2017

A Phenomenological Examination of Virtual Game Developers' Experiences Using Jacob's Ladder Pre-Production Design Tactic

Jasmine Brown-Turner
Walden University

Walden University

College of Education

This is to certify that the doctoral dissertation by

Jasmine Brown-Turner

has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
the review committee have been made.

Review Committee
Dr. Christine Sorensen, Committee Chairperson, Education Faculty
Dr. Paula Dawidowicz, Committee Member, Education Faculty
Dr. Kathleen Lynch, University Reviewer, Education Faculty

Chief Academic Officer
Eric Riedel, Ph.D.

Walden University
2017

Abstract

A Phenomenological Examination of Virtual Game Developers' Experiences Using Jacob's Ladder Pre-Production Design Tactic

by

Jasmine Brown-Turner

M.Ed., University of South Florida, 2008

BS, Florida State University, 2004

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Educational Technology

Walden University

May 2017

Abstract

Edutainment refers to curriculum and instruction designed with a clear educational purpose, including multi-faceted virtual learning game design. Tools such as the Jacob's Ladder pre-production design tactic have been developed to ensure that voices of both engineers and educators are heard. However, it is unclear how development team members experience and perceive their collaborative work while designing a virtual game using such tactics. This phenomenological study examined the experiences of agile software team members using Jacob's Ladder pre-production design as an interdisciplinary collaboration tool while designing a virtual learning game. Seven design team members (3 educators and 4 engineers) participated in semi-structured interviews and transcripts were analyzed via an inductive coding process that led to the development of key themes. Findings indicated that using Jacob's Ladder design tactic influenced the experience of the team by keeping the team focused on common goals and learner needs, organizing the team work, supporting interdisciplinary collaboration, and promoting shared understandings of the software platform limitations. Individuals played various roles, appreciated diverse views, recognized prior experience and idea sharing, and felt the design tactic supported flexibility for interdisciplinary collaboration. By linking integration strategies to interdisciplinary collaboration, findings from this study may be used by organizational leaders to consider best practices in team building for virtual learning game design, which will further support the development of effective games and growth of the edutainment industry.

A Phenomenological Examination of Virtual Game Developers' Experiences Using Jacob's Ladder Pre-Production Design Tactic

by

Jasmine Brown-Turner

M.Ed., University of South Florida, 2008

BS, Florida State University, 2004

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Educational Technology

Walden University

May 2017

Dedication

This dissertation is dedecated to the loving memory of my father, Larry Turner. I continue to reap the harvest of his investment in my education. He was simple, and wise.

Acknowledgments

I would like to express my sincere appreciation to my mentor professor Christine Sorensen and thanks to professor Paula Dawidowicz and professor Kathleen Lynch for also serving as my committee members. Each of you have played an important role in my successful doctoral journey. I would also like to thank the volunteers at Aspire Innovative Learning, for investing in innovation.

Words cannot express how grateful I am to have the love of my “framily”, grandparents, parents, siblings, and extended family. I appreciate the sacrifices that my support system has made on my behalf and celebrate the grace that has sustained me thus far. I would especially like to thank my angels who encouraged me in this process by always extending hope. My deepest gratitude is to my beloved wife Immani Brown-Turner.

Table of Contents

List of Tables v

List of Figures vi

Chapter 1: Introduction to the Study 1

Introduction 1

Background of the Study 2

Problem Statement 4

Purpose of the Study 5

Research Questions 5

Conceptual Framework 6

Nature of the Study 8

Definition of Terms 9

Assumptions 10

Scope and Delimitations 11

Limitations of the Study 11

Significance of the Study 12

Summary 13

Chapter 2: Literature Review 15

Introduction 15

Literature Search Strategy 16

Conceptual Framework 17

Virtual Learning Games 20

History of Virtual Learning Games 21
Virtual Learning Game Platforms 22
Impact of games on the learner 29
Blending Education and Entertainment 34
Gaming Principles 36
Educational Principles 39
Interdisciplinary Design Teams 42
Collaboration 44
Roles in Game Design 45
Software Development 48
Design Strategies 52
Summary 56
Conclusion 57
Chapter 3: Research Method 59
Introduction 59
Research Design and Rationale 60
Role of the Researcher 62
Methodology 65
Issues of Trustworthiness 78
Ethical Procedures 80
Summary 82
Chapter 4: Results 83

Introduction....83
Chapter Organization....84
Setting 84
Participants....85
Results90
Research Question 1....94
Research Question 2....109
Research Question 3....119
Additional Notes....130
Summary....131
Chapter 5: Discussion, Conclusions, and Recommendations....134
Introduction....134
Interpretation of the Findings....136
Limitations....149
Recommendations....150
Implications....152
Methodological Implications....154
Practical Implications....154
Positive Social Change....156
Conclusion....157
References....160
Appendix A: Invitation to Participate in Research....176

Appendix B: Data Collection Tool 177

Appendix C: Interview Protocol 178

Appendix D: Data Analysis Matrix 182

Appendix E: Human Research Protections Training Certificate 186

Appendix F: Permission to use the Jacob's Ladder Pre-Production Tactic 187

List of Tables

Table 1. Research Questions & Data Collection Guide 61

Table 2. Participant Recruitement & Data Collection Steps 81

Table 3. Game Development Team Expertise & Role 91

Table 4. Themes Identified for Each Research Question 95

List of Figures

Figure 1. Jacob's Ladder pre-production tactic 20

Figure 2. Jacob's Ladder pre-production tactic with production title/role 154

Chapter 1: Introduction to the Study

Introduction

Edutainment attempts to make each experience, deliberate or inadvertent, fun and meaningful. Virtual learning games enable students to retain and apply information in a real world context by balancing subject matter and game strategy. Between 2001 and 2010, the number of articles concerning game-based learning increased considerably, implying that this field was growing and more relevant (Hwang & Wu, 2012). The investigation of virtual learning games' potential to support academic achievement in the 21st century is a research trend (Shute, Rieber, & Van Eck, 2011; Tsai, & Fan, 2013). The most important ideas for virtual learning game design are collaboration among interdisciplinary developers, and equal representation of education and entertainment (Boyan & Sherry, 2011; De Castell, Jenson, & Thumlert, 2014; Ulicsak, 2010). In this study, I explored integration models and design strategies for developing educational games within an international community of developers who experienced the process of designing a virtual learning game.

Software from the edutainment industry is designed to expand the range of learning from rote to more complex tasks. In this study, I considerd how an agile development team used Jacob's Ladder pre-production design tactic, to address cooperation in interdisciplinary collaboration. Among development team members, the principal factors that researchers have found to increase successful integration of subject matter and game strategy are cooperation (Shelton & Scoresby, 2011), a joint effort (Bari & Ahamad, 2011), partnership, and communication (Jin, 2012). Factors that impede

collaboration in aligning instructional and gaming principles include a lack of interdisciplinary representation, and not employing integration strategies (Downey, 2011; Kickmeier-Rust & Albert, 2010; Starks, 2014; Wang & Chen, 2010). In 2010, Hirumi, Appelman, Rieber, and Van Eck (2010c) recommended the Jacob's Ladder pre-production design tactic to address collaboration for designing virtual learning games, but little research is available on this model. Although fun learning is a straightforward concept, educational entertainment is a complex theoretical domain. In this study, I thus considered how the Jacob's Ladder pre-production design tactic influences the experience of agile software teams as they develop virtual learning games.

Background of the Study

Educational games blend learning with enjoyment because edutainment recognizes the importance of pleasure in learning. Virtual learning games exist to provide enjoyment and enhance motivation, creativity, and social interaction for education (Oblinger, 2004; Ross, Morrison, & Lowther, 2010; Van Eck, 2006). Virtual environments, conceived as games, employ play theory and provide cycles of learning, situated cognition, cognitive development, and continued scaffolding (Wu, Hsiao, Wu, Lin, & Huang, 2012). Hirumi et al. (2010c) suggested merging the expertise of instructional designers and entertainment developers during virtual learning game development to ensure that both have an equal voice in the design process. Educational entertainment leads students through the process of accommodation by expressing and restructuring mental pictures of the outside world as they engage in new experiences

(Mattheiss, Kickmeier-Rust, Steiner, & Albert, 2010). Integration methods can guide the process of blending subject content and game strategy.

Design tactics perform an essential function in the flow or progression of discovery within virtual learning games. Recent changes in gaming systems and development technologies make the conglomeration of concepts more noticeable, and the educational implications more apparent (De Castell et al., 2014; Wu, Richards, & Saw, 2014). Boyan and Sherry (2011) suggested that developers use advanced design principles, blending the media flow perspective with current pedagogy for model matching and layering within virtual learning games. Likewise, Jin (2012) considered design tactics by examining predictors of optimal learning experience and approaches to the development of an online learning game. Edutainment uses varying learning modules in hopes of creating a learning environment with minimal constraint and maximum exposure. Interdisciplinary experts collaborate to design an energized activity with a high level of fulfillment.

Fields of study beyond the scope of education utilize active participation in fun activities to initiate cognitive development. Self-organizing teams may benefit from design tactics used to guide collaborative efforts among interdisciplinary experts. The idea of bringing together interdisciplinary representatives in a self-governing manner is controversial because the design tactics that guide these groups need studying (Tsai & Fan, 2013; Van Eck, 2011; Yu, 2014). Design methodologies and production strategies are required to support the profession of virtual learning game design (De Castell et. al, 2014; Hirumi et al., 2010b; Hoda, Noble, & Marshall, 2013). A better understanding of

existing design tactics, such as Jacob's Ladder pre-production design tactic, may lead to new and improved methodologies and strategies to support interdisciplinary collaboration (Hirumi et al., 2010c). Edutainment should take advantage of the biological drive to seek balance between users' personal thoughts and the world around them. Independent game design groups may benefit from design tactics to guide collaborative efforts to design a virtual learning game.

Problem Statement

The enjoyment or entertainment component of edutainment is essential, but not easy to quantify; virtual learning game design is multifaceted and involves more than just adding traditional instructional design to game mechanics. Failure to build on existing research may limit developers effective use of design tactics for creating virtual learning games (Starks, 2014; Van Eck, 2011). According to Hirumi et al. (2010c), the Jacob's Ladder pre-production design tactic is a stimulating, collaborative design tactic for motivating exchanges between instructional and entertainment designers. Previous research on developing virtual learning games has not provided insight into practitioner experiences with the Jacob's Ladder pre-production design tactic and its influence on active collaboration (Hirumi et al., 2010a, 2010b, & 2010c; Ross et al. 2010; Wang & Chen, 2010). What distinguishes edutainment from entertainment is its emphasis on expressed knowledge or the skill intended to be taught. Design tactics may influence interdisciplinary collaboration as well as the designers' quality of subject content and game play integration.

Educational entertainment is limited to curricula and instruction designed with a clear educational purpose. Design tactics give development teams the outline, guidance, and procedure for blending subject content and game play. Game production teams work together to create a productive frame of reference for social interactions that aid development and expand proficiency (Miller, 2010; Pernsteiner, Boyer, & Akcaoğlu, 2010; Wu et al., 2014). Design tactics may influence interdisciplinary collaboration within an agile team developing a virtual learning game (Hirumi et al., 2010a, 2010b, 2010c; Miller, 2010). Little is known about how design tactics, such as the Jacob's Ladder pre-production design tactic, may influence collaboration while creating virtual learning games (Hirumi et al., 2010; Luo, 2011; Van Eck, 2011). Edutainment is designed to be tested against common standards of learning to measure the user's depth of knowledge acquisition or skill development. Therefore, in this study I explored development team member experiences and perceptions of design tactics for creating virtual learning games.

Purpose of the Study

The purpose of this is phenomenological study was to explore international developers' perceptions of and experiences with the Jacob's Ladder pre-production design tactic for interdisciplinary collaboration in designing virtual learning games.

Research Questions

I designed the following research question and sub-questions to guide this study:

Primary Research Question: What are the experiences of agile software teams when using tactics designed for interdisciplinary collaboration such as the Jacob's ladder pre-production tactic?

Subquestion 1: How does the Jacob's Ladder pre-production design tactic influence the experience of agile software teams as they create virtual learning games?

Subquestion 2: How do agile software team members describe their experience of using the Jacob's Ladder pre-production design tactic in designing virtual learning games?

Subquestion 3: What benefits and/or hindrances do agile software team members experience when using the Jacob's Ladder pre-production design tactic?

Conceptual Framework

The Jacob's Ladder pre-production design tactic may influence collaborative interactions within an interdisciplinary design team working to provide innovative curricula and instruction. Hirumi (2010c) created the Jacob's Ladder pre-production design tactic and warned designers that learning requirements and traditional instruction techniques should not be shoved into a game because it would undermine the theatrical course of a story and interrupt the excitement of game play. The Jacob's Ladder pre-production design tactic is a tool for manipulating the potential of amusement and narrative within a virtual learning game (Eseryel, 2014; Hirumi et al., 2010c; Merchant, 2014). The Jacob's Ladder pre-production design tactic is informed by pedagogical theories of learning and design that guide the process of prototyping a virtual learning game (Eseryel, 2014; Hirumi et al., 2010c). One could argue that edutainment is

naturally inclined toward individualized, student-centered instructional approaches based on the responsiveness and adaptability of the curriculum. Integration tools, such as the Jacob's Ladder pre-production tactic, are used to blend education and entertainment elements within a game.

Educational entertainment is meaningful, applicable, interesting, serious, practical, purposeful, and significant. Systematic virtual learning game design approaches both entertainment and instructional elements as equal. Interdisciplinary collaboration is beneficial because winning results do not come narrowly from education or entertainment, nor are they negotiated through only uniting the two (Eseryel, 2014; Hirumi et al., 2010c; Merchant, 2014). The Jacob's ladder pre-production tactic may help development team members consider what a real game looks and feels like, and it brings interdisciplinary expertise to their design work in constructive ways (Majgaard, 2014; Wu, 2014). Researchers have called for future work in making more interactive content to enrich the game graphics, but have noted that adopting new methods in the production processes and in designers' habits in virtual learning game design needs integration models (Gershenfeld, 2014; Su, 2013). Developers take into account ways to create a distinctively pleasurable experience during the learning process; integration models can help a design team consider subject content and game strategy during interdisciplinary collaboration. The Jacob's Ladder pre-production tactic is an integration model that can influence the design process of educators and entertainers. Achievement comes from the deliberate interactions between specialists from different fields of study working to accomplish a common objective (Hirumi et al., 2010c; Su, 2013). As Hirumi, et al.

(2010c) have noted, “games may be designed to fulfill one or more instructional goals, but the elements of a good lesson do not simply translate into the elements of a good educational game” (p.3). Inclusion of both educational and entertainment expertise is necessary because the process of virtual learning game design includes determining the role of instruction, evaluating the needs of each learner, and creating interventions to assist in the learning process (Eseryel, 2014; Merchant, 2014). In Chapter 2, I explain how the Jacob's Ladder pre-production design tactic is meant to help agile teams, and why agile methods are most suitable for interdisciplinary experts working to fuse instructional and entertainment design.

Nature of the Study

To guide this research, I used a phenomenological framework to explore the experiences of team members and to identify trends in their attitudes and opinions regarding use of the Jacob's Ladder pre-production design tactic to design virtual learning games. There are several types of qualitative research strategies, but the phenomenological approach, as described by Edmund Husserl (2012), seemed ideal for exploring software team members’ perceptions of design tactics and interdisciplinary collaboration in the process of creating a virtual learning game. Organizational documents and project products, though not considered data sources to satisfy the study inquiries, can inform the interpretation of the interviews (Kaufer et. al, 2015; Van Manen, 2014). . In this study, I focused on understanding the reality of the participants by using semi-structured interviews with the participants that concerned the experience of designing a virtual learning game.

Edutainment provides users the opportunity to gain a deeper understanding by interacting, questioning, and continuously improving on ideas. I selected the research site to target individuals outside the United States and reach the international community of makers with an interest in developing educational games. Lou (2011) suggested that researchers should use a smaller sample size to study individual experience. Therefore, I determined that the practice of designing a virtual learning game using the Jacob's Ladder design tactic was best understood by listening to the stories of seven interdisciplinary team members. A data collection guide for face-to-face interviews helped me capture essential information about using the Jacob's Ladder pre-production design tactic in a standardized format (see Irvine, 2011; Edmund Husserl, 2012; Maxwell, 2013). In this study, I analyzed participant responses to face-to-face interview questions about the experience of using the Jacob's Ladder pre-production design tactic to design a virtual learning game. By pre-coding, coding, reducing, and interpreting qualitative data from interview transcripts, I was able to identify shared understandings of the participants (see Miles, Huberman, & Saldana, 2014).

Definition of Terms

Agile software team: A group of software team members who employ techniques wherein resolutions develop through partnerships between self-organizing individuals. Such methods promote flexible planning, transformative development, early delivery, and continuous improvement that encourages rapidly flexible response to change (Yu & Petter, 2014).

Content expert: The title given to an educator who specializes in a particular subject area (Anderson, 2008; Squire, 2011; Yu, 2014).

Edutainment: The term used to describe leaning that blends education and entertainment. Edutainment technologies include toys, games, sports, leisure, media, mass communication, and fine and performing arts (Ahlers, 2009; Jarvin, 2015).

Gamification: The application of game strategies (e.g., point scoring, competition with others, rules of the game) to other areas of activity, typically to encourage engagement (Wu, Richards, & Saw, 2014).

Interdisciplinary collaboration: the process of involving two or more disciplines of study (Hirumi et al., 2010c; Van Eck, 2011).

Software development team: A group of individuals who work together to write operating information used to program computers (Dittman at. al, 2010; Van Eck, 2011).

Software engineer: The title given to an individual who designs and builds computer programs (Anderson, 2008; Squire, 2011; Yu, 2014).

Virtual learning game: An online educational stage for learners to virtually retrieve scholastic outcomes, activities, and assessments based on the game strategy that dictates learning experiences (Oblinger, 2004).

Assumptions

In this study, I assumed that participants were familiar with integration tools, such as the Jacob's Ladder pre-production design tactic, and had the familiarity necessary to recognize what, for them, constitutes its positive points and flaws. I also assumed that the responses provided by the participants were honest and that they could accurately recall

and describe their experiences. Finally, I also assumed that using Jacob's Ladder pre-production design tactic influences the collaboraitve work of interdisciplinary teams in some way that can be understood through interviewing team members.

Scope and Delimitations

The study included international participants who were voluntary production team members at the research site. Participants were educators or engineers. I looked specifically at an agile team's use of the Jacob's Ladder pre-production design tactic as an integration tool. Publicly available documents, including published organizational information and prototype materials, were used to inform the analysis.

Limitations of the Study

Educational entertainment is comprised of curricula and instruction designed for skill and knowledge acquisition, as well as individual enjoyment. Virtual learning game design has its challenges and advantages; the most important issues to consider are subject area content and game mechanics, design team organization, and overall production strategies. This study differed from previous research in that, because of the sampling method, findings are not generalizable and the focus of the study was one specific agile software design team in the process of using a specifc production strategy. The development of virtual learning games have benefits for facilitating change and improvement in education, but only when stakeholders involved in the development recognize the importance of interdisciplinary collaboration in the early stages of development. The study included international participants who were production team

members at the research site. The study looked specifically at an agile team's use of the Jacob's Ladder pre-production design tactic as an integration tool.

Significance of the Study

Fun learning provides entertaining instruction that allows the student to learn within the constructs of an enjoyable external event in hopes of converting the new experience into a part of the existing intellectual basis. The primary importance of this study is that it may help stakeholders involved in producing virtual learning games to understand, from a team member's perspective, how design tactics influence collaboration among interdisciplinary expert team members. Van Eck (2011) suggested that the body of research and practice in other disciplines is far more standardized and systematic than that which exists in game-based learning. Research into the influence of the Jacob's Ladder pre-production design tactic on interdisciplinary collaboration when designing virtual learning games is useful for policy makers in governments and professional organizations that support the educational game industry (Hirumi et al., 2010c; Van Eck, 2011). The potential contribution of this study is the advancement of best practices in virtual learning game design and positive social change in K12 distance education (Davis, 2014; Merchant, Goetz, Cifuentes, & Keeney-Kennicutt, 2014; U.S. Department of Education, 2013). In this study, I explored a design tool that could support the development of virtual games by influencing the process of interdisciplinary collaboration among development team members. Entertainment is an easy context to help shape the knowledge or skills that the learner creates because many multimedia devices are equipped for variation and accommodation.

Of secondary significance in this study, was the identification of factors that commonly serve as barriers to collaboration and may be of particular value to agile software design teams. Overcoming barriers may require more sound practices in the discipline of developing virtual learning games (Tsai & Fan, 2013); thus, there is a range of possible solutions that could result from their identification. In the case of designing a virtual learning game, previous studies have not described the experiences of interdisciplinary teams using the Jacob's Ladder pre-production design tactic (Hirmi et al, 2010a, b, c). In this qualitative phenomenological study, I build on prior research about developer use of design tactics in the process of creating virtual learning games (Hirumi et al., 2010c; Tsai & Fan, 2013; Van Eck, 2011). As an instructional methodology, inclusion encompasses diverse ways of knowing, learning, instructing, teaching and training. At the very least, in this study, I provided a voice to team members as a step forward in interdisciplinary collaboration for developing virtual learning games.

Summary

In educational contexts, the expectation is no longer for students to simply acquire information; instruction must encourage exploration and discovery to develop knowledge and skills. Previous studies have shown a need for a strategic, iterative approach to design that permits designers to think about particular educational outcomes and anticipate how changes impact design goals (Dillon, 2010; Hirumi et al., 2010a, 2010b, 2010c; Van Eck, 2011). During an examination of the literature, I found no research on the design process of agile software team members employing the Jacob's Ladder pre-production design tactic in virtual learning game design. Thus there was a critical scholarly gap in

understanding how team members involved in designing virtual learning games can better serve production goals, and how integration models might help development teams balance education and entertainment elements (see Dillon, 2010; Hirumi et al., 2010c; Tsai & Fan, 2013; Van Eck, 2011). Together, the design team works to design a product that encourages students to arrive at their own version of the truth based on guided exploration. Using integration tools to bridge the gap between interdisciplinary experts is a clear way to guide the process of collaboration within virtual learning game design.

