art and become the graphic person and they're learning art and animation, or like the sound engineer type thing or learning

		literacy in terms of writing and storyline and narrative and descriptions for games and things like that – so a lot of **both hard and soft skills**…

In vivo codes

Code	Definition	Example
Assessment	In this study (1C): - How Joe's assessments (e.g. student blog posts, final projects, completed quest logs) reflect scaffolding of game design concepts	(OBSERVATION) - Joe has his students complete quests about what games are and how they've evolved to give them a baseline of understanding for creating their own games
Assistance	In this study (1C): - How Joe helps students in the classroom - How Joe encourages the students to help each other - Situations where students do NOT require assistance	(INTERVIEW) "I mean the fact that they're just so engaged and actually not necessarily coming up for air or needing **assistance** because they're just plugging forward and ya know, accomplishing big chunks of what they're trying to do AND seeing them struggle with certain things and then coming out the other side..."
Autonomy	Definition in research: the ability to take charge of one's learning (Holec, 1981) In this study (1C): - The situations where Joe gives his students the freedom to choose how they approach the material (via quest lines)	(OBSERVATION) Joe explained that all students began with the same set of quest lines to learn about the development of games, but that depending upon what areas of concentration they selected, quest lines diverged/branched

		out into different activities. Not all students would complete the same exact quests/take the same path to learning over the course of the semester.
Cooperative Learning	Definition in research: ”Cooperative learning is a successful teaching strategy in which small teams, each with students of different levels of ability, use a variety of learning activities to improve their understanding of a subject. Each member of a team is responsible not only for learning what is taught but also for helping teammates learn, thus creating an atmosphere of achievement” (OERI, 1992) In this study (1C): - When Joe’s students work together in small groups or pairs - When Joe discusses the advantages of having students work together	(OBSERVATION) After completing a mini lesson reviewing what the main components of games are, Joe had the students break into groups (of their choosing) to create their own games using a platform of their choice (most students were using Minecraft).
Crowd Sourcing	Definition in research: “Simply defined, crowdsourcing represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people	(OBSERVATION) Joe had students use the platform “Declara” to engage in crowdsourcing information on the topic of virtual reality.

	in the form of an open call. This can take the form of peer-production (when the job is performed collaboratively), but is also often undertaken by sole individuals. The crucial prerequisite is the use of the open call format and the large network of potential laborers" (Howe, 2006) In this study (1A): - When Joe engages his students in online crowdsourcing platforms in order to promote the sharing of information	
~~Empowerment~~ (see autonomy, self-directed learning, motivation)		
Engagement	In this study (1B): - When Joe makes specific planning decisions designed to capture and retain the interest of his students	(INTERVIEW) "I think it's [working with Minecraft in the classroom] an experience feeling like it's something of real meaning and value to them"
~~Guidance~~ (See Assistance)		
Immersion	Definition in research:	(OBSERVATION)

	"[V]ideo game playing actually provide adolescents with a vehicle for fantasy that can help promote growth (Kestenbaum & Weinstein, 1985). In fact, the immersion effect produced while playing video games promotes attention and concentration, processes extremely relevant for learning (Egli & Meyers, 1984)" (Rosas, et al., 2003) In this study (1B): - When Joe's pedagogy (especially VR) deeply immerses his students in material which may or may not be relevant to the specific content he is teaching (e.g. Immersing students in creating a game OR immersing them in playing an actual game)	Students had the opportunity to test drive a new VR platform called the HTC VIVE at the start of the semester (literal immersion in a virtual reality world)
Iterative Design	Definition in research: "Iterative design is a design methodology based on a cyclic process of prototyping, testing, analyzing, and refining a work in progress. In iterative design, interaction with the designed system is used as a form of research for informing and evolving a project, as successive versions, or iterations of a design are implemented" (Zimmerman, 2003).	(INTERVIEW) Me: So, what skills do you feel your students are learning as a result of participating in your class? Joe: Okay, well the **iterative design process** is huge. Um, and learning in that I don't think they're so accustomed to being really ingrained in that process so there's a whole lot of kids thinking they're just gonna set out and build a game and then all the sudden realize how much they have to go