Instructional game design requires the incorporation of different perspectives and many fields of thought, without showing partiality towards any one over another. Chapter 2 includes a review of literature about the evolution of educational video games, and of research on virtual learning game design, agile software development, interdisciplinary collaboration, and design tactics. Chapter 3 includes discussions of the research design and rationale, my role as the researcher, and methodology. Chapter 4 outlines the findings of the study, and Chapter 5 includes interpretations, limitations, and implications for social change.

Chapter 2: Literature Review

Introduction

Educational systems promotes many alternative methods of teaching and learning, such as educational entertainment. Virtual learning games use game strategy characteristics to present subject matter in a digital environment. Commercial entertainment games exist solely for enjoyment, but, Piaget (1999) described the practice of play as an initial stage of intelligence where repeated experiences create functional pleasure. Most commercial games are not likely to closely map desired learning outcomes, nor provide for development teams that benefit from both education and engineering expertise (Ahlers, 2009; Hirumi et al., 2010c; Mohtashami, 2011; Whitton, 2012). Virtual learning game design is a unique field that requires shared awareness among production managers of integration tools they can use to enhance the blending of education and entertainment (Anderson, 2008; Delacruz, 2009; Squire, 2011; Yu, 2014). The development of educational games depends on interdisciplinary collaboration to integrate education and entertainment elements.

Providing instruction that both educates and entertains is the major component of edutainment; the goal is to guide students in gaining specific knowledge and skills by using tools and resources that they may enjoy. A strategic approach to collaboration is necessary for designing all types of virtual learning games (Hirumi et al, 2010 a, 2010b, 2010c; Hwang & Wu, 2012; Van Eck, 2006). Educational game development and design strategy involves both subject content and gameplay (Eseryel, 2014; Jarvin, 2015;

Pernsteiner, Boyer, & Akcaoğlu, 2010). Developers' use of integration models is essential from preparing instructional designers to work with software engineers (Alotaibi, 2014; Hirumi, 2010; Mohtashami, 2011). Societies continue to experience exponential change and development that can be seen by the way people communicate knowledge and skills to younger generations. The following literature review provides information regarding the foundation for approaches to designing virtual learning games, my rationale for exploring integration strategies, and a description of the Jacobs' Ladder pre-production tactic.

Literature Search Strategy

In this review of scholarly literature, I researched virtual learning game design, as applied to many different fields. I conducted my search for relevant studies in a range of areas simultaneously using the EBSCO, ProQuest Central, Science Direct, SAGE interfaces, and Academic Search Complete databases, which I accessed from the Walden University Library. Specifically, the databases I searched included: ERIC, Education Research Complete, SAGE Premier, ED/IT Digital Library, Education Research Starters, Academic Search Premier, Communications & Mass Media Complete, ProQuest Dissertations and Theses, ProQuest Education Complete, ProQuest Psychology Journals, and Social Science Journals. For the game-based learning component, I examined all articles containing the term *Jacob's Ladder pre-production design tactic*. I conducted systematic reviews of the search term *educational games, edutainment, educational entertainment, educational software development, virtual learning games, game design, instructional design, interdisciplinary collaboration, collaborative teams, teamwork,*

agile software development, and *integration methods*. For this study, I considered peer-reviewed articles published in scholarly journals since 2007.

Conceptual Framework

Educational entertainment is commonly used outside the classroom, but has made its way into the mainstream curriculum design because of its positive impact on academic achievement. In this literature review, I examine how the game-based learning industry can benefit from integration models and design strategies. Despite the popularity of educational games, today's approaches are near the beginning phase regarding pedagogical and educational gravity (Kickmeier-Rust & Albert, 2010; Van Eck, 2011). Researchers have approached the challenge of integrating learning outcomes and video game play by using mental paradigms of educational content and a variety of skills (Bruner, 2006; Boyan & Sherry, 2011; Hirumi et al., 2010b). In the literature, I found explainations of how design tactics that provide integration models may help support interdisciplinary collaboration and avoid the dominance of educators or engineers in the development process—an imbalance that may result in a game that is neither fun nor entertaining (Hirumi, 2013; Hirumi et al., 2010c; Kickmeier-Rust & Albert, 2010). Growing educational systems must be poised to consider myriad ideas that relate to edutainment. Design tactics might help interdisciplinary development teams collaborate.

Educational entertainment provides authentic experiences in an interactive context to facilitate learning through integration across the curriculum. The reasons why self-governing teams work well together are discoverable only through a research process that explores common interactions, like interdisciplinary collaboration. The inclusion of a

clear method for integrating education and entertainment can guide a design team in the process of creating a virtual learning game (Hirumi, 2013; Hirumi et al., 2010c; Kickmeier-Rust & Albert, 2010). Colleagues with extensive know-how in the entertainment business and experts in the field of education created the Jacob's Ladder pre-production design tactic to take advantage of the practical features, while protecting against the downsides, of both instructional design and entertainment design (Hirumi et al., 2010c). Design tactics increase collaboration between educators and software engineers, and help meet the demand for game-based learning in K-12 distance education (Paraskeva, 2010; Starks, 2014). The Jacob's Ladder pre-production design tactic may help software teams in the early stages of developing a virtual learning game.

In addition to educators working to facilitate the use of fun learning, other aspects of educational systems are a consequence of simple trends demonstrated through social norms. Developers can use this design tactic to outline game elements such as mechanics, dynamics, and aesthetics by identifying important factors in instructional and entertainment design (Hunicke et al., 2004; Hirumi et al., 2010c; Kanuka, 2008). The Jacob's Ladder pre-production design tactic may guide interdisciplinary collaboration among members of a self-organized team. As shown in Figure 1, Hirumi et al. (2010c) indicated that virtual learning game designers should consider the questions outlined by the Jacob's Ladder design tactic: (a) Who Cares? (b) Why Care? (c) Where do we go? (d)

How does it work? (e) In what context?

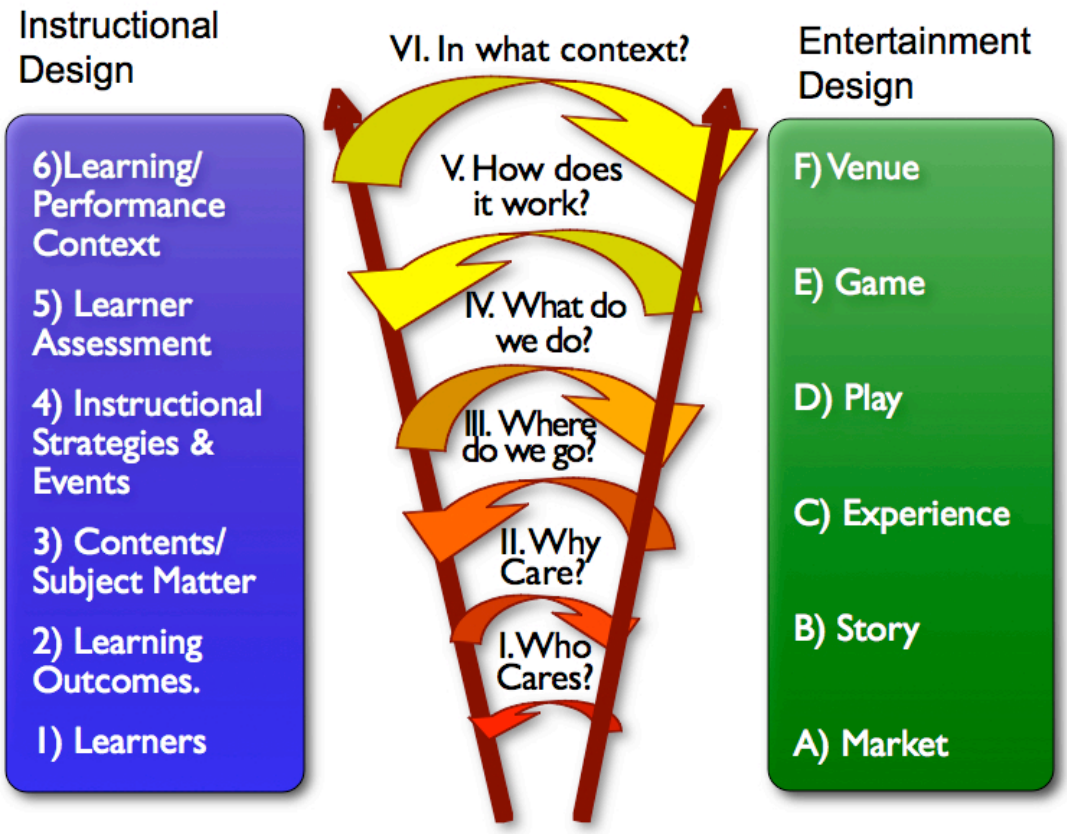


Figure 1. Jacob's Ladder pre-production tactic integration model for blending education and entertainment. Adapted from Hirumi, A., Appelman, B., Rieber, L., & Eck, R. Van for "Preparing Instructional Designers for Game-Based Learning: Part II." By A. Hirumi, B. Appelman, L. Rieber, and R. Van Eck, 2010, *TechTrends, 54*(3), p. 43. Used with permission of Atusi Hirumi, 2015.

Interdisciplinary collaboration is vital for increasing parternships between instructional designers and entertainment designers. Hirumi et al. (2010c) emphasized the positive consequences of having an equilibrium between education and entertainment, and a balance between creative, experimental, and methodical approaches to design.

Virtual Learning Games

The edutainment industry encompasses various forms of media which allow extraordinary things to be possible using digital worlds. A strategic approach is necessary for the design of virtual learning games in all forms. Innovation in instructional design demands intelligent integration of learning technologies in agreement with recognized educational philosophy while accounting for the fundamental assets and frailties of virtual learning games (Hirumi, 2013; Van Eck, 2006). Tsai and Fan (2013) examined game-based learning (GBL) studies published in SSCI-indexed journals from 2003 to 2012, and found game-based learning research has been on the rise since 2006. Literature further indicated that it may be beneficial for developers to follow a more direct and strategic approach to integrating game-based learning and the interdisciplinary collaboration required (Hwang & Wu, 2012; Jarvin, 2015; Van Eck, 2006). The more educators understand about entertainment in the field of education, the better stakeholders can consider its educational merits. Educational research offers insight into the incorporation of education with entertainment and the design of all types of virtual learning games.

Continued game-based learning research may contribute to the overall growth of this field. Globally, researchers from many countries have played a part in expanding this area of study, as advancement in game-based learning research has significantly increased in recent years (Gerber, 2014; Hwang & Wu, 2012; Tsai & Fan, 2013). According to Hwang and Wu (2012), of the digital game-based learning articles available in seven major educational technology journals from 2001 to 2010, most did not contain

precise educational game design strategies. Most of the studies that Hwang and Wu reviewed were focused on the examination of students' enthusiasm, opinions, and feelings toward digital games (Hwang &Wu, 2012). Mixed and quantitative investigative practices were used more in GBL research, especially since 2008 (Tsai & Fan, 2013), with little focus on qualitative designs. Virtual learning games have a rich history of using technology effectively to increase academic success.

History of Virtual Learning Games

It can be argued that edutainment has existed throughout time, even in simple oral tradition that manifest as parables and fables to further social development and promote social change. Advances in technology led to the expansion of virtual learning games. During the 1990s, video game design advanced significantly with the invention of 3D elements (Oblinger, 2004). Developers were expected to program 360-degree atmospheres that contained more wide-ranging components (Hwang, 2012; Oblinger, 2004). Game designers were originally just programmers, but as the video game industry expanded, design required an entire team (Oblinger, 2004; Shelton, 2011; Zinn, 2008). Oblinger (2004) predicted that the next generation of educational engagement would lean toward more games in online environments because they are believed to bring about deeper knowledge. The evolution of technology is essential to the expansion of virtual learning games because improvement in the social conditions of cyber learning promotes increased enjoyment.

The information students gather through each encounter within the learning environment shapes their educational experience as they acquire, enhance, or make

changes to their understandings. The rapid adoption of this interactive media has resulted from researchers' positive beliefs concerning technological advancements and the educational advantages of virtual learning games. Virtual learning game design has only recently become a major subject of scientific study (Ahlers, 2009; Murphy et al., 2010; Shelton, 2011). A review of past and present technology research shows an increase of technology practice in schooling in the areas of distance education, educational games, and simulated training (Ross, Morrison, & Lowther, 2010). Research has shown that the usefulness of virtual learning games is directly linked to game design (Meyer, 2013; Whitton, 2014; Wu et al., 2012). The edutainment industry embraces constructivist ideas of teaching and learning by applying them to the creation of various multimedia devices. Technology usage heightens innovative advances in the global push for virtual learning games, as systematic development varies among different types of platforms.

Virtual Learning Game Platforms

Educational entertainment focuses on the positive emotional experience of the individual student, and takes into consideration mind, body, and spirit. Educational games using design tied to popular platforms are ideal for providing guidance tailored to student needs and achievement levels. Virtual learning games address competencies by articulating explicit expectations regarding learning objectives and procedures within the game platform (Eseryel, 2014; Jin, 2012; Sahrir, 2012; Wu, 2011). Developers use various types of gaming programs to collaborate when determining the specific knowledge and skill they want users to acquire, and the manner of presenting content-related preferences (Alotaibi, 2014; Tan, 2010; Wu et al., 2012). The process of

embedding instruction into games involves the concepts of agile collaboration, interdisciplinary teams, and integration models for different platforms (Gerber, 2014; Marvel, 2012; Shelton, 2011; Wu, 2014). Edutainment is student-centered instruction that originates from the student's point of interest in entertainment mediums, and builds upon this awareness to reach educational goals. Virtual reality, augmented reality simulations, and multiplayer online games are examples of popular educational game platforms.

Virtual reality. The Edutainment industry grows as a result of multimedia technological innovation and increased emphasis on the virtual learning experience. Virtual worlds represent imagined experiences by mimicking the physical presence of real life. Merchant et al. (2014), examined the overall bearing of instructional design in virtual reality to encourage the use of virtual learning games in K-12 and even in adult education settings. Literature suggested that if students repeatedly assessed, learning gains could deteriorate without consideration of instructional design within virtual reality environments (Clinton & Rieber, 2010; Merchant et al., 2014; Meyer, 2013). According to Clinton and Rieber (2010), the rise in and diversification of online forms of instructional materials further causes difficulties in the design process of educational games, requiring not only technical complexity but also entirely new philosophies for virtual learning game design. This perspective aligns with the idea that education is the accumulation of lessons through life experiences, both deliberate and inadvertent, that shapes an individual's knowledge, skills, and beliefs. Creators of virtual worlds make connections between content areas and operate them as a third actor in the learning process.

The virtual learning game designer may play a part in the learning experience of each player. Virtual learning environments are worthy of further investigation because participants have reported high perceived levels of concentration, significance, assurance and fulfillment, overall course motivation, and demonstrated achievement of specified course objectives (Hirumi, Sivo, & Pounds, 2012). Continually, research results suggest games, simulations, and virtual worlds are effective in improving learning outcomes by providing information in different formats, allowing learners to choose a style that matches their preference, and promoting the conscious and subconscious practice of new knowledge and skills (Squire, 2011; Merchant, 2014). Therefore, it is essential that virtual learning game designers carefully select instructional elements when utilizing virtual reality technologies (Clinton & Rieber, 2010; Merchant, 2014). The game designer is responsible for each aspect of student interaction.

Even if a student does not successfully complete a specific task, the effort used in attempting to do so will lead to accommodation. Developing virtual worlds compares to writing lesson plans for the traditional classroom. Fisser, Voogt and Bom (2013) and Merchant et al. (2014), both discovered a decrease in effectiveness and student learning gains when particular design elements were missing from virtual learning games. Experiments in cognitive science reveal that designing games for learning without validated models of game constructs to rely on are relegated to hoping that students will stumble on highly effective games from which they can extrapolate heuristics (Fisser et al, 2013; Merchant et al, 2014; Van Eck, 2011). If designers fail to collaborate, resulting in poorly blended subject content and gameplay, a virtual learning game may be less

efficient (Alotaibi, 2014; Boyan & Sherry, 2011; Shelton & Scoresby 2011). Educational entertainment shapes instruction in a way that uses the social environment as a foundation to experience varying knowledge and skills that promote shared understandings of truth. The custom of using virtual worlds for the purpose of education requires both mastery in learning platforms and education technology.

Augmented reality simulations. Augmentation supports learning via distant relationships by using real-time virtual objects to shape student interactions. Research on 3D virtual worlds suggested gamers experience a combination of knowledge, skills, and outlooks through the detection of the player's movements in specific augmented contexts (Cela-Ranilla, Esteve-Mon, Esteve-González, & Gisbert-Cervera, 2014; Gorlatch et al., 2012). Augmented reality does not simply represent the virtual learning game itself; it also requires the simulation to represent the process of developing player interaction over time (Benedettini & Tjahjono, 2008; Mysirlaki & Paraskeva, 2012; Wu et al, 2014). Augmented simulations provide an infrastructure to ensure that ubiquitous information necessitates that the user makes choices (Gorlatch et al., 2012; Mysirlaki & Paraskeva, 2012). Edutainment relies on the concept that we learn through the process of building knowledge and skills; although the learning process is individual, it is dependent on other individual and things in the environment. Advances in augmented reality and simulations can create systems in which the user encounters the real world via a virtual learning game.

The Edutainment industry gives proper regard to the learner as an individual and instructors as facilitators in the learning process. Developing simulations of decision-

based interactions for the purpose of preparing students to perform a particular task is a complex endeavor. Virtual learning games replicate the real world with logic implemented as data structures, and the simulated context provides processing rules that continually promote user action in real time (De Castell, Jenson, & Thumlert, 2014; Gorlatch, 2012; Wu et al, 2014). The simulator environment is a move from informative pedagogies to co-creation of knowledge within a subsisting platform to support learners' critical thinking and skills development (Majgaard, 2014; Whitton, 2014). The software design team controls the artistic and technical aspects that enable fast development of an augmented application and software development tools that help distribute game elements on multiple computation infrastructures (Benedettini & Tjahjono, 2008; De Castell et al, 2014; Tsai, 2013). Play can be viewed as an unquantifiable behavior or seen as an important guide to cultural and intellectual development. Augmented reality, within a virtual learning game, is likely to require the integration of several interdisciplinary concepts to design applications with a digital human presence.

The Edutainment industry exists as a response to the need to develop interactive curriculum for interpychological and intrapsychological growth. Mobile apps that feature augmented reality are emerging as game-based learning undergoes an epistemological change towards improving player interactions that are not only on the screen, but supports embodied simulation. The way that designers ensure that the virtual learning game remains uniform throughout the augmented experience is by focusing on player interactions and learner outcomes (De Castell et al, 2014; Majgaard, 2014). In the process of designing virtual learning games, software teams have noted the importance of

valid source information, thus simplifying characteristics within the simulation, and ensuring fidelity of learner outcomes (Benedettini & Tjahjono, 2008; Majgaard; 2014). The research described the influence of software design on the real life experiences of players, looking at how realistically they integrated augmentations in the context of virtual learning (De Castell et al, 2014; Majgaard, 2014; Whitton, 2014). Play is a fundamental notion viewed through complex expressions of understanding as instruction is designed to build understanding. Augmented reality and simulations are a popular virtual learning game platform.

Online multiplayer games. The distinction between Edutainment and entertainment is an emphasis on expressed knowledge or skill intended to be gained. Multiplayer video games are capable of supporting simultaneous interactions among large numbers of students. Massively Multiplayer Online Games (MMOGs), as complex organisms, have elements that can be useful for other domains, such as business and educational settings (Gorlatch, 2012; Mysirlaki & Paraskeva, 2012). According to Gorlatch (2012), users are dynamically connected to a joint application session to address challenging requests for Internet infrastructures, Real-Time Online Interactive Applications (ROIA), and other infrastructures such as Multiplayer Online Role-Playing Game (MMORPGs) and high-functioning systems for simulation-based training. Designer perceptions of students' current level of proficiency with Massive Multi-player Online Role-Playing Games (MMORPGs) interact with the climate within the virtual learning platform (Wu, 2014; Wu, Hsiao, Wu, Lin, & Huang, 2012). A similarity between Edutainment and entertainment is the vast scope of activities that bring

enjoyment. Educational game developers might improve player interactions and how the student gains knowledge and skills within online multiplayer games.

Edutainment provides a way to shape the experiences by increasing student engagement and meeting the distinct needs of diverse populations. Interdisciplinary design teams require the type of collaboration efforts featured within multi-player games. An MMORPGs environment is ideal for increasing social interaction because players work together to achieve a common goal (Mysirlaki & Paraskeva, 2012; Wu, Richards, and Saw 2014). Wu, Richards, and Saw, (2014) conducted a study of the effects of Massive Multiplayer Online Role-Playing Game (MMORPGs) as an electronic virtual learning environment and found it to be an effectively rich arena for collective interactions. Exploring a massively multiplayer online role-playing game helped to identify a platform for managing effective collaborative environments for development teams (Mysirlaki & Paraskeva, 2012; Wu, Richards, & Saw, 2014). Cooperative learning is a good example of advances in communication being a valuable opportunity to facilitate learning. Online multiplayer games offer a unique virtual learning game environment that enhances connectivity among players.

A complete range of knowledge and skills are learned by using software; educators have become more aware of the usefulness of development through interdisciplinary curriculum and instruction. The process of creating a virtual learning game requires a clear method for integrating instruction within the virtual learning environment. Cognitive behavioral game design requires integration methods that represent both instructional and gaming aspects of the virtual learning games (Bari &

Ahamad, 2011; Starks, 2014). Specific tools and techniques, such as integration models, design patterns, and code refactoring improve the quality of collaboration and enhance project dexterity (Bari & Ahamad, 2011; Eseryel, 2014; Starks, 2014). Integration models aid in the process of simulating the components separately to formalize certain parts of game design and can facilitate the creation of more complex online multiplayer games (De Castell, 2014; Eseryel, 2014). Educational entertainment has emerged as a branch in the field of education that considers pleasure vital to the learning process. Games may include serious elements, but make a significant impact on the learner designers can take advantage of varying platforms.

Impact of games on the learner

Our society has grown to embrace diversity and mandates that our educational system ensures all students the right to learn. Educational games are expected to help the player by facilitating academic progress through differentiation. Tsai and Fan (2013) published their paper to attract teachers' attention to integrating games into their online courses or curriculum, specifically for curriculum subject matter that is conceptual and not easy to comprehend. They suggested that designers in the game-based learning industry ought to be knowledgeable of and use a thorough, systematic process to help students' education and improve their stimulation through gameplay (Tsai, 2013). Previous research explored the philosophies, methods, and challenges of educational technology and found a need for contributions from other disciplines to design virtual learning games (Hwang & Wu, 2012; Luo, 2011; Tsai & Fan, 2013). Because edutainment is so closely related to the entertainment industry, the Edutainment industry

is prepared to provide diverse curriculum and instruction. Developers work to create a learning experience that is a motivational, engaging, and academically challenging while also promoting social interaction.

To gain a greater understanding of educational entertainment may come from considering these learning environments as part of the modern constructivist classroom. A positive impact on the learner is just one reason for virtual learning game design. Studies of virtual learning games have evaluated their effectiveness and found interrelationships between enthusiasm, involvement, and critical thinking (Allam, 2008; Eseryel et al, 2014; Fisser, Voogt, & Bom, 2013). The design elements of a virtual learning game have an impact on the learning process (Brunsell & Horejsi, 2013; Merchant et al, 2014; Reeve, 2009; Wang & Chen, 2010). Research exploring the factors influencing learning success suggests that development teams need guidance to ensure that learner outcomes are attainable while playing the virtual learning game (Eseryel, Law, Ifenthaler, Ge, & Miller, 2014; Tsai et, al, 2012). Virtual learning environments, infused by game mechanics, work because they are believed to have a positive effect on education. Research on the advantages of virtual learning games requires a more systematic look at game design. Research on adolescent online activity concluded that teachers are expanding lessons to reproduce collective media routines used by students, within a design cycle, might make higher student achievement possible (Boyan 2011; Fahser-Herro, 2010; Johnson, 2013). Su and Cheng (2013) investigated how game-based education affected student's engagement and academic success and reported that eighty percent of students were satisfied, and eighty-three were more confident with

course work after using a virtual learning game. According to Murphy, Science, and Thorndike (2010), if games work because of inspiration, performance, and passion, then developers should consider: what motivates students; why students participate; and the basics of human psychology. Changes in our society support edutainment because today's institutions work to keep pace with technological advances and the demands of digital natives. Educational games should make the learning process more efficient by ensuring content and more enjoyable by increasing motivation, engagement, academic skills, problem-solving, and social interaction.

Motivation and engagement. Edutainment essentially works to only give information once the individual is engaged to having a desire for and usefulness of the information. Motivation help student want to partake in virtual learning games because they get pleasure from simply playing. Motivation is the reason students participate in learning activities. Students' intrinsic drive for support, awards, interest and success influence the effectiveness of knowledge acquisition (Balloffet, Courvoisier, & Lagier, n.d;Fisser et al, 2013; Reeve, 2009). Previous studies sought to demonstrate increased student engagement through the use of virtual learning environments by comparing the benefits of a treatment group of pupils enrolled in a game-based course compared to a control group of students not enrolled (Fisser et al, 2013; Wang & Chen). When students gained mastery of challenging material, the instructional design matched to learner readiness and the achievement was credited to game strategy and preference matching on flow for an entirely engaged experience (Kuh et al, 2008; Wang & Chen, 2010). Educators who embrace the understanding of schematics are more likely to

recognize the importance of students being engaged at the initial point of learning and through the process. Motivation and engagement helps student desire to participate in virtual learning games when they enjoy the benefits of playing as an enduring environment.

Educational entertainment feeds the underlying assumption that the learner must apply understanding to an authentic task through which he/she gains new knowledge and masters new sets of skills. Virtual learning games are designed to sustain motivation by helping the student make emotional connections to content through gameplay. The complexities of design elements help engage the individual within variable context (Fisser et al, 2013; Kuh, Cruce, and Shoup, 2008). Design elements are factors that have some bearing on the effectiveness of students' knowledge acquisition and can impact levels of motivation and promote self-efficacy (Fisser, Voogt, and Bom, 2013; Reeve, 2009). Research studies suggested that without motivation, a player would not experience academic progress; therefore design elements shape the learning experience (Fisser et al, 2013; Wang & Chen, 2010). Application of knowledge and skills is essential to the tools and resources designed by the Edutainment industry. Virtual learning game design should include elements that inspire a desire or compulsion to stay involved in the learning process.

Academic Skills. This type of curriculum and instruction is designed for the individual student. The primary goal of virtual learning game design is to help each student acquire and demonstrate academic skills. More resources are being devoted to the designing virtual instruction with multidimensional characteristics for teaching attitudes

and behaviors that factor into K-12 and higher education academic success (Bonner, 2010; Merchant et al, 2014; Stumm et al, 2011). Combining gaming with academic skills provides a perceptive of both intelligence and diligence (Merchant et al, 2014; Stumm, Hell, and Chamorro-Premuzic, 2011; Tsai et al, 2012). Designing applications relevant to academic skills is measured by the students' ability to perform age-appropriate school activities (Merchant et al, 2014; Tsai et al, 2012). A big contributor to the growth and development of Edutainment is our cultural emphasis on the individual in a society that promotes individual beliefs, values, and expressions. As the field grows, developers consider the integral relationships between virtual learning games and academic achievement to promote scholastic dexterity.

Problem solving. This form of instruction recognizes that as individuals are entertained by various mediums just as students learn in different ways and need differentiated or distributed learning. A successful game-based learning environment supports mental processes through the presentation of meaningful problems and varying levels of challanges. Problem-solving is a vital academic skill that virtual learning games address by helping students understand the effects of a problem and providing the game elements that may apply to the various solutions (Miller and Robertson, 2010; Zichermann, 2011). The learner gains experimentation with perception, reasoning, and judgment in a risk-free learning environment (Klopfer, 2009; Miller & Robertson, 2010; Zichermann, 2011). Evidence suggests that supporting abstract thinking within virtual learning game design helps students come up with creative solutions (Alotaibi, 2014; Miller and Robertson, 2010; Rubin, Watt, and Ramelli, 2012). Design teams need a

strategic plan for moving student attention throughout the learning process state and helping him or her overcome obstacles within an artificially intelligent system.

Social interaction. The smile is a common factor of the human race and the catalyst for the entertainment industry that is both being shaped by and shaping our society. Virtual learning games can empower the learning process by getting students to enjoy the learning process and experience possitive interactions with others. Using games as social environments and applying game mechanics to non-game practices has emerged as an approach to teaching and training (Brunsell & Horejsi, 2013; Panoutsopoulos & Sampson, 2012). Research suggests that virtual learning games can guide the behaviors and beliefs of students through managing complex social interactions (Levine & Hoffner, 2006; Panoutsopoulos & Sampson, 2012). Gaming places social interactions at the core based on pleasurable and exciting experiences in which, gamers receive opportunities for positive motivation, choice, frequent feedback, and rewarding opportunities for increasingly complex content (Brunsell & Horejsi, 2013; Levine & Hoffner, 2006). Virtual learning games may increase social interactions by giving students greater access to diverse populations.

Blending Education and Entertainment

The development of virtual learning games involves blending instructional design and video game design. Instruction designed to create a resemblance of a situation that would occur naturally within a specific cultural setting is complex. Design teams manipulate subject area content and game strategy to create innovative learning experiences by blending the aspects of education and entertainment equitably (Blanco,

Torrente, Marchiori, Martínez-ortiz, and Fernández-manjón 2012; Eseryel, 2014). Blanco et al, (2012) studied the effectiveness and feasibility of applying game strategy to nongame circumstances, as an instructional design approach in the classroom. It is the interactive aspects of video game design that enhance player interaction with the match, thus furthering the purpose of entertainment and education (Blanco et al., 2012; Pernsteiner, Boyer, & Akcaoğlu, 2010). Traditional tools and resources for teaching and learning may not allow for individuals to work at their own pace; unlike most toys, games, and leisure activities. The design and development of a virtual learning game design help shape the educational and entertainment experience.

Educational entertainment addressed the need for incremental learning and knowledge building by leading participants in actively synthesizing ideas. The student/player may have issues with avoiding content, lacking sustained engagement, or encountering inconsistencies in activity rigor. Designers address these issues by embedding authentic, purposeful activities into gameplay for ongoing interaction with content in a logical, consistent, and scaffolded manner (Pernsteiner, Boyer, & Akcaoğlu, 2010). Findings have suggested that learner's interest, involvement, and scholarly accomplishment are significantly affected by the makeup and the pattern of game assignments built into virtual learning games (Charsky & Ressler, 2011; Blanco et al., 2012; Eseryel, 2014). A lesson for designers is that the design goals of project planning should convey the desire to situate player experiences with authentic opportunities to interact with new concepts (Blanco et al., 2012; Eseryel, 2014; Pernsteiner et al, 2010). By simply participating in a game, students have the opportunity to gain a deeper

understanding by interacting, questioning, and continuously improving on ideas. The process of designing a virtual learning game involves high consideration of the learning experience and integration strategies.

Blending education and entertainment requires making decisions and finding creative resolutions concerning educational game development that may improve academic results. Integration strategies consider both known and ambiguous aspects of the virtual learning game intertwined throughout the unit rather than at the end (Blanco et al., 2012; Siko, 2013). Integration models support interdisciplinary collaboration by considering the various perspectives towards creating a real life context where students manipulate subject content (Leinonen, Durall, Kuikkaniemi, Mikkonen, Nelimarkka, Syvänen, & Toikkanen, 2014; Sobhani & Bagheri, 2014). Incorporating individual preferences as players take on increasingly more complicated challenges; levels are designed to include student-centered obstacles to help players navigate complex thinking and the rules of gameplay (Blanco et al., 2012; Kay & Knaack, 2007; Siko, 2013; Sobhani & Bagheri, 2014). A student's prior knowledge is valuable to the learning process because we develop our ways of formulating information by interacting with others in our growing worldview. Design tactics rely on practical methods for integrating gaming and educational principles.

Gaming Principles

The foundation of gameplay design involves varied, and comprehensive gaming principles applied to address the diverse needs of learners. Gaming principles rely on interactive elements to increase students' motivation, satisfaction and achievement by

unlocking achievements as they accomplish levels; failure to a standard allows players to learn from their errors (Blanco et al., 2012; Shen, 2009; Su, 2013). Student-centered learning aligns with the gaming principle of players themselves, often devising tailored design elements, like player profile creation, to improve the platform (Bennedsen & Caspersen, 2008; Shen, 2009; Tsai, 2013). Interdisciplinary collaboration is vital to the design of visual cues to an establishment of setting, characters and mechanics bridging emotional connections to knowledge areas (Bonner, 2010; Sproull, 2011; Su, 2013). Through playing an educational game, students share individual perspectives in a way that results in the individual construction of understanding that may not be reached in a solitary reflection of experience. Software experts apply game mechanics to learning by creating authentic challenges and satisfying rewards.

Game strategy. Participating in an edutainment activity brings about the knowledge and skills for adaptation and organization; concepts that are essential to thinking. Game strategy is a complete algorithm for playing the game that considers the experience from a user perspective to guide a player in every possible situation throughout the match. The benefit of a set of strategies for all players is providing a clear method for representing subject content and gameplay with specified actions (De Castell, 2014; Wu, 2014). Researchers have found that game strategy is an important part of online games and can facilitate a quick sense of community among students by making a game simultaneously meaningful (Marvel, 2012; Wu, 2014). Developers use concept prototyping and pre-existing engines to design game strategy based on shared

experiences (De Castell, 2014; Marvel, 2012; Wu, 2014). Game strategy influences interactions towards instructional goals.

Media flow. Educational Entertainment provides enjoyable ways to engage students in the process of using decisions making skills interpret the world through critical analysis individually and as a corporate function. Virtual learning games rely on real-time communication to enable the students to connect directly and receive a constant stream of information. An important aspect of programming strategies is to recognize the fundamentals of player relationships to the virtual world and allow the student to construct their flow within the gameplay (Hirumi, 2010; Jin, 2012; Sahrir, 2012; Wu, 2011). Adopting agile software development approaches to exploit the connection between systems and their potential to create partner knowledge by focusing on developing consortiums as gateways into software development (Bari, & Ahamad (2011). Self-organizing development teams need instructional design principles to keep students involved in the multidimensional concepts of both educational and entertainment input (Bari, & Ahamad, 2011; Boyan, 2011). Maintaining student engagement from one segment to another is advanced by blending investigation of gaming from the media flow viewpoint with recent educational philosophy.

User interface. Edutainment provides a range of opportunities to enhance gratification for an individual during the learning process. The user and a computer system interaction should result in knowledge and skill development facilitated by input devices and software. Within the virtual learning game environment, the user interface shapes the potential a set of commands for a user's communication (Leffingwell, 2011;

Tsai, Yu1, and Hsiao, 2012). Parts of any program require teamwork to establish programming design for overall contextual guidance within the user interface (Leffingwell, 2011; Leonard, 2010; Tsai et al, 2012). Agile practices enhance the software team's shared understanding of the games appearance, response, and content within the context of the user interface (Bari & Ahamad, 2011; Hoda, Noble, & Marshall, 2013). The notion of entertainment in learning is built upon an understanding of how student involvement relates to academic success. Additional research could explore the interaction between the user; a computer system interaction; the input devices and designing software for academic achievement.

Educational Principles

Philosophies of learning might reduce risks of wasting large amounts of prototyping time associated with monitoring and adjusting approaches to instruction. Research suggested that effective teaching within virtual learning games involves referencing learning theories and progressively refining interactions based on student interaction (Alotaibi, 2014; De Castell, 2014; Hirumi et, al, 2010c; Wu, 2014). Best practices in learning provide a basis for understanding how students organize knowledge and apply what they know to human development (Domjan, 2014; Wu, 2012). Failure to base the educational game design on deep-rooted and practical instructional theories of appropriate teaching roles increases the risk failing to support learning, yielding a student entertained but who has not obtained new skills or knowledge (Well-Romero, 2013; Wu, 2014). Educational principals are essential for a students centered approach to helping players reach measurable learning gains.

A complete range of knowledge and skills are learned by using software to link interactive play with learning modules. Some of the design techniques used in games can represent conditions that are parallel to principles of learning. Serious games are tools that provide goal-directed practice, interpreted by the player, to help explore targeted feedback for various circumstances (Ulicsak, 2010; Wu, 2012). The effects of video games have been proven positive in changing behavior to develop mastery in a variety of practices integrating them within professional settings (Tsai & Fan, 2013; Wu, 2012). Virtual learning game platform types must include serious games that align with educational principles (Clinton & Rieber, 2010; Gorlatch et al., 2012; Merchant et al., 2014). Good teachers continually strive to make to conditions for teaching and learning better for each student. Teaching by the use of game elements is a part of the instructional design within various virtual learning game platforms.

Authentic activities. Providing innovative curriculum and instruction can be a cumbersome task and has led educators to enhancing instruction with Edutainment. Real-life learning is authentic when students create a meaningful artifact to share with their world. Advances in the technology of virtual learning games allow students to see the ideas they learn to come to live in a meaningful way (Alotaibi, 2014; Avouris & Yiannoutsou, 2012; Lombardi, 2007). In gaming, the design elements enable players to experience authentic activities in a setting that is relevant to them by embarking on quests for points, often a measure of a character's learning gains (Avouris & Yiannoutsou, 2012; De Castell, 2014; Wu, Richards, & Saw, 2014). Research studies explored game experts' perceptions of any number of tasks given to students and discovered the importance of

collaborating to design and develop relevant and interesting virtual learning environments (Johnston-Wilder, Tan, & Neill, 2013; Wu et al, 2014). In addition to enhancing instruction, another major role of educational entertainment is providing curriculum and instruction that meets the needs of diverse populations. An even blend of subject content and game elements influence each interaction by facilitating experiences that add value to instruction and learning.

Challenges and rewards. As an instructional methodology, inclusion considers diverse ways of knowing, learning, instructing, teaching and training. Gameplay offers students differenciated challenges, and the delivery of rewards maintains a player's interest in the learning process. Educational principles, such as steadily increasing levels of difficulty with steps up in rank and contextual feedback with new tools or spaces, support learning for players driven to explore (Whitton, 2014). Virtual learning game design consists of random choices that bring consequences and all option outcomes that may impact the student as relevant factors (Starks, 2014; Wu, Hsiao, Wu, Lin, & Huang, 2012). The designer's goal and the purpose of virtual worlds are the player's exploration of self while achieving completeness and by providing gamers with the positive experience of overcoming a challenge (Majgaard, 2014; Whitton, 2014). Challenges and rewards are a useful part of influencing the players' game strategy within the virtual learning game.

Mental models. Edutainment is beneficial to the learning experience because this type of curriculum and instruction makes a direct connection to an internal representation of the student's world. The game's internal symbols are designed to represent external

realities to shape behavior in performing a task based on educational principles. The construction of mental models and the improvement of a broad range of skills are outcomes resulting from playing a virtual learning game (Boyan, 2011; Kickmeier-Rust & Albert, 2010). Interdisciplinary collaboration is necessary to perceive reality and replicate the important details that encapsulate what is popular to students and the diverse customs in which the likelihood may occur (Marvel, 2012; Shelton, 2011; Wu, 2014). Future studies can build on previous discoveries about arranging the convolution of reality into simpler psychological ideas (Hirumi et al., 2010a, b, c; Marvel, 2012; Shelton, 2011; Wu, 2014). The Edutainment industry supplies tools that use the student's point of view to personalize instruction. Each mental model represents a possibility for instruction to capture common experiences within different ways interdisciplinary design teams may approach them.

Interdisciplinary Design Teams

Various new curriculum design strategies work to increase discovery learning in the classroom. Collaborative practices support interdisciplinary teams in the course of incorporating education and entertainment within virtual learning games. Past research indicates that development teams need to institute a formal process to complete work, reach clear goals, and experience better communication among team members to develop innovative learning experiences (Dittman, Hawkes, Deokar, & Sarnikar, 2010; Goldstone, 2009). The concepts agile methods, interdisciplinary collaboration, and integration models are prevalent in research on educational games (Marvel, 2012; Shelton, 2011; Wu, 2014). Since agile methods require cross-functional teams,

practitioners must be self-motivated and reflective (Dittman, et al, 2010; Hoda, Babb, & Norbjerg, 2013). Games use imagination, curiosity, and require participants to exercise will-power such as games which involve fighting, chasing, social and family interactions. Interdisciplinary collaboration is beneficial to many fields of study, but necessary for designing virtual learning games.

Changes in our society reflect demands and expectations for entertainment, technological convenience, and satisfying lifestyles. Interdisciplinary design teams work together using several design strategies to create educational games that meet industry standards in both education and entertainment. Software development teams should be equipped with a variety of skills and tools to use effectively emerging technologies (Delacruz, 2009;Hoda et al, 2013; Wu, 2014). Particular insight into agile methods and the divergent characteristics of an interdisciplinary team, a single integration model, cannot adequately represent design procedure (Dittman, et al, 2010; Rapanta et al., 2013). Individual practitioners guide best practices in the field of software development and rely on each other for consultant expertise (Hoda et al, 2013; Mangalaraj et al., 2014; Marvel, 2012). The notion of providing students with pleasurable experiences interrupts the formal learning sector as a force that impacts the future of distance learning. Therefore, positive interactions between interdisciplinary design teams are essential to the design and development process.

How educators and engineers relate to each other impacts the overall development of an educational game. The communication process among team members is related to team dynamics because useful blueprints of designing become apparent during an

exchange of ideas (Ahmad, M., Rahim, L. & Arshad, N 2015; Mangalaraj et al., 2014; Rapanta, Maina, Lotz, & Bacchelli, 2013). According to Mangalaraj, Nerur, Mahapatra, & Price (2014), interdisciplinary teams need design-centric research that empirically examines the efficacy of modern software practices such as design patterns and pair designing. Studies outline several integration approaches, but Hirumi (2010c) suggested that Jacob's Ladder Pre-Production Design Tactic for supporting interdisciplinary collaboration between educators and entertainers working collectively to create a virtual learning game. The tools and processes that influence competencies, collaboration, roles in game design, and teamwork are essential to designing virtual learning games.

Collaboration

Collaboration can be a problematic endeavor because providing direction for the team has the added task of including educational standards in the development. In an ideal world, software teams regularly engage in practices that enhance management systems, technical skills, and cross-functional proficiency (Hoda et al, 2013; Hirumi et al., 2010). An interdisciplinary collaboration between engineering and educators is needed to address the non-traditional elements of educational games (Celedón-Pattichis et al., 2013; Mohtashami, 2011). In addition to the inclusion of suggested models of interdisciplinary collaboration, researchers describe cooperation as the most important aspect of integrating subject matter and game strategy (Hirumi et al., 2010; Mohtashami, 2011; Tan, 2010). Certain historical constructs such as language, mathematical symbols, and understandings of nature are solely based on the inherited culture and background of

each individual.The process of designing a virtual learning game includes individual expertise and the ability to work with others.