	In this study (1A/1B/1C): - (1A) Joe's lesson planning/curriculum building is in itself a form of iterative design -- he will typically use the same unit structure each semester, with many of the same quest lines, but he will change up the material depending upon his students' reactions - (1B) Joe changes his curriculum based on student feedback -- he keeps what works and redesigns the curriculum as necessary (e.g. Quest lines change) - (1C) - Joe emphasizes the importance of having students design, test the design, and revamp their designs based on feedback loops	back and iterate on their game and get feedback that was unexpected to them and have to build that in and stuff – so that process – **it's design thinking – iterative design** thing is like huge...
Motivation	Definition in research: "Motivated students display interest in activities, feel self-efficacious, expend effort to succeed, persist at tasks, and typically use effective task, cognitive, and self-regulatory strategies to learn. Motivated teachers feel that they can help students learn, put extra time into instructional planning, and work with students to help ensure their learning and mastery of knowledge and	(INTERVIEW) "At the time I know we were trying to do some things with Project SPARK and XNA Studio because the kids could develop things on the computer with Visual C Sharp and then see it on the X-Box which I thought was extremely motivating…"

	skills. When motivation declines, other educational outcomes also suffer. Teachers must not only impart knowledge and teach skills, but also establish a motivating environment for learning" (Pintrich & Schunk, 2002). In this study (1B): - When Joe expresses explicit intent to motivate his students - When students show evidence of motivation in Joe's classroom and for his assignments	
~~Pedagogy~~ (too broad)		
Professional Development	Definition in research: "Professional development shall be comprised of professional learning opportunities aligned with student learning and educator development needs and school, school district, and/or state improvement goals" (NJDOE, 2014). In this study (1A): - When Joe enriches his planning process by participating in and/or running	(INTERVIEW) "when I took the… teacher camp for 3D Game Lab I learned about their quest-based system and that's what kinda taught me about that approach so I guess that was incredibly valuable to learn."

	professional development activities	
Research	In this study (1A): When Joe acquires unique pedagogical opportunities by making himself and his classroom available for outside research studies	(INTERVIEW) "Then through Foundry10 we did some research together on game design in the classroom which is fairly non-traditional and we did some presentations on that and then when she started the VR research again it was a great fit for my kids in terms of ya know, creating content, and things for VR and, so, ya know, exposing them to what's possible and so in that study..."
Self-directed Learning	Definition in research: "In essence, SDL is seen as any study form in which individuals have primary responsibility for planning, implementing, and even evaluating the effort. Most people, when asked, will proclaim a preference for assuming such responsibility whenever possible" (Hiemstra, 1994). In this study (1A): - When Joe plans to relinquish control of the learning process to his students	(INTERVIEW) "[T]here are times where I might direct instruction a little and then – but a lot of times where kids would be working on very different things because of the structure of the **self-based quest approach**, and, ya know as long as they can figure out what quests they're supposed to be working on – ya know if they have questions – to get them past any part I can support them in that, but so it's very different um ya know – really went from more of a linear approach to a, ya know, non-linear approach."
Technological Tools	In this study (1A): - Occasions on which Joe	(INTERVIEW)

	plans to use and effectively implements in his pedagogy various technological resources (beyond 3D Game Lab, GameMaker, and Virtual Reality, which are coded separately) which facilitate student learning	"I'm gonna have them do something or at least make optional some activities involving uh, ya know, blogging about their experiences…maybe some of them will get interested in the different technologies so they'll do a little research and blog on that and that sort of thing so they'll all be involved at least on that level, and then some of them, the real goal is that they'll find ways to develop content, that-FOR VR, which is a real interesting challenge..."
Virtual Reality - HTC VIVE - Oculus Rift - Other VR	Definition in research: "[V]irtual reality entails presenting our senses with a computer generated virtual environment that we can explore in some fashion" (www.vrs.org.uk) In this study (1A): - Joe plans for and executes the use of various virtual reality activities (e.g. VIVE, Oculus Rift) in his classroom	(INTERVIEW) "There's a new, the people who made Second Life, created something called Hi-Fidelity which is ... a VR place like Second Life but um, you could build your own space in there – I would LOVE for kids to be involved in that but these are all things we kinda need to get over a little bit of a learning curve or hump, that kinda thing, but yeah, for me it's all about what they can now create – so create and explore with virtual reality"

TPACK Codes (Examples not provided here due to significant overlap – see Venn Diagram on pg. 72 of this document for more info)