As the individual receives more exposure to shared international social norms, it changes the learning by using the global community as the basis of evaluation. Adequate professional knowledge and collaboration are necessary for modifying instructional and gaming principles, so they are well suited for a virtual learning experience. Creating effective computer lessons require enormous resources and often educators and entertainers are in need of joint processes to support communication infrastructures (Popa & Stănculea, 2012; Siko & Barbour, 2014). According to Pirola-Merlo (2010), collaboration towards project progress is impacted by the encouragement of innovation, task guidance, and member safety. A positive relationship between virtual learning game designers allows each contributor to share his or her expert experience within the design and development process (Ahmad et al, 2015; Delacruz, 2009; Siko & Barbour, 2014; Popa & Stănculea, 2012). Educational entertainment uses amusing ways to provide interactions that help each learner distinguish social meaning and reach learning goals from fun experiences. The varying roles on a game design team require collaboration, in particular for those working to blend subject area content and gameplay.

Roles in Game Design

Successful interdisciplinary teams clearly distinguish the roles and responsibilities of each team member. Respecting individual roles and autonomy helps experts overcome a constrained design approach to integrating game activity with educational goals (Shelton & Scoresby, 2011; Gunter et al, 2006). Individual tasks and simultaneous

integration of gameplay and subject content can be difficult without an appropriate merger of expertise and equal input (Gunter, Kenny, & Vick, 2006; Shelton & Scoresby, 2011). The long-term goal is to encourage innovative design by varying roles in the development of intelligent virtual learning environments (Gutierrez-Santos et al, 2012; Hoda et al., 2013). This type of curriculum and instruction is responsive to our cognitive need for relevance when instructing all ages. The process of designing an educational game requires each team member to carry out various roles and establishes a clear direction for team support and supervision.

Role interdependence ensures that learning theory and educational research is used to enhance teamwork. By combining the engineering and education task, we create a strong and diverse team who can implement the curriculum within a virtual learning game (Celedón-Pattichis et, al, 2013; Deshpande, 2015; Shelton & Scoresby, 2011). According to Pirola-Merlo (2010), there is a positive connection between team focus on innovation and the degree of success experienced by the development teams is influenced by individual roles. Interdisciplinary collaboration with documented outcomes supports each team member's roles based on his or her area of proficiency (Hoda et al., 2013; Shelton & Scoresby, 2011). Virtual learning game design is complex and requires experts who respond appropriately to each other and the particular needs of students.

Teamwork in collaboration. Many nontraditional education options are now available and continue to evolve; the Edutainment industry has emerged as more curriculum and instruction is designed in nontraditional learning environments. Teamwork is critical for effective and efficient operation among interdisciplinary groups.

Interdisciplinary teams foster teamwork by following an interactive or agile style of development that adjusts to technology advances and changing student needs (Blanco et al, 2012; Yu & Petter, 2014). In virtual learning game design, collaboration involves cooperation, joint effort, partnership, and communication among game designers to provide players with more meaningful actions (Hirumi et al, 2010c; Tan, 2010). Reflective practice can encourage teamwork by helping teams value time devoted to professional development and recognize the valuable input of others (Hoda, Babb, & Norbjerg, 2013; Tan, 2010). Educational software development teams need the combined efforts of both education and entertainment experts in an equitable way.

High-quality teachers continually strive to make to conditions for teaching and learning better for each student. Successful team processes support collaborative decisions and opportunities for solidarity. Through teamwork, educators and engineers can maximize advances in digital technologies and support the community of programmers in the field of virtual learning game design (Boyan & Sherry, 2011; Celedón-Pattichis et, al, 2013). According to Gutierrez-Santos et al, (2012), providing computer-based support for an exploratory learning environment involves; identification of feedback strategies, the collection of evidence, and reasoning from the evidence to deduce when to follow a particular feedback strategy. Using integration models can promote an exchange of ideas and greater interdisciplinary collaboration for instructional game design (Boyan & Sherry, 2011; Moore, 2005;Tucker & Armstrong, 2008). Team culture can entail a broad range of issues that interdisciplinary groups address with varying software development strategies.

Software Development

In the field of virtual learning game design, the pre-production phase of software development describes the content and rules of the virtual learning environment. A game design team shapes instructional design by producing an initial game proposal containing the concept, narrative, setting, and game elements (Bari, & Ahamad, 2011; Boyan, 2011; Jin, 2012). Research findings suggested that participants in educational games profit from a mixture of traditional education and gamification fueled by software development (Boyan, 2011; Kickmeier-Rust & Albert, 2010). Kickmeier-Rust and Albert (2010) explored micro-adaptively to protect against immersion within ineffective games and used interventions to demonstrate and evaluate educational concepts. Software development is complex when applied to an agile team developing a virtual learning game.

The Edutainment industry encompasses various forms of new media and extrapolating from these varied sources allows extraordinary things to be possible. Adaptive Software Development (ASD) is a strategy used by self-organizing groups based on rapid application development. The connection between self-organizing teams and virtual learning game design provides an opportunity for a substantial advancement in the success rate of software projects (Hoda, 2013; Szalvay, 2004). Through the analysis of three specific agile practices, Yu & Petter (2014) demonstrated how specific agile software development methodology could enable better collaboration within interdisciplinary teams. Adaptive Software Development (ASD) relates to Jacob's Ladder Pre-Production Design Tactic because agile methods are most suitable for

interdisciplinary experts blending instructional and entertainment design (Hirumi et al, 2010c; Highsmith & Bayer, 2006). In the study of virtual learning games, the concept of Adaptive Software Development (ASD) aligns with interdisciplinary collaboration during the pre-production phase of virtual learning game development.

Understanding what makes learning fun is the key to engaging students and interesting them in learning. Software development methods, such as using design tactics, can guide the self-organizing roles of an educational game design teams. To consider self-organization practices based on shared mental models, researchers identified multiple agile practices, stated benefits from practice, and challenges of implementation (Szalvay, 2004; Yu & Petter, 2014). Hoda (2013) suggested using an agile coach and the importance of being aware of the self-managing temperament of these functions to bring about their appearance rather than imposing them on team members. Research supporting the self-organizing roles of many development teams helps to enlighten our understanding of interdisciplinary collaboration in the workplace (Hoda, Noble, & Marshall, 2013; Yu & Petter, 2014). The Edutainment industry helps teachers use differentiation to help students exercise higher order thinking skills. Dynamic teamwork and interdisciplinary collaboration in game design fits the model of agile strategies in guidance of self-organizing teams.

Pre-production. Differentiating via production means that students have more choice in how they will demonstrate to the teacher, class, or other audience what they have learned. The pre-production phase of educational software development plays an essential part of the instructional experience. The rules and narrative determine how

easily students function within a virtual learning game (Nancarrow, Booth, Ariss, Smith, Enderby, & Roots, 2013; Van Eck, 2011). Today's games are more social and allow students to express themselves while learning and engaging in social issues that can incorporate many aspects of civic life for more meaningful insights in all academic areas (Alotaibi, 2014; Boyan, 2011; Eseryel, 2014). The focus of this type of software development is tailoring personal gaming encounters by establishing a suitable equilibrium between academic test, the learner's aptitude, and the individual learning development (Boyan, 2011; Eseryel, 2014; Kickmeier-Rust & Albert, 2010). The pre-production phase of virtual learning game design sets out to make the attainment of knowledge and skill more appealing and valuable.

Agile software design. In the design of virtual learning games, active software development is suitable for tailoring pre-production design goals with long term objectives. Game companies creating virtual worlds utilize specific techniques, such as continuous integration. These techniques focus on code, creativity, and community to improve project agility (Collier, 2011; Roquilly, 2011). The multiple roles of a virtual learning game design team provide spontaneous self-organizing team support that permits the tackling various projects. (Hoda, 2013; Roquilly, 2011). Practitioner experiences within self-organizing teams that promote development, teamwork and program adaptability is a research gap (Hoda, 2013; Roquilly, 2011; Yu & Petter, 2014). The adaptive nature of agile software design structure is for the continually changing stages of virtual learning games.

Segments in game design. In addition to tailoring innovative strategies, segments in game design encourage continuous revolving stages to prioritize customer satisfaction. An adaptive socio-technical system is necessary to maintain mobile development within virtual learning game design (Hoda, Noble, and Marshall, 2013). This part of conception helps to determine the rules impacting the psychological and social aspects of gameplay (Hoda, 2013; Yu & Petter, 2014). The timing of software delivery is vital, Yu et al., (2014) explored how new software is frequently delivered by the combination of fundamental rules as stages or segments in game design to direct players' interactions in weeks rather than months. Design teams work together to address the varied segments prioritizing timing and player interaction in virtual learning game design.

Shared understandings. Altering the methods of instructional design or content organization to facilitate learning is a common using educational entertainment. The software development team consists of interdisciplinary experts interacting as a single entity with varied approaches to blending subject content with game strategy. Past research on virtual learning games may apply to digital game-based learning provides essential foundations for supporting shared awareness for educational software development teams (Dittman at. al, 2010; Moe, 2015;Van Eck, 2011). These presumptive shared understandings among design team members spur development of relationships and space within the games to simulate complex social context (Boyan, 2011; Dittman, Hawkes, Deokar, & Sarnikar, 2010; Siko & Barbour, 2014; Van Eck, 2011). Design research on using gaming as an instructional strategy suggest that development teams should understand cognitive load, engagement, artificial intelligence, and collaborative

psychology for a solid underpinning from which to design instructional games (Siko & Barbour, 2014; Van Eck, 2011). Shared mental models support interdisciplinary collaboration in virtual learning game design.

Design Strategies

Educational Entertainment embodies curriculum and instruction that provides students' success through the practice of inquiry. There are several strategies or design plans for creating the virtual learning game. Design frameworks provide a schematic view of how core element of design guide students through a particular set of emotions and instincts (Dillon, 2010; Gershenfeld, 2014; Tan, 2010). Development teams should consider various aspects of games, such as mechanics, dynamics, and aesthetics by exploring precise explanations for these terms concerning the player's experience (Hunicke et al, 2004; Kanuka, 2008; Su, 2013). Design tactics, such as Jacob's Ladder Pre-Production Tactic, help delineate the components of interactive entertainment and pedagogy during design (Hirumi, 2013; Hirumi et al, 2010c; Kickmeier-Rust & Albert, 2010). Design approaches such as the (1) Mechanics, Dynamics, Aesthetic framework, (2) the Actions, Gameplay, Experience framework, and (3) the Jacob's Ladder Pre-Production Tactic are examples of integration models.

Mechanics, dynamics, and aesthetics framework (MDA). Design teams make critical decisions about the learning experience by inventing game elements. Many decisions are made during the game's design to determine which elements are consistent with the game's vision and learning outcomes (Hunicke et al, 2004; Kanuka, 2008; Su, 2013). This approach is a method for addressing choice of design, MDA is a prescribed

way of understanding game design, development, and exploration (Hunicke et al, 2004). There is overwhelming evidence in virtual learning game design that the meaningfulness of games is relevant to the ideas of those who create them (Hunicke et al, 2004; Su, 2013). Perceiving games as vigorous structures helps develop procedures for interactive design to improved elements for desired response from players.

Recognizing the importance of enjoyment is a major contribution of this type of design thinking. Using the MDA framework can help agile software teams set goals and arrange mechanics accordingly. The design process varies, and companies have different procedures and philosophies for approaches to start with an idea or a copy a previously built game (Merchant, 2014). The MDA approach clarifies the iterative processes of developers and researchers who study the development of games and objects within games (Hunicke et al, 2004). As with Jacob's Ladder Pre-Production Tactic, the game narrative is often the starting point for creating a game or to aligning game mechanics (Hirumi et al, 2010c; Merchant, 2014; Shelton, 201; Su, 2013). The MDA framework and other integration models like it seek to guide the design process.

Actions, gameplay, experience framework. The field of virtual learning games benefits from having a set of precise methods for teaching developers how to analyze and understand games. Outside factors such as technology budgets cuts or changes in learner outcomes result in a streamlined design with only the essential features (Dillon, 2010; Gershenfeld, 2014; Tan, 2010). Building on the MDA model, the AGE framework introduces an approach for teaching environments where beginning game designers formalize their ideas in a consistent fashion (Dillon, 2010; Yu, & Petter, 2014). As the

production progresses, artists are asked to make everyday decisions about including additional elements to predict creating the full implementation of subject content and game strategy (Dillon, 2010; Gershenfeld, 2014; Tan, 2010). Integration models, such as the AGE framework can help a design team prioritize resources.

These design strategies were developed in response to a need for curriculum and instruction that students enjoy. The AGE approach to integration can prevent misinterpretations of program details in virtual learning game design. A playful and reflective game designer understands the consequences of each decision and encountering the unknown features of the production process (Zichermann, 2011). Designers' attention to detail is appropriate for approval in the commercial setting because the prototype impacts a virtual learning game continuous adoption from the earliest stages (Majgaard, 2014; Zichermann, 2011). Subject content and game strategy are embedded within the narrative described by the pre-production phase of design (Hirumi et al, (2010c; Majgaard, 2014; Zichermann, 2011). The environment in which we learn has become just as important as the content being taught to many educational psychologists. The Mechanics Dynamics and Aesthetic framework (MDA) and The Actions, Gameplay, Experience frameworks are examples of integration approaches that form the foundations for Jacob's Ladder Pre-Production Tactic.

Jacob's Ladder pre-production tactic. The Jacob's Ladder Pre-Production Tactic has aspects similar to other design frameworks, but focuses on blending education and entertainment uniformly. Designing a virtual learning game requires a clear view of how the overall experience will help students reach learning goals (Dillon, 2010;

Gershenfeld, 2014; Hirumi et al, 2010c). The Jacob's Ladder Pre-Production Tactic allows for an inclusive view of a game in a coherent manner where its core gameplay elements clearly relate (Hirumi et al, 2010c; Kanuka, 2008). Design tactics, such as Jacob's Ladder Pre-Production Tactic, can help organize the major components of the virtual learning game subject content and gameplay (Hirumi et al, 2010c; Kickmeier-Rust & Albert, 2010). Jacob's Ladder Pre-Production Tactic can influence collaboration among interdisciplinary design teams working in a self-organized manner.

The development of educational games is an intricate process. The benefit of integration tools and formal models is that it forces the designer into a given standardized workflow and methodology, which may be useful for production purposes (Gershenfeld, 2014; Hirumi et al, 2010c). Integration tools may be used to synthesize connections between pedagogical assumptions, instructional approach, student relations, and the use of promising technologies (Bari & Ahamad, 2011; Hirumi, 2013). According to Jacob's Ladder Pre-Production Tactic, Instructional design focuses on the learners, learning outcomes, content/subject matter, instructional strategies & events, learner assessment, and learning performance context (Hirumi et al, 2010c). The ideas of play theory suggest that educational entertainment is beneficial to the learning experience because this type of curriculum and instruction makes a direct connection to an internal representation of the student's world. Developer perceptions of Jacob's Ladder Pre-Production Tactic can influence the process of designing virtual learning games.

Summary

The major themes associated with virtual learning game design includes blending education with entertainment, agile software development, and interdisciplinary collaboration using integration strategies, such as the Jacobs' Ladder Pre-Production Tactic. Literature explores how virtual learning games designed for enjoyment, and may be aligned when educators and engineers work together to blend education and entertainment (Hirumi et al, 2010a,b,c; Mohtashami, 2011; Whitton, 2012). Instructional designers of virtual learning games find integration tools essential to interdisciplinary collaboration (Hirumi et, al, 2010; Mohtashami, 2011). To date, research does not explore how agile software team members describe their experience of using Jacob's Ladder Pre-Production Design Tactic in virtual learning game design (Hirumi et, al, 2010a,b,c). A review of software development's reliance on agile practices gives good reasons for learning more about integration models.

The perceptions of developers using the Jacobs' Ladder Pre-Production Tactic remain a fertile research area to explore. Likewise, identification of how this tool may influence interdisciplinary collaboration also needs further study (Hirumi et, al, 2010a,b,c; Yu, 2014). Integration tools serve as a principal instrument for development teams benefiting from the expertise of both educators and engineers (Anderson, 2008; Squire, 2011; Moe, 2015; Yu, 2014). Absent from research literature is an explanation of what agile software team members experience in using design tactics such as The Jacob's Ladder pre-production design tactic and what they identify as beneficial or non-beneficial characteristics of Jacob's Ladder Pre-Production Design Tactic in developing virtual

learning games (Hirumi et, al, 2010a,b,c). Prior researchers with expertise in technological systems, gaming, and educational models have set the foundation for a strategic plan that designs virtual learning games for new generations.

Conclusion

Specialists, administrators, and educators must be equipped to increase the use of technology in learning environments. Virtual learning game design benefits from exploring interdisciplinary collaboration among members using Jacob's Ladder Pre-Production Tactic. Research suggested that agile methods, interdisciplinary collaboration, and integration models are essential to virtual learning game design (Marvel, 2012; Shelton, 2011; Wu, 2014). The lack of investigation into active groups in virtual learning game design denotes a small amount of empirical evidence to demonstrate how interdisciplinary teams systematize subject content and gameplay (Hoda, 2013; Yu & Petter, 2014). Research studies described the tendencies and concerns in instructional technology based on the greater use of games for learning by adolescent and recommended exploring Jacob's Ladder Pre-Production Design Tactic to support educational game design (Hirumi, 2010; Shute, Rieber and Van Eck; 2011). Exploring the benefits of daily social interactions, stimulated through entertainment, promotes Edutainment and the use of social interaction to aid students in acquiring significant social meaning. A gap remains from existing studies and leaves a need for further exploration of how integration models influence design tactics within agile teams.

Previous research fails to describe the aspects of Jacob's Ladder Pre-Production Design Tactic that software team members believe influence interdisciplinary

collaboration. Therefore, the proposed research study investigates the integration of subject matter and game strategy. Full details concerning the proposed research study are in Chapter 3. The study's analysis and findings communicated in Chapters 4 and 5.

Chapter 3: Research Method

This phenomenological research study explored the experience of using the Jacob's Ladder pre-production design tactic and its influence on interdisciplinary collaboration during agile game design from a developers perspective. I used semi-structured interviews as the primar method for data collection (see Bailey, 2014; Maxwell, 2013). Findings were linked to themes I identified during the process of data analysis including self-governing groups, interdisciplinary collaboration, and integration tools. Edutainment-based instruction encompasses curricula that measure students' success through their practice of inquiry. In this study, I addressed the significance of the Jacob's Ladder pre-production design tactic in designers' lived experiences of designing a virtual learning game. The components of Chapter 3 include an introduction, an explanation of the research design and reationale, a description of my role as the researcher, details about the methodology, and an explanation of how issues of trustworthiness were addressed.

Introduction

I designed the research methodology according to the purposes, utility, and validity of findings, and to plausible alternatives to the process of creating virtual learning games. The phenomenological framework can provide an in-depth understanding of the conscious experience of collaborative practice in the design process of a virtual learning game. My research method included identifying presuppositions, exposing ideas emerging from the data, providing analysis, and describing the designers' experiences of using Jacob's Ladder pre-production design tactic. While previous

research has documented useful information about blending content and game elements, researchers have not examined how specific models might influence interdisciplinary collaboration in a self-organized group (Hirumi et al. 2010 a,b,c; Majgaard, 2014). A virtual learning game design team typically consists of five to ten members, and research has indicated that a smaller sample size is appropriate for gaining greater depth in qualitative studies (Bailey, 2014; Luo, 2011). The use of computer games by children and the growing interest in the potential of commercial games for learning is important to schools. In this study, I examined how agile software design team members intentionally used a particular integration model to create an educational game, and I explored its influence on the experience of interdisciplinary collaboration.

Research Design and Rationale

Using a phenomenological approach, I asked participants to consider their experiences with, and the benefits and limitations of, using Jacob's ladder the pre-production design tactic for designing virtual learning games. In order to understand human behaviors and determine what factors influenced them, qualitative methods help researchers interpret a unique situations that quantitative data may not explain (Bailey, 2014; Craver, 2014; Moran, 2000). Qualitative research methods are ideal for exploring social dynamics, such as interdisciplinary collaboration, through the perspectives of people who experience them directly (Luo, 2011;Van Manen, 2014). Data that emerge from phenomenological studies consist of detailed information and insights about participants' experience with others (Bailey, 2014; Kaufer and Chermero, 2015). In this

phenomenological study, I sought to provide a profound understanding of team member experiences in the process of designing a virtual learning game.

Specifically, I explored how the Jacob's Ladder pre-production design tactic influenced agile software teams as they created virtual learning games. For the purposes of this study, social science qualitative methods were more appropriate, and I used an interview data collection guide (see Husserl, 2012; Maxwell, 1996) as a common data collection tool. I used specific interview questions about agile practices and interdisciplinary collaboration in software development. The central questions that guided this study were:

Primary Research Question: What are the experiences of agile software teams when using tactics designed for interdisciplinary collaboration such as the Jacob's ladder pre-production tactic?

Subquestion 1: How does the Jacob's Ladder pre-production design tactic influence the experience of agile software teams as they create virtual learning games?

Subquestion 2: How do agile software team members describe their experience of using the Jacob's Ladder pre-production design tactic in designing virtual learning games?

Subquestion 3: What benefits and/or hindrances do agile software team members experience when using the Jacob's Ladder pre-production design tactic?

Interview transcripts from the research site members who participated in a virtual learning game design team showed detailed information about participants' experiences as well as their attitudes, opinions, and values (see Craver, 2014) in relation to

interdisciplinary collaboration among development team members. Phenomenology research methodology helped me find meaning in the participants' experiences of virtual learning game design and the significance of the Jacob's Ladder pre-production design tactic in the process.

The experience of participants in interdisciplinary teams using the Jacob's Ladder pre-production design tactic during the prototyping stages of virtual learning game design was the focal topic for this study. I employed qualitative research methods to explore social dynamics through the perspectives of people who experienced them directly (see Craver, 2014; Dermot, 2000). I met with participants in an online collaborative space, and data that emerged from interview transcripts contained detailed information and insights about participants' experiences in virtual learning game design. Qualitative methods are appropriate for interpreting a unique situation that quantitative data may not explain (Bailey, 2014; Craver, 2014). In this inquiry, I explored what agile software team members identified as characteristics of integration models important in developing virtual learning games, and how they experienced using an integration model during design.

Role of the Researcher

I used an interview protocol that consisted of open-ended questions about participants' experience with virtual learning game design, and about the influence of the Jacob's Ladder pre-production design tactic on creating a prototype document. The non-profit group was willing to support this interdisciplinary collaboration research as documented with a Letter of Cooperation, a practice suggested in the literature (Hirumi et

al. 2010a,b,c; Husserl, 2012). As the literature indicated, the best way to capture people's experiences and their attitudes toward and opinions of social interactions is by talking candidly to them (Bailey, 2014; Luo, 2011). Individual participants received a detailed essay on research findings after my analysis of the information. I also sent unofficial associates or persons who could possibly be influenced by the research actions or consequences a general research summary after data analysis, as suggested by Husserl (2012) and Maxwell (1996).

The research site is a virtual workshop for connecting with people, developing resources, and supporting edutainment. As described on its website, the study site is a national charity organization established in 2010 that "provides free and discount priced tickets for low income families" and provides a "variety of edutainment activities" to promote entertaining learning experiences for these low-income families. At the time of this study, the research site currently had three founders, of which I am one, who identify and secure donations or in-kind offerings of tickets for those the organization serves (Aspire, 2016). All other members at the research site are community volunteers and free of risk (see Van Manen, 2014); these volunteers include educators, programmers, producers, product managers, designers, animators, and sound engineers who serve on the Edutainment Development Team. Volunteers participating in the Game Development Team create the games, and comprised the population from which I drew participants.

As a founding member of the organization, I received early access to the virtual space, and was involved in building the volunteer community. I serve on the research and development team, but have no power or perceived power to exert over other groups

in the organization because we are all volunteers. The structure of this group was ideal for investigation because self-organizing teams are commonly made up of volunteer or independent members working in an interdisciplinary community (Hirumi et al. 2010 a,b,c; Majgaard, 2014). My role as the researcher was to study the development team while taking actions as recommended by Maxwell (2013) to decrease any threat to participants. I ensured members understood that, just as their educational game design team membership was not compulsory, neither was participation in the study. Participating in the Edutainment Development Team at the research site is completely voluntary as was participation in the research study.

My role as a founding member did not conflict with individual participation in the game design team because this group was self-organizing and all design teams are made up of community volunteers. Maxwell (2013) suggested participants be colleagues, not subordinates, and I have no supervisory role in the game design team and am not a participant on the virtual learning game development team. My colleagues knew that the data collection was not part of their membership at the research site or any other aspect of my title as a founding member. Data collection was separated from my involvement with this organization to make sure that possible participants did not feel coerced into taking part in the research study.

The Edutainment Development Team is a self-organizing group, and I took steps to reduce any risks to participants. Before the study began, I sent each participant information about the study, a statement of confidentiality, and a consent form as recommeded in the literature (Dermot, 2000; Husserl, 2012). Interviews were used to

capture designers' experiences and their attitudes toward and opinions about interdisciplinary collaboration by talking candidly to them (see Bailey, 2014; Luo, 2011; Van Manen, 2014). Irvine (2011) suggested a small sample of no more than 10 participants is appropriate for interview instrumentation to gather the participants' descriptions of their experience. Group membership and participation in the research study were voluntary, and research participants were unpaid contributors whose agreement to participate was documented with a consent form after Walden University Institutional Review Board (IRB) approval number 06-08-16-0169230.

Methodology

This qualitative research methodology considered participant selection logic, instrumentation, data collection, and data analysis. Phenomenological research is ideal for exploring lived experience (Dermot, 2000; Husserl, 2012) and was used in this study to examine an interdisciplinary team's experience in the process of developing a virtual learning game and to better understand the phenomenon of using Jacob's Ladder Pre-Production Tactic. This qualitative methodology emphasizes the implementation of activities that highlight links between real-world situations, as proposed by Panoutsopoulos (2012), for exploring collaboration. I followed an interview protocol, described by Irvine (2011) and Craver (2014), that included preparing recording equipment, notebooks, consent forms, and explaining the content in a way that was simple for participants to understand. As a researcher of international participants, I was conscious of the pertinent human subjects protection laws and individuals overseeing research within other countries and complied with the relevant international compilation

of human subjects policies. All team members were fluent in English and no translations were needed.

In order to capture all the data, I condensed the data gathered into categories and then themes that were interrelated to answering research questions. I transcribed the recorded data from the interview soon after each meeting, as suggested by Miles (2014), to identify missing information and revise the data collection guide. After all the data were collected, I labeled units of meaning within the transcripts with codes based on words expressed by interviewees or interpreted terms as advised by Bailey (2014) and Patton (2002). As suggested in the literature (Maxwell, 2013; Dermot, 2000), data were organized by theme and did not include any statements unrelated to the research questions. Codes reflected participants' statements about their experiences with game-based learning, how they felt about the experience of designing virtual learning games in a team, and the factors that influenced their ability to collaborate using integration models.

Gathering information from semi-structured interviews provided a broad range of data and the data collection guide helped to capture the essential information in a standardized format. I asked questions and listened to the participants' responses and asked follow-up questions as needed, following the advice of Husserl (2012). I expressed interest in the participants' responses and maintained a friendly tone of voice to convey an open stance as others advised (Irvine, 2011; Maxwell, 2013). In this study, I provided a better comprehension of how Jacob's Ladder Pre-Production Design Tactic (Hirumi et al, 2010c) was used in agile practice. I employed phenomenological research throughout

the study methodology. The goal of this qualitative phenomenological research was to describe an interdisciplinary team's lived experience in the process of developing a virtual learning game and to better understand the phenomenon of using Jacob's Ladder Pre-Production Tactic.

This phenomenological study involves the four steps of bracketing, intuiting, analysis, and description of the Jacob's Ladder Pre-Production Tactic. During bracketing, I isolated designers' perceptions of the Jacob's Ladder Pre-Production Tactic from previous experiences with interdisciplinary collaboration. During intuition, I found common understandings as they emerge from organizing data. During analysis, I applied pre coding and computer assisted codes to identify the common themes of using the Jacob's Ladder Pre-Production Tactic. During describing I provided a written handout and verbal debriefing (Hirumi et al, 2010 a,b,c; Majgaard, 2014; Van Manen, 2014) to illustrate the influence of Jacob's Ladder Pre-Production Tactic The following sections describe participant selection logic, instrumentation, procedures for recruitment, participation, data collection and data analysis plans.

Participant Selection Logic. A phenomenological approach to participant selection isolated The research site designer's perceptions of the Jacob's Ladder Pre-Production Tactic from previous experiences with interdisciplinary collaboration. The research population was individuals who used the Jacob's Ladder Pre-Production Tactic as a tool for designing a virtual learning game. The population of interest included the members of the Edutainment Development Team, and represented interdisciplinary collaboration a described by Majgaard (2014). The educational game design team was a

self-organized group that included both educators and engineers, crossing disciplinary boundaries (Aspire, 2016). I sent a recruitment message to all design team members explaining the study and indicating the criteria for participation and asked interested persons to contact the researcher.

To qualify for this study, a study participant met the following criteria:

1. Was an active member of Aspire Innovative Learning, Inc.
2. Participated in an educational game design team.
3. Had expertise in an area of education or engineering.
4. Used the Jacob's Ladder Pre-Production Design Tactic tool for virtual learning game design.

The sampling strategy represented the larger population of designers by focusing on a self-governing group of educators and engineers to better understand the Jacob's Ladder Pre-Production Tactic influence on interdisciplinary collaboration. With a goal to provide fun learning experiences for all learners, Aspire notes on its website that it relies "on edutainment-based instruction because it is proven to increase student engagement (AspireIL, 2016). A total of 7 team members agreed to participate representing both education and engineering perspectives.

Instrumentation. I used a data collection guide (see Appendix B: Data Collection Tool) that consisted of information requested of every participant. According to Bailey (2014), researchers use guides to ensure that they collect the complete spectrum of information that they need. The interview guide led to individual descriptiosn of shared involvement with virtual learning game design, interdisciplinary collaboration, and the

Jacob's Ladder Pre-Production Tactic. I encouraged participants to give a full description of their experience to recognize and specify the overall assumptions of the Jacob's Ladder Pre-Production Tactic.

The data collection focused on open-ended questions that allowed me to explore multiple aspects of creating virtual learning games from the point of view of the research study participants, as strategy recommended by others (Englander, 2012;Van Manen, 2014). Participants lived experiences with interdisciplinary collaboration builds on previous research (Dermot, 2000; Husserl, 2012) by asking how integration models influence virtual learning game design. To fully describe how participants view the Jacob's Ladder Pre-Production Tactic, I bracketed out, as much as possible, previous experiences with virtual learning game design. The interview questions concentrated on assembling data that helped describe experiences of using the Jacob's Ladder Pre-Production Tactic and in due course presented a composition of the common experiences of the educational game designers.

The communication progression is a significant part of the recruitment, participation, and data collection procedures. The open-ended questions in the data guide were separated into three major sections: (a) influence on team experience (questions 1-4); (b) influence on individual experience (questions 5-8); and (c) benefits and hindrances experienced (questions 9-11). A summary question (question 12) asked if there was anything else the team member would like to share about the process of working in an agile team using Jacob's Ladder Pre-Production Tactic. Each interview lasted one to one and a half hours. Research participation was not anonymous, but confidential and

following the collection of member data all identifiers were removed from the dataset and participants were assured of confidentiality, as described by Miles, Huberman, and Saldana (2014). I followed a qualitative research protocol to understand human behaviors (Husserl, 2012; Dermot, 2000) associated with interdisciplinary collaboration for virtual learning game design. Table 1 illustrates how the research questions, data collection guide, and interview questions aligned.

Table 1

Research Questions and Data Collection Guide

Research Question	Guide Sections	Interview Questions
1. How does Jacob's Ladder Pre-Production Design Tactic influence the experience of agile software teams as they create virtual learning games?	Influence on team experience (Questions 1-4)	1.What words would you use to describe Jacob's Ladder Pre-Production Design Tactic? 2. From your experience, what does it mean to use this tactic within an agile software team? 3. Describe your experiences with interdisciplinary collaboration as you design games using the tactic. 4. In what ways does the Jacob Ladder's Pre-Production Design Tactic influence the work of the agile group?
2. How do agile software team members describe their experience in using Jacob's Ladder Pre-Production Design Tactic in designing virtual learning games?	Influence on individual experience (Questions 5-8)	5. How did you participate in the virtual learning game design process? 6. What role did others play in the virtual learning game deign process? 7. Describe your feelings, attitudes, or opinions about the interdisciplinary collaboration process in agile groups? 8. What else can you tell me about your experience in using

(*table continues*)

		Jacob's Ladder design tactic while designing games?
3. What benefits and/or hindrances do agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic?	Benefits and hindrances experienced (Questions 9-11).	9. In what ways does Jacob's Ladder Pre-Production Tactic influence communication? 10. Based on your experience, what do you like the most about the Jacob's Ladder Pre-Production Design Tactic? Why? 11. What do you like least about the Jacob's Ladder Pre-Production Design Tactic? Why?
	Summary question (Question 12).	Is there something in addition you would like to share about the process of working in an agile team using Jacob's Ladder Pre-Production Tactic?

Procedures For Recruitment, Participation, and Data Collection

The procedures for data collection, participation, and recruitment helped answer the research questions. I identified and had access to design team members who worked together to create virtual learning games through the Aspire Innovative Learning member network (http//aspireil.org/team). To obtain a list of interested development team members, I sent the virtual learning game designers an email enclosing a concise explanation of the study and a flier (Appendix A: Invitation to Participate in Research) with a request that team members who were interested in contributing to this study contact me by email or telephone to learn more. In person or through videoconference, I addressed each team member who communicated an interest in contributing to the study, as described by Irvine (2011) and Lou (2011). Each participant helped describe the experience of using the Jacob's Ladder Pre-Production Tactic.

Describing the influence of the Jacob's Ladder Pre-Production Tactic on a specific group with seven members provided more than enough information to answer research questions. For each participant, I read and explained the consent form that included information about the risk-free and voluntary nature of their participation, a description of research activities, and an explanation of the purpose of the study. Each participant was asked to sign and received a copy of the consent form before the interview proceeded. I explained to members that the interview consisted of twenty questions and a directed discussion to ensure that questions were answered, as suggested by Irvine (2011). A first-person perspective from members from The research site shed light on the practitioner experience and the influence of Jacob's Ladder Pre Production Design Tactic on interdisciplinary collaboration. All identifiers from the dataset were removed and participants were assured of confidentiality, as described by Miles, Huberman, and Saldana (2014). For each participant, I followed steps described by Maxwell, (2013) and Van Manen (2014):

- Before recruiting research participants or collecting data, I obtained approval from the university's Institutional Review Board (IRB).
- I asked the chairman of the Board of Directors at The research site, to sign a letter of agreement as a representative of the organization
- I published a research flier within the group network to clarify the purpose of the study, describe the inclusion criteria, and provide my contact information.
- I sent the virtual learning game designers an email containing the research flier and requested individuals who were interested in participating in this

study to contact me by email or telephone to learn more (Appendix A: Invitation to participate in research).

- For each participant, I read and clarified the consent form containing an explanation of the study's purpose, its principles of confidentiality, and the voluntary and risk-free nature of their involvement.
- To receive an "I consent" response to the consent Form), I met face-to-face or through videoconference at locations and times suitable for the participant. Each participant who expressed an interest in contributing to the study received a signed copy of the consent agreement.
- I used a data collection guide that consisted of questions and information requested of every participant during the interview (Appendix C: Interview Protocol).
- I reviewed interview transcripts during follow-up meetings with participants to perform member checks.
- Dissemination of study results to participants and other stakeholders took place via an essay on the findings.

The ability to meet face-to-face with participants in international settings was a unique circumstance encountered in data collection. Semi-structured interviews were held with seven participants, who represented the larger population of 20 or more designers within the self-governing group of educators and engineers. I recorded the interviews using voice notes; After each interview, I transcribed the interviews into separate Word documents for each of the seven participants in this study. This sample size was

considered appropriate for exploring participant perceptions. The location, frequency, and duration of data collection for each participant varied based on participant request. The steps used to recruit and conduct the interviews is described in Table 2.

Table

Participant Recruitment and Data Collection Steps

		Duration	Location	Communication
Step 1	Letter of Cooperation	5 minutes	Online	Email
Step 2	Invitation to participate in research	1 minute	Online	Intranet/Internet
Step 3	Informed consent	15 minutes	Online	Internet
Step 4	Semi-structured interview	1hour to 1hr. & 30min.	Online or at Aspire remote location	Video Conference unless participant preference was for a face-to-face interview
Step 5	Follow-up meetings	30 minutes to 1hr.	Online or at Aspire remote location	Video Conference unless participant prefers face-to-face
Step 6	Dissemination of study's results	1minute	Online	Internet: Blog Email to Aspire leadership and to participants

During data collection I used an interview protocol that consisted of information and questions presented to each participant during the interview (see Appendix C: Interview Protocol). I met online with each participant unless the participant was available to meet face-to-face using a conference room at one of Aspire's many network MeetUp locations. I reviewed the transcribed documents and organized the transcribed interview text into codes using the qualitative analysis software tool NVivo. As a form of member checking, follow-up meetings with participants were conducted to review interview transcripts and perform member checks (confirming the validity of researcher's interpretations). At the conclusion of each interview, I asked all participants an overarching question to discuss anything not already covered during the interview.

Audio recordings and interview transcripts were stored as electronic documents in password protected secure files on my computer; this file was archived on a secure Gmail cloud associated with my jasmine.turner@waldenu.edu account. The initial data collection was an electronic recording of participant interviews, recordings were transferred into Word transcripts and then uploaded as an electronic document into NVivo software. The data were recorded in a safe and secure manner. The research study followed the data collection plan presented in chapter 3 without variations. I used a data collection guide for every participant during the interview (Appendix B: Data Collection Guide) and all game development team participants reflected on their experience with the Jacob's Ladder Pre-Production Tactic.

I disseminated a summary of study results via an essay on the findings posted via the The research site's member only blog. The data collection processes did not present

any unusual circumstances and no participants declined or discontinued participation; the research study did not negatively impact any participants relationship with the researcher or the participant's access to the community group.

Data Analysis. The data examination for this research study connected the data to specific research questions by following coding strategies and using electronic software for analysis. Inductive coding as described by literature (Patton, 2002; Craver, 2014), was used because themes were developed and verified as the data were explored and not predetermined. Phenomenological data analysis steps generally involve repeated iterations of reading and coding (Maxwell, 2013; Van Manen, 2014). Quotations from participants about experiences highlight the meaning of each factor related to the influences of Jacob's Ladder Preproduction Design Tactic on interdisciplinary collaboration. I addressed research questions as Miles (2014) described, by defining and describing each theme related to interdisciplinary collaboration in a virtual learning game development team and the influence of the Jacob's Ladder Preproduction Design Tactic.

A computer software program (NVivo) was used for analysis to highlight significant sentences from the transcripts that provided an explanation of how the participants experienced the Jacob's Ladder Pre-Production Tactic. This data analysis procedure included selective and open coding (Craver, 2014; Patton, 2002; Van Manen, 2014) because themes expanded and were confirmed as the data were scrutinized. From the data, I composed a description of each code and selected the text that relateed to a code for each theme from the structural and textural depictions to a more composite description of the important aspects of designer perceptions, a practice consistent with

other researchers (Maxwell, 2013; Miles, 2014). Clusters of meaning arose as I organized these significant statements into themes.

Bazeley and Jackson (2013) described the NVivo computer software program as an instrument to systematize and examine the data collected from textual data transcribed from audio recordings of interviews as Microsoft Word documents. In the process of data analysis I:

- Listened to and transcribed interview recordings.
- Pre-coded interview themes related to the Jacob's Ladder Pre-Production Tactic.
- Imported interview transcripts into the NVivo computer software program.
- Opened and explored interviews.
- Coded anticipated and emergent themes.
- Ran query to find deeper connections.
- Reflected on query results to answer research questions.

This software allowed me to create word clowds and word trees that analyzed data by identifying frequently apprearing words in selected materials and helped to explore the context surrounding the words. I explored hierarchical charts and diagrahms of the data to help recognize the most prominate themes in the data and show connections between interview responses and the answers to research questions. Discrepant descriptions of the team, expert, benefits, or hindrances of the Jacob's Ladder Pre-Production's influence of virtual learning game design were factored into the composite description. Clusters of meaning arose as I organized these significant statements into

themes and the analysis primarily focused on the common experiences of the participants. However, data analysis treated discrepant cases as an opportunity to identify alternate perspectives.

Issues of Trustworthiness

Ensuring the rigor of In this study, I address trustworthiness as an essential component of qualitative research. Research methodology has suggested measuring the merit of research findings based on the techniques used to guarantee integrity (Bailey, 2014; Maxwell, 2013; Van Manen, 2014). In this study, I followed qualitative strategies to improve credibility, transferability, dependability, and confirmability.

Member checks and reflexivity helped establish credibility in this research study. Member checks confirmed the study's research conclusions and showcased my desire to ensure findings, themes of analysis, and data were accurate. A critical component in this study, transcripts were emailed to participants for review, and they were asked to confirm the accuracy of the data. I valued participants' member checks as an integral part to affirming the comprehensiveness of the data collected and to ensure the study had greater credibility. Through member checks I examined whether or not participants perceptions may have changed or been influenced by the research process. A reflexive journal helped disclose values, beliefs, and/or perspectives of the researcher that might influence findings from this study to ensure credibility. My experiences, opinions, and feelings concerning the research study were acknowledged as part of the research interpretation process.

Providing a thick descriptions and detailed methodology information helped address issues of transferability. The thick discription of the qualitative interview included ver batim participant responses and notes of my interpretations to create a deeper account of the data collection process. Throughout this research study, I illustrated the particular context of this self-organizing team and interdisciplinary practices, but I did not publish participant roles within results to avoid potential risks of disclosure. A thick description of the process of using Jacob's Ladder Pre-Production Tactic, using participants' own words, helped demonstrate the extent to which the conclusions related to other situations and among other development teams. Using quotes from each participant and relevant interview dialogue was helpful during data analysis. I have realized the unique nature of this design team and its' specific design strategies I also provided detailed information related to the methodology of the study that can allow other researchers to replicate the work in other community group settings.

The code-recode strategy used during data analysis improved the dependability of this research. The code-recode strategy strengthened intracoder relaibility and an inquiry audit verified my activities during the data collection process. While re-reading the interview transcripts I used pre-codes to confirm that the categories represented interview responses by breaking down data from codes to ccategories and themes.

Reflexivity and peer review helped establish confirmability. Reflexivity served to enhance both credibility and confirmability as previously described. I ensured that my background, as an educational technologist, did not affect the interpretation of developers' perceptions and the framing of research results by comparing my data

analysis with another researcher. During the peer review process a coding comparision helped to confirm consitency in coding agreement. A colleague reviewed some of the data and coding and considered the findings in light of the data; there was a high level of inter coder agreement during peer review. Together, reflection and peer review helped me interpret concepts and gather a practical interpretation of research data to better understand developer's perceptions.