Code	Definition	Example

Content Knowledge (CK)	Definition in research: "[T]eachers' knowledge about the subject matter to be learned or taught" (Koehler & Mishra, 2009) In this study (1A): When Joe demonstrates knowledge about the principles and theories of game design.	
Pedagogical Knowledge (PK)	Definition in research: "[T]eachers' deep knowledge about the processes and practices or methods of teaching and learning. They encompass, among other things, overall educational purposes, values, and aims. This generic form of knowledge applies to understanding how students learn, general classroom management skills, lesson planning, and student assessment" (Koehler & Mishra, 2009). In this study (1B): When Joe demonstrates knowledge about the principles and theories of teaching, and an understanding of how students learn.	
Technology Knowledge (TK)	Definition in research: When teachers "understand information technology broadly enough to apply it productively at work and in	

	their everyday lives, to recognize when information technology can assist or impede the achievement of a goal, and to continually adapt to changes in information technology" (Koehler & Mishra, 2009). In this study (1A): When Joe demonstrates fluency in various forms of technology (game design programs, the Internet, computers in general, etc.) and willingness to adapt to technological changes and impediments.	
Pedagogical Content Knowledge (PCK)	Definition in research: A teacher's "transformation of the subject matter for teaching. Specifically, according to Shulman (1986), this transformation occurs as the teacher interprets the subject matter, finds multiple ways to represent it, and adapts and tailors the instructional materials to alternative conceptions and students' prior knowledge. PCK covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy" (Koehler & Mishra, 2009).	

	In this study (1A-C): The specific ways in which Joe teaches game design principles, technology notwithstanding.	
Technological Content Knowledge (TCK)	Definition in research: "an understanding of the manner in which technology and content influence and constrain one another. Teachers need to master more than the subject matter they teach; they must also have a deep understanding of the manner in which the subject matter (or the kinds of representations that can be constructed) can be changed by the application of particular technologies" (Koehler & Mishra, 2009). In this study (1B): When Joe acknowledges the ways in which technology can enhance (or restrict) the understanding of game design principles.	
Technological Pedagogical Knowledge (TPK)	Definition in research: "an understanding of how teaching and learning can change when particular technologies are used in particular ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate	

	pedagogical designs and strategies" (Koehler & Mishra, 2009). In this study (1B): When Joe demonstrates knowledge of the advantages and disadvantages of technological tools in his classroom.	
Technological Pedagogical Content Knowledge (TPACK)	Definition in research: "TPACK is the basis of effective teaching with technology, requiring an understanding of the representation of concepts using technologies; pedagogical techniques that use technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help redress some of the problems that students face; knowledge of students' prior knowledge and theories of epistemology; and knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones" (Koehler & Mishra, 2009). In this study (1A-C): When Joe effectively integrates content, pedagogical, and technological	

	knowledge in order to teach game design using technology.	

Scaffolding Codes (from the literature – see Hannafin, et al 2009)

Code	Definition	Example
Conceptual Supports	Definition in research: "Guides learner in what to consider; considerations when problem is defined" (p. 131) In this study (1C): When Joe provides explicit hints and prompts when students are unsure of how to proceed (Vygotskian scaffolding)	(CLASSROOM OBSERVATION) Haron [pseudonym] has a question about posting an article on VR [virtual reality] to Declara [a crowdsourced knowledge platform] – **Joe sits down next to him to assist him** with moving the article from another group he posted to – Joe **walks him through the process** for posting an article to the Declara board
Metacognitive Supports	Definition in research: "Guides how to think during learning; ways to think about a problem under study and/or possible strategies to consider; initial role in finding and framing problems; and ongoing role during resolution" (p. 131) In this study (1C): When Joe suggests that students plan ahead when completing a task	(BLOG POST FROM JOE – Joe describes the prompts he provides students with when they first start to) "As a guide for their reflection, I offered the following **ideas** (they don't have to stick to these but it provides a guide as they start their **weekly reflections**:

		What product / tool are you working with? **Share what you have learned so far through the experience.** **What progress [sic] have you made so far?** **What is your plan for moving forward (next steps and big plan)?** **interesting a ha moments you have had through the experience of taking ownership of your learning.**
Procedural Supports	Definition in research: "Guides how to utilize the available OLE features; ongoing 'help' and advice on feature functions and uses" (p. 131) In this study (1C): When Joe has the students use guides outside of (or in addition to) those resources available within 3DGameLab to learn a particular concept or how to work/create with a particular platform or tool	(INTERVIEW TRANSCRIPT) They might be **looking for tutorials** for something to do with Raspberry Pi, then they're gonna essentially **recreate that**, like we call that **a "Watch It Build It"** and **they follow that** with modding what they just created that was really a copy of something and then ultimately create their own project as part of that…
Strategic Supports	Definition in research: "Guides in analyzing and approaching learning tasks or problem; provided initially as macrostrategy or ongoing as	(INTERVIEW TRANSCRIPT) "When someone is working on something consistently, but they aren't really 'getting' what they need out of it – or, I

	needs or requests arise" (p. 131) In this study (1C): When Joe invites experts from the field to enter his classroom (virtually or in person) to share their perspectives	feel like they aren't going to be able to finish what they started and they bit off more than they could chew, then **I'll redirect them** to an alternate-an alternative route."