Ethical Procedures

Prior to research, I completed Human Research Protections training (Appendix E: Human Research Protections Training Certificate) and the research site provided a Letter of Agreement granting permission for access to relevant data, access to participants, and facility use. I have written/emailed permission to use the Jacob's Ladder Pre-Production Tactic in the dissertation (Appendix F: Permission to use the Jacob's Ladder Pre-Production Tactic). When gathering data, I abided by the ethical principle of respect for persons, and I offered ample time to review the study information and ask questions prior to giving informed consent for participation. The research study begin, upon IRB approval (IRB number: 06-08-16-0169230).

Data collection tools, such as interviews, require that participant recruitment be coordinated in a non-coercive manner that takes advantage of a group setting with no compensation (Craver, 2014; Maxwell, 2013). In this study, I followed ethical procedures to ensure that participant rights were protected. The consent form gave the investigator's contact information and reviewed benefits and risks of participation, data

collection processes, procedures for recruitment and participant selection, and details on the purpose of the study. The consent form:

- Described the sample's inclusion criteria to help participants understand why members involved in virtual learning game development were being asked to participate.
- Explained the research purpose, description of the data collection procedures, and an estimate of the time commitment for participation.
- Stated that participation was voluntary and that the participant had the right to decline or discontinue participation at any time with no penalty.
- Identified my role as a doctoral student and asserts my commitment to protecting and preserving their confidentiality and participants' rights.
- Explained that declining or discontinuing participation does not negatively impact the participant's relationship with the researcher or the participant's access to the community group.
- Included a description of anticipated risks and benefits to participants and that there was no thank you gift(s), compensation, or reimbursement for participation.
- Indicated how to contact the researcher or contact a Walden University representative with questions.
- Instructed a participant to keep a copy of the informed consent form for their records.

Each participant received information about the study, a statement of confidentiality, and a consent form before participating in this study. There were no thank you gift(s), compensation, or reimbursement for participation.

Summary

Overall, the edutainment industry is directly impacted by the changes made in our society towards globalization, technological revolution, social connectivity, and multiculturalism. In this study, I explored through the eyes of the designers, the process of designing a multifaceted learning experience that comprises more than just adding customary instructional design to game mechanics. A qualitative phenomenological study approach was ideal, affording a description of the experience of using Jacob's Ladder Pre-Production Tactic to understand the influence of specific integration were discussed in Chapter 3. Chapter 4 describes the study's data analysis and results. Chapter 5 presents answers to the research questions and conclusions from research findings.

Chapter 4: Results

Introduction

The results of this study helped me to explain why edutainment-based learning has become the basis for much curricula and instruction, as educators recognize the importance of taking creative engagement seriously. The purpose of this qualitative phenomenological study was to explore developers' perceptions of and experiences with the Jacob's Ladder pre-production design tactic for interdisciplinary collaboration in designing virtual learning games. A phenomenological approach promoted an open exploration of experiences using this particular game design tool. My analysis of the data collected from the interviews helped me answer the overarching research question: What are the experiences of interdisciplinary agile software teams when using tactics designed for such teams such as the Jacob's ladder pre-production tactic? In this chapter, I provide answers to the research questions and identify the reasons this study is important. Hirumi et al. (2010c) suggested merging the expertise of instructional designers and entertainment developers during virtual learning game development to ensure that both have an equal voice in the design process. An underlying function of edutainment is keeping the current methodologies of teaching and learning in sync with technological advances to produce graduates for a competitive global market

In response to this requirement from industry, and for other pedagogically-driven reasons, educational entertainment is also relatively high on the agenda of initiatives that promote creative curriculum. My findings confirm the importance of design methodologies and reinforce the idea that production strategies are required to support the

profession of virtual learning game design. The following research sub-questions guided the data collection:

1. How does the Jacob's Ladder pre-production design tactic influence the experience of agile software teams as they create virtual learning games?
2. How do agile software team members describe their experience of using the Jacob's Ladder pre-production design tactic in designing virtual learning games?
3. What benefits and/or hindrances do agile software team members experience when using the Jacob's Ladder pre-production design tactic?

Chapter Organization

In this chapter I present information about the setting and participants for this study, and then discuss as the study's results. The Setting section includes information about the context of the study and a description of the participants in the research study. The Results section presents findings based on participant responses to interview questions. Most importantly, in the Results section, I answerseach research question while considering discrepant cases. In the chapter summary, I review the overall findings.

Setting

The research sitewas intentionally selected to target an international community of makers and find an answer to the overarching research question. The research site is a national non-profit organization wth a goal to provide equal access to edutainment activities. The organization provides free and discounted tickets for edutainment experiences (e.g. face-to-face and virtual field trips guided by academic coaches), and

instructional services (academic coaching, homework help, standardized test prep) to families in need. This company promotes equal access to edutainment by investing seed money in the development of educational entertainment products and services.

A part of the research site's structure, international volunteers from various backgrounds work together on the EDÜT development team. As described on the research sites web page (http://www.aspireil.org/team), they are community volunteers who include educators, programmers, producers, product managers, designers, animators, and sound engineers who serve on the Edutainment Development Team. The development team aims to produce an EDÜT App or game that would be a virtual learning environment and would enhance the research sites ability to provide the free and reduced-priced services to low-income families. This international community of about 20 experts is comprised of change agents with a goal of providing "Equal Access 2 Edutainment." Work is conducted collaboratively through virtual means and face-to-face MeetUp groups.

Participants

Participants for the study came from the Edutainment Development Team, a self-organizing group within the research site. Steps were taken to reduce risks to participants while making use of international organizational networks within virtual communities. I conducted candid one-on-one interviews with each participant to collect data regarding designers' experiences, and their attitudes toward and opinions about interdisciplinary collaboration.

I met with participants at the research site remote meet-up locations in Clearwater, Florida, London and Cambridge, England, and virtually, based on the preferences of the interviewee. For Participants 2, 3, 4, & 7, I conducted face-to-face interviews at St. Pete Makers, London GameDev Indie dev Networking, and MakeSpace Cambridge locations. Participants 1, 5, & 6 preferred virtual interviews. For these interviews, I used Google Hangout software from my academic user account. I followed the same interview protocol for both face-to-face and virtual settings.

At the research site, membership is free and currently consists of over 25 active members. A total of seven members who serve on the design team agreed and participated in the study. Participation in the study was voluntary, and research participants were unpaid contributors. Participants included three educators and four engineers from the research population of individuals who used the Jacob's Ladder pre-production design tactic as a tool for designing virtual learning games.

During the analysis process, I grouped the participants as either educators or engineers, and found that individuals from both areas of expertise played varied roles within the agile group. Table 3 shows participants' expertise area (educator or engineer) and their team member role.

To qualify for this study, each study participant met the following criteria:

1. Was an active member of Aspire Innovative Learning, Inc.
2. Participated on an educational game design team.
3. Had expertise in an area of education or engineering.

4. Used the Jacob's Ladder pre-production design tactic tool for virtual learning game design.

Table 3

Game Development Team Member Area of Expertise and Role

	Expertise	Role/Title	Background	Experience
Participant 1	Educator	Game Producer	Educational Technology	10 + years
Participant 2	Educator	Product Manager	Marketing	3 years
Participant 3	Educator	Creative Director	Higher Education	5 years
Participant 4	Engineer	Game Designer	Network Security	1 year
Participant 5	Engineer	Programmer	Independent Contractor	10 + years
Participant 6	Engineer	Digital Animator	Engineering Student	3 years
Participant 7	Engineer	Audio Engineer	STEM Ambassador	5 years

I recruited the members of the Edutainment Development Team for semi-structured, one-on-one interviews by posting a research flyer and sending an email invitation. The educational game design team was a self-organized group, and participant contact information was obtained from the chairperson of the board at the research site.

The invitation to participate flyer included a request for game development team members to take part in a 1.5 hour interview session and a 30-minute follow-up meeting. After posting the invitation, I sent a recruitment message to all design team members explaining the study, indicating the criteria for participation, and asking interested persons to contact me. The game development team members who responded to my e-mail invitation, met inclusion criteria, and replied “I consent” to the consent form email were used in the study. Participants in the research study played varying roles, but held

specific titles based on individual background and professional experience with virtual learning games. A description of the various roles follows.

Participant 1: Game producer: The game producer liaises between organizational leaders and the game development team. Working closely with the game's project manager, the producer focuses on getting the game finished on time and on budget Tasks involved in the job include: coordinating the release of screenshots and demo disks, handling the outsourcing of audio and visual elements, editing/cutting scenes, and running focus tests.

Participant 2: Product manager: The product manager's role is to help maximize the sale or distribution of the game. Tasks involved in the job include: liaising between development team members, managing the marketing budget, formulating feedback on the game's unique concept, creating and distributing packaging and marketing materials, and handling intellectual property licenses.

Participant 3: Creative director: The creative director focuses on the quality and style of the game. Task involved in the job include: defining the framework of the game, exploring technical advances, redesigning characters and scenarios, and promoting the game’s dynamic features.

Participant 4: Game Designer

The game designer demonstrates a profound understanding of hardware platforms and software techniques for different platforms. Task involved in the job include: putting together the concept/prototype document, making adjustments to the

original specifications during development, preparing a document that describes the intended playing experience.

Participant 5: Programmer

The game programmer incorporates and adapts code as required. Working at the heart of the game development process, the game programmer must meet different platforms' particular programming requirements. Tasks involved in the job include testing the code.

Participant 6: Digital Animator

The digital animator gives life to game characters and other elements such as objects, scenery, vegetation, and environmental effects. Working with the audio engineer, the animator outlines the number of frames used or the number of characters that appear to optimize the platform. Tasks involved in the job include using the animation tools and making libraries of animations for each character, and creating an underlying structure/skinning of the characters.

Participant 7: Audio Engineer

The audio engineer creates a sound design for the game. Working with the animator, the audio engineer is responsible for sourcing any sound effects to produce the soundtrack for the game. Tasks involved in the job include: improving or creating sound effects, lip syncing animation to re-versioning the game in other languages, and addressing technical options for a non-linear game environment.

Results

When examining developers' perceptions of the Jacob's Ladder pre-production design tactic , I found that the tactic had an overall beneficial influence on interdisciplinary collaboration within virtual learning game design. Themes that resulted from my analysis of the interview data are provided for each research sub-question described below. Where quotes are used, participants are identified by number; for example, P1 stands for Participant 1. I used the data collected from participants' resposes to the following questions to answer the overarching question of what design team members experienced using the Jacob's Ladder pre-production design tactic in virtual learning game design:

1. How does Jacob's Ladder pre-production design tactic influence the experience of agile software teams as they create virtual learning games?

2. How do agile software team members describe their experience of using Jacob's Ladder pre-production design tactic in designing virtual learning games?

3. What benefits and/or hindrances do agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic?

Table 4 shows the themes that evolved from my analysis of the data. Before reporting on findings for each research question, I will briefly give a sample quotation for one of the themes in each queston.

Table 4

Themes Identified for Each Research Question

	Theme 1	Theme 2	Theme 3	Theme 4
RQ1: Team Experience	Keeping the team focus on common goals and learner needs	Helping organize the team work and is easy to use	Supporting interdisciplinary collaboration across diverse disciplines	Promoting shared the understanding of platform, limitations, and performance.
RQ2: Individual Experience	Providing opportunities to play various roles within the team and encourages appreciation of diverse perspectives	Promoting recognition of prior experience and idea sharing in the virtual learning game design process	Supporting flexibility and adaptation in interdisciplinary collaboration	
RQ3: Benefits and Hindrances Experienced	Supporting communication, coordination, self awareness and openness,	Being useful for concept illustration	Taking more time and has limited depth and ability to address all production needs	

Research Question 1 responses revealed how the Jacob's Ladder Pre-Production Tactics influenced the team experience by guiding an open discussion of virtual learning game design strategies, including several trends in virtual learning games, the types of platforms and technologies available. Research themes related to how the Jacob's Ladder Pre-Production Design Tactic influenced the team experience included: (1) keeps team focus on common goals and learner needs (2) helps organize the teamwork and is easy to use, (3) supports interdisciplinary collaboration across diverse disciplines, (4) promotes shared understanding of platforms, limitations, and performance. For example,

participant 1 experienced clarity about team organization while using the Jacob's Ladder Pre-Production Tactic to illustrate the EDÜT game concept and stated:

"From my experience, using this pre-production design tactic within a community of experts means answering the big questions that both educators and software engineers need to know about the game" (P1).

Research Question 2 responses explained how Jacob's Ladder Pre-Production Tactic's influenced the individual experience by promoting flexible roles, including variations of gaming or gameplay strategies, and influencing adaptation of educational pedagogy. Data supports the themes that the Jacob's Ladder Pre-Production Design Tactic influences individual experience as it (a) provides opportunities to play various roles on the team and encourages appreciation of diverse perspectives, (b) promotes recognition of prior experience and sharing of ideas in the virtual learning game design process, (c) supports flexibility and adaptation in interdisciplinary collaboration. For instance, P4 experienced lively interactions about team roles while using the Jacob's Ladder Pre-Production Tactic to oversee specific projects and perform varying project tasks and explained:

"Of course, my feelings, attitudes, and opinions about the interdisciplinary collaboration are positive, actually that's what being a game designer is all about, because it's the agile group that lets you play the role of an educator one day and an engineer the next."

Research Question 3 responses helped to describe benefits and hindrances experienced using Jacob's Ladder Pre-Production Tactic for virtual learning game design

and revealed how its use shapes the collaborative process. Data supports the finding that the Jacob's Ladder Pre-Production Design Tactic (a) supports communication, coordination, self awareness, and openness (b) is useful for concept illustration, (c) takes more time and has limited depth and ability to address all production needs. Participant 7 experienced a better understanding of the game, but wanted greater emphasis on the engineering about software design using the Jacob's Ladder Pre-Production Tactic and said:

"The Jacob's Ladder Pre-Production Tactic is great for brainstorming, but it does not consider all the intricate details of software development that should be discussed before the project begins."

The findings of this research study describe how an agile software team uses tactics designed for interdisciplinary collaboration, particularly Jacob's ladder pre-production tactic. Results from the research study illustrated how the Jacob's Ladder Pre-Production Tactic's use influenced the team and individual experiences, the overall benefits and hindrances involved, and the ways in which it represented essential elements of both education and entertainment. The previous quotations were highlighted to illustrate some overarching ideas that resulted from codes used for data analysis and the specific categories and themes that emerged to answer each research question. A more in-depth explanation of the findings follows. A full listing of the initial codes, categries, and themes found in the data can be seen in Appendix D: Data Analysis Matrix.

Research Question 1

How does Jacob's Ladder Pre-Production Design Tactic influence the experience of agile software teams as they create virtual learning games? Four themes were identified: (a) keeps team focus on common goals and learner needs (b) helps organize the teamwork and is easy to use, (c) supports interdisciplinary collaboration across diverse disciplines, (d) promotes shared understanding of platforms, limitations, and performance.

Theme 1: Common Goals and Learner Needs

The process of working in an agile team using Jacob's Ladder Pre-Production Tactic set the organization's vision and mission as the game design priority.

> "This is different than any other thing because it deals with competencies by articulating learning objectives and procedures within the game" (P1).

> "Creative, Progressive, Concise, Unbiased. There are a lot of things I could say about this design tactic for virtual learning gains, but the most important part of this tool is addressing our need to create a strong image …..From my experience, using this design tactic within a software team means focusing on the production objectives. Being aware of the needs of users is the most important aspect of the game we're developing" (P2).

Participant 2 explained how using Jacob's Ladder design tactic aligned with best practices in learning and a review of literature in game design provided a basis for understanding how students organize knowledge and apply what they know to human development.

Developers shared about the process of working in an agile team using Jacob's Ladder Pre-Production Tactic and described how it helped to focus the team's work on the learner/player needs.

> "We use this design tactic for analyzing the need for the student and assessing what the student's strong points are and catering to that...learning a lot more about creating an entire game, for an educational purpose' (P2).
>
> "Because we have people with strong backgrounds in education they have made it plain that we need to know what information the learner is receiving and which edutainment activities they participate in….. game-based learning more about instructional design and the impact on students….. We [educational game development team] are all thinking about the player as a learner" (P3)
>
> "[It can] bring in this cohesiveness so there can be a learning discussion; try new ways for catering of each world to each student (P4).
>
> "What strikes me about the Jacob's Ladder diagram is that it puts the market first. Business types in the game industry would love if more designers said, I'm going to make a game for xyz demographic as their starting point" (P5).

Jacob's Ladder Pre-Production Design Tactic influence on the experience of agile software team helped the team select a student-centered platform, as they created virtual learning games.

Overall, developers' perceptions of the Jacob's Ladder Pre-Production Tactic and its influence on the team refers to a strategic approach to virtual learning game design, the trends for game design teams and virtual reality.

"In as much as instructional design traditionally thinks a lot about the message and the messenger, this is why we cannot simply reflect on the essential aspects of the teaching without thinking about learning" (P6).

"The educational part of a virtual learning game is the most important, my role is to translate the instruction into a language the students can understand" (P7).

"We [game development team members] want to create a simple engaging virtual learning environment that will grow overtime; my role is to think about the families who are already waiting to use this tool and all the new families we will reach once the game is developed" (P2).

"I usually only focus on the objects available to the characters interface design and forms of play, but I now see how these essential pieces of the game impact learning" (P4).

" It makes me think about the people who care, our learners or target market" (P1).

In summary, the participants identified that using the design tactic helped the team work collectively toward a common goal and kept them focused on the learner. For some, thinking of game development in terms of learning goals and learner needs was a new experience. Having a structure (the design tactic) was important in helping the entire team maintain that focus.

Theme 2: Organize the Teamwork and Easy to Use

Jacob's Ladder Pre-Production Design Tactic influenced the experience of the agile software team as they created virtual learning games in enabling discovery of practical solutions for organizing the team and by helping to easily illustrate the game concepts.

"Each participant learns quickly from their successes and failures in navigating the ladder" (P1).

" I would say it is simple. We're working smarter not harder. All I want is for everyone to be on the same page" (P3).

"The pre-production design process is a great way to brainstorm and know upfront the resources available" (P7).

"My participation in the learning environment was simple and easy; This isn't a hard sale, it's an easy product with a simple design process" (P2).

"Whatever anybody creates pretty much flows because we all know the main points just moving on up the Jacob's Ladder. It's funny because that's the stairway to heaven" (P3). Participants described the turmoil of working on software development teams without a specific design plan.

Participant 4 believed that the Jacob's Ladder Pre-Production Tactic outlined core game elements and recalled the chaos of working on software development teams that don't use a specific design plan. In the long term, the team member felt development cycles are better when they address design problems early and quickly.

Quotes from the participants illustrate how Jacob's Ladder Pre-Production Design Tactic helped to organize the work of the team, was simple and easy for the team to use, and supported flexible adaptive cycles.

"We [the game development team] used Jacob's Ladder to design an outline for the game, but it also helped organize the group" (P4).

Team members also discussed the design tactics usefulness in helping to organize the work. One team member (P5) noted that an incomplete concept illustration was the reason the Jacob's Ladder Pre-Production Tactic was used.

"An incomplete concept illustration was the reason we used the Jacob's Ladder Pre-Production Tactic to note computer code needs. It's hard to indentify the best ways to develop the application without some insight into the game" (P5)

Others seemed to agree that using the tactic helped resolve that issue.

"This is an effective integration tool because it's getting straight to the point and helping to see all the core elements" (P2).

Team members mentioned the simplicity of the tool and how quickly they learned using the process. Participant 3 agreed that the Jacob's Ladder Pre-Production Tactic helped outline the total game feel.

"This design tactic is straightforward and deals with competencies by articulating learning objectives and procedures within the game" (P1).

"It was important to have a summary because this isn't the typical type of game that I create. I need a complete concept illustration" (P5).

"Just like answers to the questions on the design tactic; the preproduction process is about asking the necessary questions to help fine tune the needs of the games and identify the strong points and experience" (P 4).

With the Jacob's Ladder Pre-Production Design Tactic the agile software team was bettter able to organizd the game story and feel. They found the tool to be simple, straightforward, and an effective tool for organizing the work to develop the game.

Theme 3: Support Interdisciplinary Collaboration across Diverse Disciplines

Experiences with interdisciplinary collaboration as developers design games using the design tactic are interactive. This feature of the tactic helped connect individuals and disciplines with diverse parts all necessary to function well.

"Considering the impact of subject content and game play is a significant part of designing an educational game, and our small business needs to go outside the box to take advantage innovation opportunities" (P1).

Jacob's Ladder Pre-Production Design Tactic influenced the experience of the agile software teams in encouraging team members to exchange expertise as they create virtual learning games. One participant described the experience as similar to a body; there are multiple and different parts, but all are necessary to create an effective whole.

"We [educational game development team] are working together because of our areas of expertise, now we both have a bit of a background in education and engineering ….the expertise in each discipline like the function of the body are one. … The experiences help to give us the unique multi-level perspective that creates diverse

learning experiences. The experience, expertise and efficiency is elevated as one discipline connects with another" (P1).

There seemed to be appreciation for the different roles members played within the team and an acknowledgment of the importance of the different perspectives. Elaborating on how the Jacob's Ladder Pre-Production tactic helped guide the experience, P5 stated: "Good game designers are not necessarily programmers, but preparing for the computer code requires the entire team.″ Other comments reflected this same sentiment.

Jacob's Ladder Pre-Production Design Tactic influenced the the experience of the agile software team inensuring exchange of expertise as they created virtual learning games.

Participant 1 recalled how the need for this non-profit educational organization to recruit more experts in engineering placed a further burden on finding interdisciplinary collaboration solutions.

"We have a good idea of the overall concept and everybody can use whatever skills they have, see what they can do to make it better… I do a little, but nothing serious, but that doesn't matter in our group because we just share ideas and make whatever we can," (P3).

My experience working with educators and engineers and a bit of everybody is exciting. When I join indie development teams I get to meet so many different kinds of people and we all have different backgrounds" (P3).

"We want to maintain the flexibility of an agile team for the team members and make sure that each team member's contributions are acknowledged" (P4).

"The team was a strategic partnership of people from varying backgrounds because most individuals were not previously part of pre-production decisions concerning the music, sound effects, and character voices for the story line" (P7).

"Work within an agile group can be evenly distributed, but not often because of the self-organized nature of the group. I don't think I could work on a project like this without a bit of flexibility" (P6).

"The game design team did not recognize the importance of integration strategies before bringing together a diverse group of individuals to work on the project that prepared to prototype educational game play" (P4). The game development team member experiences instructional design demands for learning technologies, but a more holistic approach is facilitated by the inclusion of multiple perspectives.

Participant 1 echoed previous research that explored the challenges of educational technology and found a need for contributions from other disciplines to design virtual learning games. The team must create a commercially successful idea for both education and entertainment. Jacob's Ladder Pre-Production Design Tactic influenced the experience of the agile software teams' communication as they created the virtual learning games. Given the interdisciplinary nature of the team, the design tactic facilitated the work by providing a structure for sharing and collaboration. It helped support the development of the collaborative team.

"The consideration to use various experts gives life to game characters and other elements and my role is easier when I know exactly what the team wants" (P6).

"The Pre-Production tactic will allow the team to have direction, a solid foundation for processes, and understand the need to be an important part of a team" (P2).

According to Participant 6, interdisciplinary collaboration considers student interactions within the learning environment and the behavior capabilities of the game engine. "Interdisciplinary collaboration is the key to this project with both educators and engineers we decided early on how the characters would behave act" (P6).

Participant P1 described interdisciplinary collaboration as the best way to design a commercially successful idea for education, and entertainment and P2 explained how this pre-production tactic helped focus the brand marketing to target students. Participants 3 and 4 explained how shared mental models support interdisciplinary collaboration in virtual learning game design by exchanging resources.

It seems using The Jacob's Ladder pre-production design tactic was effective in supporting the collaborative experience for the interdisciplinary team. However, the should remember that the pre-production phase of educational software development is only the beginning of working in an agile team.

Theme 4: Shared Understanding of Platforms, Limitations, and Performance

As a result of the enhanced interdisciplinary comunication and collaboration as described in theme 3, team members were able to better establish shared understandings of the game platforms, limitations of the systems, and performance aspects, all technical facets of game development. As one member stated, " We all want to make the game, it's

just some terms you use, and depending on your background might be hard for someone else to understand. They may just use a different term ” (P3).

“Before the decision to create a virtual learning environment, the educators did not have the same ideas because the engineers handled issues related to technological resources” (P7).

All better understood virtual learning games in general, the trends in educational game design, and the specific need for platforms built to impact academic achievement positively. Participant 5 experienced working as both an educator and engineer and echoed what literature suggested, that an adaptive socio-technical system is necessary within virtual learning game design.

The structure of the design tactic encouraged sharing of information on technical aspects. Developers shared additional information about the technical aspects of using Jacob’s Ladder design tactic while designing games. When asked what else can you tell me about your experience in using Jacob’s Ladder design tactic while designing games agile software team members expressed their personal interest in creating virtual learning games.

Participant 5 warned of negative personal experiences and demanded that the game design plan must meet different platforms’ particular programming requirements. In the same way, P6 explained the process to optimize performance on the platform. Participant 5 and 6 spoke of how service learning exposed them to socio-economic factors and cultural awareness by describing interdisciplinary collaboration during pre-production as making it easy to bridge emotional connections to knowledge areas.

Participant 7, who mixes the music to create the soundtrack for the game, explained how the participant did not recognize the way the market, story, experience, play, and venue related to the company's commitment to face-to-face and virtual field trips. Participants 1 and 2 focused on getting the game finished on time and budget and developing long-term plans for how the game will change over time.

Jacob's Ladder Pre-Production Design Tactic helped the team focus on core elements. The influence of this particular tactic on the experience of agile software teams as they created virtual learning games was helpful for discussing the integration strategies and technology tools available as evidenced in the following quotes.

"It was important to have a summary because this isn't the typical type of game that I create. I need a complete concept illustration" (P5).

"We (educational game design team) need to have a clear plan for the core game elements because video game design components may require advanced technical skills" (P4).

"The platform we choose for the virtual learning environment can contain wide-ranging components and the project resources available within the technology selected should include a well-equipped framework for the soundtrack" (P7).

"The game platform was identified early in development and this type of reflective practice can encourage teamwork" (P5).

"The technology selected to power this particular educational game must work for the organization's overall target population. The educational game development team

experiences several discussions about game movement and the process of embedding instruction into game interactions" (P6).

Involving all team members, with the equitable voice in the design process was described as responsible for making sure the playable versions of the game were sufficiently high quality, "I definitely learned to ask about the venue or context for future considerations of how the Matrix to Glory can be used beyond academic coaching" (P3). When asked to share additional information about the experience of using Jacob's Ladder design tactic while designing, the games developer explained how it helped outline the key frames used to optimize performance on the platform.

The engineers have to confirm to the overall regulations, for example, department of education requirements for certain security protocols to partner with schools. Participant 4 explained the process to prepare for incorporating ready-made code libraries.

"Using this type of open code data is popular among indie projects and it helps you overcome the obstacles of continually running the game and working to create elements that other applications already use" (P4).

Agile software teams experienced a review of best practices and technology options for creating virtual learning games while guided by the Jacob's Ladder Pre-Production Design Tactic. This guidance was described by participants.

"Jacob's Ladder Pre-Production Design Tactic helped to work towards successful delivery. The game design plan must meet different platforms particular programming requirements" (P5).

Participant 3 wanted to maintain focus on embedding the Edutainment Index within the virtual learning game to ensure player participation in virtual field trips to educational entertainment activities and declared: “the timing of software delivery is vital!”

The Jacob Ladder's Pre-Production Design Tactic influenced the work of the group by helping identify the game platform early in development. The Jacob's Ladder Pre-Production Design Tactic also influenced the experience of team members by provoking discussion on the framework of instructional game elements. Jacob's Ladder Pre-Production Design Tactic helped to describe the game. Developers’ perceptions of the Jacob's Ladder Pre-Production Design Tactic influence on the experience of agile software teams’ focuses on a strategic approach to virtual learning game design.

“Computer code is important in software design, but when we use the Jacob’s Ladder Pre-Production Tactic to focus on the game feel…Of course, successful delivery of the game is a priority, but it's good to start by considering how the virtual learning environment will look and feel to the student” (P7).

“When you consider the reach of the game engine it becomes obvious why Aspire chooses an educational game a learning tool to best artwork, music, and audio assets” (P3).

"I had the chance to see the big picture and describe how I imagine the characters to be within the Matrix to Glory" (P6).

One participant was impacted by the introduction to game strategy that explained media flow and noted how important it was to "Create a clear and concise user interface,

the games are designed to seamlessly blend the major components of a student success skills course and the classic game of wisdom, but the elements of an online course do not simply include all the unique features of a good virtual learning game" (P2).

Another participant noted, “While working on the game development team, I realized how the design goals of project planning communicate my ideas about player experiences…and the Jacob’s Ladder Pre-Production Tactic gave me the opportunity to interact with new concepts in educational game design. My role as a programmer should have a voice in pre-production design because the big picture helps me incorporate and adapt any already made code and writes code” (P5).

“Unlike traditional instructional, educational games are about the story more so than subject area content…, but the Jacob’s Ladder Pre-Production Tactic is a good approach for remembering the fundamental elements of the curriculum. We [software developers] need to be sensitive to learner outcomes" (P3).

Participant 5 explained why working to provide Equal Access 2 Edutainment by connecting more than 50 Edutainment companies with over 1,000 families in need requires a strong technical framework. Members of Aspire’s game development team have diverse backgrounds and represent how researchers from more countries have played a part in expanding game-based learning during recent years.

Jacob's Ladder Pre-Production Design Tactic influenced the experience of agile software teams' as they created the fundamental design elements of the virtual learning game, influenced the teams’ understanding of technological advances, and helped outline the core game elements. Using Jacob’s Ladder design tactic while designing games was a

new strategy for all participants. Agile software team members described their experience in using Jacob's Ladder Pre-Production Design Tactic in designing virtual learning games as helpful for demonstrating a deep understanding of hardware platforms and software techniques for different platforms.

Team participants came from a variety of backgrounds, both technical and educational. Using the tactic did help support shared understandings of technical aspects, but perhaps not a complete understanding. One of the technical experts commented on a desire to help educators with little experience in game development bettter understand the process of providing cross-platform graphics and rendering game physics libraries, saying, "Each level will look the same way, we can only have one overall theme for the design, it does not matter if you have ever created a game because we have all played one; just picture the experience that you want to have, your fantasy" (P6).

Overall, developers' perceptions of the Jacob's Ladder Pre-Production Tactic and its influence on the team refers to a strategic approach to virtual learning game design, the trends for game design teams and virtual reality, the specific need for considering the learning impact of varying technology platforms. During the process of working in an agile team using Jacob's Ladder Pre-Production Tactic members of The research site's game development team experienced a positive group culture. This study's research findings promotes the idea that design tactics are a practical method for integrating gaming and educational principles.

Research Question 2

Three themes emerged from the analysis to describe how using the Jacob's Ladder Pre-Production Tactic influenced the individual team member's experience: (1) provides opportunities to play various roles on the team and encourages appreciation of diverse perspectives, (2) promotes recognition of prior experience and idea sharing in the virtual learning game design process, (3) supports flexibility and adaptation in interdisciplinary collaboration.

During the process of working in an agile team using Jacob's Ladder Pre-Production Tactic members of The research site's game development team experienced a positive group culture. Openness was important in increased sharing of information. This particular game development team found it beneficial for individuals to use the Jacob's Ladder Pre-Production Tactic to embed educational activities into gameplay, for ongoing interaction with content in a logical, consistent, and scaffolded manner.

Theme 1: Diverse Roles and Diverse Perspectives

Jacob's Ladder Pre-Production Design Tactic helped change perceptions and encouraged appreciation of diverse perspectives and roles. Several explained how they and others played different roles in the design process of the virtual learning games:

"The educational part of a virtual learning game is the most important, my role is to translate the instruction into a language the students can understand"(P7).

"We definitely need to be sensitive to learner outcomes. Not just people with an educational background, but everyone on the team… My area of expertise played an

essential role because I'm able to think about the thrilling aspects of the game and make sure that it's obvious why the images and sounds, and overall feel of the game" (P3).

"Considering the impact of subject content and game play is a significant part of designing an educational game" (P1)

The Jacob's Ladder Pre-Production Design Tactic influenced the experience of agile software team members by allowing them to play varying roles within the virtual learning game design process and providing new perspectives.

"This is a strategic plan to partner educators and engineers in appreciate of interdisciplinary collaboration. Everybody played varying roles" (P1).

"Putting together the concept/prototype document helps us not to take any aspect of the game for granted or assume that other team members educational background or professional experience limited their perspectives on design. This will allow experts to work together to maximize production" (P4).

"Interdisciplinary collaboration is necessary and there's no way around it because most professionals with an extensive background have had experience in a few fields" (P3).

"A strategic plan to partner educators and engineers in appreciation of interdisciplinary collaboration. Everybody played varying roles" (P1).

Individual members voluntarily participated in the virtual learning game design process as an active part of a self-organizing group. Some found that those who intended to play specific roles, such as helping to maximize the game sales, became more

versatile. Both educators and engineers wanted to focus on the quality and style of the game. According to participants:

"Interdisciplinary collaboration is necessary and there's no way around it because most professionals with an extensive background have had experience in a few fields" (P3).

"This is not a developer centric way of making a game … On one hand, we may be losing focus on fun and that's the true test of a good game. Obviously, the player is the most important part of the game, it's the player that will be having fun is we achieve both education and entertainment as our goal" (P6).

"I think that having the conversation and knowing what to say to educators and engineers to try new things" (P4).

The experience of agile software team members as they created virtual learning usng this design tactic helped each bring their expertise to participate in the virtual learning game design process. Using a design tactic helped to liaise between team members and organizational leaders and helped individuals focus on the quality and style of the game. The process helped members to recognize their own limitations and the benefit of having other areas of expertise on the team.

"We all played an important role in this process, but you can't do everything" (P2).

"[The process] made all the other team members began to think of how important it was to recognize the simple game play and build on that experience; it raised my interest in instructional design (P5).

Participant 3 recalled when they first started talking about creating an app as a resource tool. “Thinking of something to connect our edutainment partners directly to the families we serve. I didn’t even consider the game play, maybe just a nice website, maybe a bit of gammification in the way the application looked; That’s all!” (Participant 3).

The Jacob's Ladder Pre-Production Design Tactic influence on the experience agile software team members increased overall participation as they created virtual learning games.

“We all helped make the game and we all addresses the learner, learning outcomes, events/activities, assessment, and the context” (P3).

“My individual role, as creative director, required me to see all team member points of views and help everybody get a clear picture of the families playing this game and the individual student who needs to develop life skills” (P3).

“We perform different task do all have our roles, but they aren’t set in stone and it’s mostly based on what overall task we need each person to perform” (P4).

Each participant in the virtual learning game design process was influenced by the Jacob's Ladder Pre-Production Design Tactic. Individual members participated in the virtual learning game design process as an active part of a self-organizing group. Some found that those who intended to play specific roles, such as helping to maximize the game sales, became more versatile. Their experience in using Jacob's Ladder Pre-Production Design Tactic helped individuals to play varying roles within the virtual

learning game design process and to recognize and appreciate the expertise others brought to the table.

Theme 2: Valueing Prior Experience and Idea Sharing

Using Jacob's Ladder Pre-Production Design Tactic helped the agile software team members share expertise as he or she created virtual learning games. The tactic helped foster sharing of ideas and enhanced cooperative learning. Group members performed tasks based on prior experience in the virtual learning game deign process. Participant 1 described how "…. working together because of our areas of expertise, now we both have a bit of a background in education and engineering". Members felt their expertise was valued and their opinions welcomed.

"As an educational game it is to think more about what the student will learn and the types of analytics that must be built; My role is to structure all our ideas around practical use of technological resources" (P5).

"Generally, games may be designed without any initial input from a sound engineer and I never even considered how sounds impact learning or if my role even related to meeting instructional goals, but with the Jacob's Ladder Pre-Production tactic I see the big picture" (P7).

Within an agile team, the role others play in the design process is based on individual expertise in creating virtual learning games. The role others played in the virtual learning game deign process was established by the individual who contributed ideas using the Jacob's Ladder Pre-Production Design Tactic. Participant 1 explained how additional points and successes were achieved when the members began to push other

participants toward greater decisions and depth of understanding. Other echoed that thought.

"It was a good to see different perspectives of what's most essential to the overall game design. That's why I say, it's all important! Because when your working with a group of people with different backgrounds and understandings of making a high-qualitygame, or even creating an educational game" (P3).

"We have to consider what's most essential from different perspectives. That way each team member sees the big picture, but can focus on their area of expertise" (P3).

"You think about the core features of the game and scale your work to practical task" (P4).

Jacob's Ladder Pre-Production Design Tactic influence on the experience agile software team members was an open conversation of knowledge and skill as they created virtual learning games.

"Others would participate in the execution of the production of the game, be able to critique, provide feedback for the betterment of the product" (P2).

"Individual expertise presented a solution to objects, scenery, vegetation and environmental effects and composing, scoring and recording of music" (P7).

"We can't prioritize every feature that we want to see in the game, but we can agree on what's most important. This design tactic helps us all to think about and come into agreement on what's the most" (P2).

The role others played in the virtual learning game deign process was influenced by the using the Jacob's Ladder Pre-Production Design Tactic. Sharing was particularly recognized as an effect of using the tactic.

“Interdisciplinary collaboration would allow those who are the best of the best to put their expertise to work. The company experienced increased interactions within the projects forum after team members recognized other roles and share expert advice based on this design tactic” (P2).

“No matter what your background is, what you have to say is important” (P2).

“Involving all team members, with equitable voice in the design process was so beneficial. It’s not like anyone was sitting around, waiting to find out what’s next. Everybody had an equitable voice in designing the game because game design has become a hybrid field of its own. Were all just educational game designers” (P3).

“The game development team experienced an increase in communication between interdisciplinary experts from the team members playing varying roles, such as writing custom code as required” (P5).

“ I know it doesn’t seem like it’s about communication, but it is. This is what we need to establish from the onset To know what the purpose of the game is beyond the typical indie design construct that isn’t always directed for something this essential to learning” (P6).

“Participation, communication, and acknowledging of everyone's portion is important” (P2).

The virtual learning game deigns process was enhanced by using a design tactic and it influenced the experience of exchange of ideas among agile software team members as they created virtual learning games. Liaising between organizational leaders and the game development team was a specific role of an individual team member, but by using the design tactic, all members felt prepared to discuss both educational and entertainment features of the game.

Participant 1 believed his background in Human Resource Management naturally led to the role of fostering communication between the game development team members and recalled having each team member place idea sticky notes on a large projection of the Jacob's Ladder Pre-Production Tactic (Chapter 1: Figure 1). Additionally, P5 working at the heart of the game program and P6 working to outline the number of key frames used, expressed a desire to learn more about instructional design to identify authentic activities and align them with appropriate challenges and rewards.

The interdisciplinary collaboration process in the agile group allowed individual experts to demonstrate their knowledge and skills as they created virtual learning games. The Jacob's Ladder Pre-Production Design Tactic influenced the experience by identifying individual roles. Using Jacob's Ladder Pre-Production Design Tactic in designing virtual learning games helped to consider the distribution of the game and the overall scenery, vegetation and environmental effects, and the composing, scoring and recording of music. In addition the use of the design tactic provided a structured approach to communication and sharing and promoted a safe encironment for sharing.

Theme 3: Flexibility and Adaptation in Interdisciplinary Collaboration

Jacob's Ladder Pre-Production Design Tactic focused the team with ease and helped the group make adjustments as needed. Developers found the interdisciplinary collaboration process within the group to be flexible. When adjustments needed to be made, they were, and work continued.

"Some development team members did not want to work closely with others, but their ideas did impact everyone else" (P1).

"There may be conflict, but we need a solution hat works on all levels, when everybody starts to speak the same language" (P4).

"Working together to see what needs to be done and who's best to do what can be tricky" (P3).

"Gave me the opportunity to interact with new concepts in educational game design. There's a lot of good input from the group and you do not wait to the end of prototype development for feedback" (P5).

Participant 1 described how it feels like there are so many pivot points that have to be incorporated in the interdisciplinary collaboration, that at times it seems too difficult to put each intricate insight into motion in the groups.

Team members described their experience in using Jacob's Ladder Pre-Production Design Tactic in designing virtual learning games as working closely with the game's project manager, creative director time, and game designer. Feelings, attitudes, and programmers explained why the interdisciplinary collaboration process in agile groups allows the entire team to work at the heart of the game.

" I can tell you that this experience has brought us all to see the benefits and limitations of this type of teamwork" (P2).

"Wanting both educators and engineers to work together in all aspects of the game production process was the reason we used the Jacob's Ladder Pre-Production Tactic for conceptualizing this virtual learning game" (P7).

"This design tactic could address long-term plans for how the game will change over time. The engineer may have big ides about the learning process, but that may not be the key for the educator" (P4).

Overall, developers' perceptions of the Jacob's Ladder Pre-Production Tactic and its influence its influence on the individual experience refers to the process of blending education with entertainment, customary gaming or gameplay strategies, and the idea that educational pedagogy should adopt game models for virtual learning games. The Jacob's Ladder Pre-Production Design Tactic influence on the experience agile software team members helped showcase both educational and engineering ideas as they created a virtual learning game and provided for flexibility in the process. Several team members shared opinions about how the interdisciplinary collaboration process as a self-organized group was guided using the Jacob's Ladder Pre-Production Design Tactic.

Individual team members felt excited about the interdisciplinary collaboration and the process of working to create virtual learning game. Overall they felt they gained in expanding their own knowledge and skills through their interactions and that the flexibility and adaptability of Jacob's Ladder technique supported the best use of

individuals' skills, the sharing of information, and development in the end of a better product.

Research Question 3

What benefits and/or hindrances do agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic? The general themes revealed in the analysis reference benefits to collaboration and teamwork as well as benefits in the game development process (themes 1 and 2 respectively). Hindrances center on the time it takes and that this one strategy does not address all production needs (theme 3). The themes were identified as: (a) supports communication, coordination, self awareness, and openness (b) is useful for concept illustration, (c) takes more time and has limited depth and ability to address all production need

The game development team members experienced a formal process to complete work, reach clear goals and experience better communication among team members. Research results on the benefits and hindrances of using the Jacob's Ladder Pre-Production Tactic explained how the concepts agile methods, interdisciplinary collaboration, and integration models are all connected. The game development team, at The research site, addressed both the beneficial and hindering aspects of using the Jacob's Ladder Pre-Production Tactic to support self-motivated and cross-functional teams and reflective practitioners.

Theme 1: Communication, Coordination, Self awareness, and Openness

Jacob's Ladder Pre-Production Design Tactic was percieved as beneficial for improving communication, coordination, self-awareness and encouraging openness to

others' ideas. Participant 1 stated, "Our company as a whole experienced an increase in communication concerning investing in game development as the game development team introduced the prototype" (P1). Another participant encouraged the continued use of the beneficial approach. "We just have to continue to use shared mental models to support interdisciplinary collaboration in virtual learning game design by exchanging resources"(P3). Improved communication was a key idea conveyed across participants.

"We all participated in what they call an adaptive socio-technical system that means working together. That means communicating with each other" (P5).

Communication concerning initial design elements was more structured using the Jacob's Ladder Pre-Production Design Tactic. Several comments reflect this benefit.

"The biggest influence on communication was guiding the process of sharing all our great ideas about what this program could offer" (P4).

Participant 2 described the tactic as helping to focus conversations on both education and entertainment and the team members had to keep this in mind for initial prototyping. Another said, "… but at least were all talking about the same things. We are just looking at the design tactic and trying to answer the questions on the ladder as it relates to the [game]" (P3).

The Jacob's Ladder Pre-Production Tactic influenced interdisciplinary communication by focusing the discussion of topics that do not directly relate to the prototyping stage, but could impact future growth and production of the game. One interviewee described the communication as "…opening more and more as the depth of each vertical movement on the Ladder"(P1). Others said:

"I like that it allows everyone a chance to exhibit his or her expertise for a game that could will be revolutionary to learning"(P2).

"When we open the floodgates for everybody to chime in on any aspect of the game we already have much more communication. I can share my idea about the profile image and somebody else might build a complete character that changes over time" (P3).

"It all started with a simple conversation. Everybody has great ideas that made for an exciting exchange of ideas for motivating students" (P6).

Participant 2 also noted that the company experienced increased interactions within the projects forum after team members recognized others' roles and shared expert advice based on this design tactic.

Tasks involved using the animation tools and techniques and improving or creating sound effects were also communicated early in production by using a design tactic. The benefit for agile software team members was the ability to communicate ideas from their of expertise or discipline and see how it directly related to others as they created virtual learning games.

Participant 3 explained how the consideration to use integration strategies came from the lack of interaction, and past research indicated that development teams need to institute a formal process to experience better communication among the team members. Using the design tactic, Participant 2 liaised between development team members, managing the marketing budget to make sure that customers were ready to download the application within a 90-day period of going to market. Participant 1 and 2 completed

tasks to coordinate the release of screenshots and demo disks and found the Jacob's Ladder Pre-Production Tactic to be an effective integration tool.

It was evident that team members felt communication concerning initial design elements was more structured using the Jacob's Ladder Pre-Production Design Tactic. The benefits agile software team members experienced when using Jacob's Ladder Pre-Production Design Tactic helped then in identifying the tasks involved in putting together the concept/prototype document. Tasks involved in coordinating the release of screenshots and demo disks went hand and hand with tasks involved in defining the framework of the game. A benefit to communication for agile software team members as they created virtual learning games was working together to address topics beyond the scope of one particular design tactic. And interviewees noted the importance of expanding communicaiton to other stakeholders.

"The game development team needs to continue the conversation about defining the framework of the game with all stakeholders during the usage phase of the development cycle, design, and development" (P3).

Participant 7, involved in improving or creating sound effects, noted that feedback from customers would help the project exceed the technological capabilities currently available. Participant 5 was involved in testing the code while fix bugs and was impacted by how this integration strategy made all the other team members began to think of how important it was to:

"Recognize the simple game play and build on that experience within several boards, so the player feels like the game is complex and not predictable; I learned the

term scaffolding to describe the levels of challenges and rewards as it relates to instructional design" (P5).

The Jacob's Ladder Pre-Production Tactic influenced interdisciplinary communication by focusing the discussion of topics as Participant 2 stated: "We cannot prioritize every feature that we want to see in the game, but we can agree on what's most important." Participant 6 used animation tools and techniques to demonstrate understanding of what other team members proposed. In some ways the Jacob's Ladder Pre-Production Tactic influence communication by simply providing a conversation ice breaker for agile software team members as they created virtual learning games.

In addition to positively contrbuting to communication, coordination, and openness to ideas, Jacob's Ladder Pre-Production Design Tactic also encouraged more self awareness and an understanding of the need to communicate with others. One team member noted, "The participant should be aware of the overt conduct and as they move through the ladder will begin to instinctively make choices that conform to what moves them toward glory" (P1).

In commenting about use of the tactic, a participant said, "This conversation with the design tactic helps others understand how their ideas would impact the priorities of everyone else." (P2). And a another said, " It made it easy for us all to ask good questions about aspects of the game we may not know more about or just didn't consider in games we created in the past" (P3). Another comment was, "In order for production to be successful, all production participants will have to communicate in order to be sure that everything is working together to make a solid game" (P2).

Overall, the data indicate that one of the key benefits of using the Jacob's Ladder design tactic is improved communication and coordination among the team members. That improved communication seemed also to lead to increased openness to the ideas of others and a better self-awareness of the knowledge an individual might lack but that the team together owned.

Theme 2: Concept Illustration

Based on experience, a clear concept illustration is what game developers like. Data in this study supports this perception and indicates that one of the benefits of the Jacob's Ladder Pre-Production Design Tactic is its ability to help identify the core elements of an educational game. Jacob's Ladder Pre-Production Design Tactic provided an outline for agile software team members as they created virtual learning games. Participant comments provide support.

"This supports interdisciplinary collaboration by making it easy to see what we need from all perspectives" (P4).

' I like the agile cycles of design, but I also like design thinking to make the development process easy" (P5).

"Agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic was helpful for involved task budget, formulate feedback on game's unique concept" (P5).

According to participant 4, "It's like this design tactic gives you the main ideas, leaving the team to go in-depth through a business requirement document or some type of game prototype tool … When we all see the core elements evolving, we can move forward with

a solution to any problems and work together to make the game better" (P4). Participant 4 also gave particular insight into the benefits of illustrating the concept and stated: "We [game development team] knew exactly how the game should look and feel and those decisions were made based on the best ideas for education and entertainment" (P4).

Developers liked the teamwork projects and tasks that came about using the Jacob's Ladder Pre-Production Design Tactic. They liked how the Jacob's Ladder Pre-Production Design Tactic provided a simple conversation prompt that led to selecting a 3D animation software package, making extensive libraries and re-versioning the game in other languages Participants 6 suggested a 3D animation software package, and recalled having a discussion about the story line of the game and reviewing sketches from another team member who's background is in education, not graphic art.

Some commented that using this tactic was better, "It's actually better this way and the consideration to use integration strategies came from the lack of interaction and past research indicates that development teams need to institute a formal to experience better communication among team" (P3).

Another suggested the usefultness of the tactic in addressing the technical options for a non-linear game environment. "I know they didn't expect that from the sound engineer, but people were happy to get my views because I have experience in game design beyond sound engineering. Jacob's Ladder Pre-Production Design Tactic helps provide the model diagram for agile software team members as they create virtual learning games" (P7). This particpant went on to say, "Wanting both educators and engineers to work together in all aspects of the game production process was the reason

the participant used the Jacob's Ladder Pre-Production Tactic for conceptualizing this virtual learning game" (P7).

The experience of using the Jacob's Ladder Pre-Production Design Tactic was beneficial for in the tasks involved in describing the intended playing experience and providing cross-platform graphics rendering for game physics required exploration of technical advances. Jacob's Ladder Pre-Production Design Tactic helped provide the model diagram for agile software team members as they created virtual learning games. Data indicates one of the benefits agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic is a strong concept illustration.

Theme 3: Time and Limited Depth and Ability to Address Production Needs

In addition to benefits in the areas of communication and concept illustration, participants also indicated Jacob's Ladder Pre-Production Design Tactic has limitations. Primary limitations noted were the fact that using the tactic takes more time, that it does not perhaps have enough depth, and that it does not address all production needs. Several team members mentioned the time factor as a hindrance. One team member described how, "Countless hours of planning has gone into the Preproduction of this product. It is necessary that all those dedicating time, dedicate it genuinely" (P2). Another said, "This particular design tactic only addresses the pre-production phase of game design and takes time for developing the tedious testing foundations needed for the agile methods to respond to cultural change" (P1). And a third noted, "Maybe because getting so many perspectives involved can seem to slow the project, but it doesn't. It makes it easier to know exactly what you're making when it's all said and done" (P5).

The data suggest that this design tool could add additional time to the development process. While enhanced communication was identified as a strength, the additional time may be a negative result of that increased communication. Something else developers' shared about the process of working in an agile team using Jacob's Ladder Pre-Production Tactic was taking much time considering the best technological resources for both education and entertainment.

Some mentioned that there is perhaps a need for more depth and a need to move beyond simply the pre-production phase. There was a need for more depth in defining the intricate pieces of game design. Participant 1 believed the game development team members did not recognize the company's resource limitations.

"The cycles of development and this tactic is only the beginning of thinking about how this game might evolved over the years. What I like least about it is that there's not more of it, that there's not a Jacob's Ladder Production Tactic or a Jacob's Ladder Production Cycle Tactic" (P3).

"We're staying on budget and getting all the boxes checked. The overall design is good, but a playable prototype requires much more elements to consider than one design strategy can address; this design tactic is just the tip of the iceberg" (P6).

It seemed what developers' liked least about the Jacob's Ladder Pre-Production Design Tactic was that it only focused on pre-production. It is not an integration strategy that addresses the complete production cycle as a whole.

"This will help the teamwork together from the beginning and continue communicating well as group dynamics change" (P4).

The hindrances agile software team members experienced when using Jacob's Ladder Pre-Production Design Tactic related to addressing technical options for a non-linear game environment and further production needs of edit/cutting scenes and running focus tests.

“This particular design tactic does not consider the long-term needs of redesigning characters and scenarios and promote games dynamic features. The Jacob’s Ladder Pre-Production Tactic was good for the concept illustration but wasn’t a consideration of running focus tests, creation of marketing materials, and handling intellectual property licensors” (P2).

"The unique characteristics of agile software development match the divergent concept of an online community single model, like the Jacob's Ladder Pre-Production Tactic, is ok…but, it does not speak to actual design procedures. This design tactic could address long-term plans for how the game will change over time’ (P4).

“The focus of this type of software development is tailoring personal gaming encounters, and the Jacob’s Ladder Pre-Production Tactic… does help establish a good balance between core performance standards, an engaging learning experience, and helping the student reach individual learning goals. We [game development team members] need a more in-depth integration tool that also considers mechanics, dynamics, and aesthetics with exact explanations term definitions” (P6).

Some mentioned the simplistic graphic was somewhat vague and other that there were hindrances in not preparing for reusable animations for each character, creating an underlying structure/skinning of the characters and other tools that made agile software

team members experience further production needs when using Jacob's Ladder Pre-Production Design Tactic. Participant 5 explained things beyond the scope of this integration tool and stated: "the game development team toolbox has several other resources that build on these shared understanding by outlining the segments of game design" (P5). Another shared that the tactic does not help with, "… reusable animations for each character, and creating an underlying structure/skinning of the characters not be the only part of how the players will interact within the game … The overall design is good, but a playable prototype requires much more elements to consider than one design strategy can address; this design tactic is just the tip of the iceberg. (P6)"

According to one participant, there are some obstacles that exist in a self-organizing team that this design tactic doesn't address. "I actually like Jacob's Ladder a lot as far as illustrating the concept goes, but we basically had to build around it, I mean add to it the answers to the questions and the technical elements that relate to story or learner outcomes" (P4).

One other note, a member indicated, "Agile software team members experience a need for more attention to intellectual property licensors when using Jacob's Ladder Pre-Production Design Tactic (P4).

One participant pretty well summarized the limitations of using the Jacob;s Ladder Pre-Production Tactic, saying:"I actually like Jacob's Ladder a lot as far as illustrating the concept goes, but we basically had to build around it, I mean add to it the answers to the questions and the technical elements that relate to story or learner outcomes. I redesigned characters and scenarios to promote games dynamic features and

felt a need for a design tactic that changed. This is perfect for pre-production, but the decision were making now will effect the cycles of development and this tactic is only the beginning of thinking about how this game might evolved over the years. What I like least about it is that there's not more of it, that there's not a Jacob's Ladder Production Tactic or a Jacob's Ladder Production Cycle Tactic" (P3).

Additional Notes

Some of the responses, while not addressing the research questions, provided some insights into the Aspire Learning organization itself and its game development efforts. Others noted individual's beliefs in the changing nature of virtual learning and the need for edutainment efforts to provide access to virtual learning.

"The game development team members understand how the adaptive nature of Agile software design structure is ideal for the continually changing stages of virtual learning games" (P3).

"We must adapt to varying resources and circumstances to make sure that Edutainment companies that offer free and discount priced tickets are well represented within the virtual learning environment"(P1).

According to participants 4 and 5 members of The research site support the Edutainment Industry by simply getting resources to families, and the development of a virtual learning game is one way of adapting to the needs of the families served. In the case of The research site's game development team, any members of the organization could volunteer to participate in the design process.

One respondent described some aspects of the game itself, saying, "Within the game, individual students from target families create profiles, interact with others, and receive free & discount priced tickets featuring elements of student identification, Social Networking, and online shopping" (P1). Finally, several of the interdisciplinary experts felt that the exposures encountered during the collaborative process contributed to their real life experiences designing virtual learning games.

Summary

Traditional methods of teaching and learning are being changed by a new generation of educational leaders. The purpose of researching the Jacob's Ladder Pre-Production Tactic was to explore the experiences of interdisciplinary agile software teams using Jacob's ladder pre-production tactic to develop virtual games. The research sub-questions helped to examine how the Jacob's Ladder Pre-Production Design Tactic influenced teams experience, individual experience, and the benefits and/or hindrances to an agile software team creating a virtual learning game. Data collection and analysis included transcripts from semi-structured interviews with all seven participants. This qualitative phenomenological study explored international developers' perceptions of and experiences with Jacob's Ladder Pre-Production Design Tactic and themes emerged from the analysis of the coded data that link back to the literature concerning designing virtual learning games. These will be explored more in Chapter 5.

This research study provided research findings and exploration of other ideas that may help developers understand virtual learning game design. The following list is a summary of the overall research findings:

1. How does Jacob's Ladder Pre-Production Design Tactic influence the experience of agile software teams as they create virtual learning games?

The Jacob's Ladder Pre-Production Design Tactic:

- Keeps the team focus on common goals and learner needs
- Helps organize the team work and is easy to use
- Supports interdisciplinary collaboration across diverse disciplines
- Promotes shared the understanding of platform, limitations, and performance.

2. How do agile software team members describe their experience in using Jacob's Ladder Pre-Production Design Tactic in designing virtual learning games?

The Jacob's Ladder Pre-Production Design Tactic:

- Provides opportunities to play various roles within the team and encourages appreciation of diverse perspectives
- Promotes recognition of prior experience and idea sharing in the virtual learning game design process
- Supports flexibility and adaptation in interdisciplinary collaboration.

3. What benefits and/or hindrances do agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic?

The Jacob's Ladder Pre-Production Design Tactic:

- Supports communication, coordination, self awareness and openness
- Is useful for concept illustration

- Takes more time and has limited depth and ability to address all production needs

The Edutainment industry considers enjoyment vital to the learning process because it evokes the essence of human expression when applied to learning goals easily established using design tactics. The findings of the study answered the research question, what are the experiences of interdisciplinary agile software teams in using tactics designed for such teams, for example Jacob's ladder pre-production tactic. Findings indicate that educational game development teams understand the integration strategies/tools needed to address both well-known and indistinct aspects of the virtual learning game design. The establishment of the Edutainment industry is a direct result of interdisciplinary contributions from both the education and entertainment field. It seems that use of such integration tools positively influences the team and individual experiences in designing games in an interdisciplinary team environment.

Chapter 5: Discussion, Conclusions, and Recommendations

Introduction

Educational entertainment is designed to improve the social conditions of the learning environment by ensuring that enjoyment is a fundamental part of the learning process. My exploration of design team members' experiences helped me to identify tendencies in independent game design, and team member attitudes and opinions regarding their use of the Jacob's Ladder pre-production design tactic. Participants described the development of a virtual learning game and the process of blending education and entertainment, and discussed those factors contributing to interdisciplinary collaboration. Furthermore, participants described participation on the edutainment development team and the core values of educators and engineers working together.

The data analysis provided evidence that team members perceived the design tactic's overall impact as positive and beneficial for the organization's diverse stakeholders. The Jacob's Ladder pre-production design tactic influenced the experience of agile software teams as they created virtual learning games by (a) keeping the team focused on common goals and learner needs, (b) helping organize the teamwork, (c) supporting interdisciplinary collaboration across diverse disciplines, and (d) promoting shared understanding of the platform limitations and performance. The combined findings for the tactic's influence on the development team fully support integration strategies as key to strengthening group dynamics in the process of educational game design, and contributing to team members' professional growth and development.

Team building and an increase in volunteer hours as the project momentum grew were intangible benefits of using an integration strategy to blend education and entertainment. Agile software team members described their individual experience in using the Jacob's Ladder pre-production design tactic when designing virtual learning games as (a) providing opportunities to play various roles within the team and encouraging appreciation of diverse perspectives, (b) promoting recognition of prior experience and idea sharing in the virtual learning game design process, and (c) supporting flexibility and adaptation in interdisciplinary collaboration. In regards to the virtual learning game, the development team enjoyed pre-production exposure to additional information regarding both fields of expertise.

Participants also served the organization by being advocates for investing in the virtual learning game by explaining the project to those who did not fully understand it. The benefits that agile software team members experienced when using the Jacob's Ladder pre-production design tactic included (a) improved communication, coordination, self-awareness, and openness; and (b) usefulness for concept illustration. However, hindrances included taking more time and limited depth and ability to address all production needs. Although participants felt that the design tactic was beneficial, they also found that it was limited and required greater consideration beyond the pre-production stage of the development process.

I used the results of data collection and analysis to answer the overreaching question regarding the experiences of team members using the Jacob's Ladder pre-production design tactic in virtual learning game design. The key findings showed how

using the Jacob's Ladder pre-production design tactic helped team members have an open dialogue about the overall game design elements while leaving them with a need for a more in-depth design tactic, such as one used to outline more technical elements. Continual research on this industry and its impact on learning is beneficial for understanding and supporting changes towards edutainment-based instruction. In this study, I contributed to addressing curriculum development needs for tomorrow's learners, diverse populations, distance education, and the global classroom. The phenomenological approach helped me explain design tactics and interdisciplinary collaboration, as perceived by the actual software team members.

Interpretation of the Findings

Current literature on educational entertainment has show that virtual learning games are an excellent way to enhance instruction. In this study, I found that the Jacob's Ladder pre-production design tactic is a tool for manipulating the potential of amusement and narrative within a virtual learning game, as the literature has indicated (Eseryel, 2014; Hirumi et al., 2010c; Merchant, 2014). The Jacob's Ladder pre-production design tactic helped inform participants' understandings of pedagogical theories of learning, and guided the process of prototyping a virtual learning game. Systematic virtual learning game design approaches both entertainment and instructional elements as equal. Using the Jacob's Ladder pre-production tactic helped the development team members consider what a real game might look and feel like, and brought interdisciplinary expertise to their design work in constructive ways.

Finding support developers' beliefs that virtual learning games provide optimal instruction, because what users enjoy as entertainment uniquely aligns with their individual learning styles. Findings showed that positive interactions between interdisciplinary design teams are essential to the design and development process, and that these interactions are facilitated by implementing integration strategies. How educators and engineers relate to each other impacts the overall evolution of an educational game.

Findings Related to the Jacob's Ladder Tactic's Influence on the Team Experience

The Jacob's Ladder tactic keeps focus on common goals and learner needs. When examining views of design team members regarding how using the Jacob's Ladder pre-production design tactic influences the team experience, I found that using the tactic helped to keep the focus of all team members, both educators and engineers, on the goals of the game and on the learners' needs. Essentially, the tactic was successful in helping team members' focus on the left portion of the model (see Figure 1) with particular emphasis on learners and learning outcomes. Others have pointed out the importance of keeping the focus on the learning outcomes when developing games (De Castell et al., 2014; Majgaard, 2014). Research exploring the factors influencing learning success has shown that development teams need guidance to ensure that learner outcomes are attainable while playing the virtual learning game (Eseryel, Ifenthaler, Ge, & Miller, 2014; Tsai et al., 2012).

Research participants explained why instructional designers of virtual learning games find integration tools essential to interdisciplinary collaboration. Others have

noted how designing an effective learning game requires a clear view of how the experience will help students reach learning outcomes (Dillon, 2010; Gershenfeld, 2014; Hirumi et al, 2010c). Many decisions made during the development of a game in the pre-production phase. It is important that those decisions made in ways that ensure that element is consistent with the game's vision and learning outcomes (Hunicke, et al, 2004; Kanuka, 2008; Su, 2013). The findings of this study suggest team members' experiences support the idea that using a design tactic such as Jacob's Ladder is effective in keeping the team focus on the goals of the game and learner outcomes.

The Jacob's Ladder tactic organized teamwork in easy to use ways.

Participants described how Jacob's Ladder pre-production design tactic was a tool for manipulating the potential of amusement and narrative within a virtual learning game design. Essentially, the tactic was successful in helping team members focus on the on the questions–the center part of the tactic model (see Figure 1)—with particular emphasis on learners and learning outcomes. As literature has shown, virtual learning games address competencies by articulating clear expectations regarding learning objectives and procedures within the game platform (Eseryel, 2014; Jin, 2012; Sahrir, 2012; Wu, 2011). Findings indicated that the benefit of integration tools and formal models is that they force the designer into a given standardized workflow and methodology, which may be useful for production purposes (Gershenfeld, 2014; Hirumi et al., 2010c). A virtual learning game's concept, design, and production were central to the development process of the self-organized team. In this study, I explored the major ideas of blending education

with entertainment, agile software development, and interdisciplinary collaboration using integration strategies associated with virtual learning game design.

The Jacob's Ladder tactic supports interdisciplinary collaboration across diverse disciplines. Findings indicated that a focus on core elements is essential to working towards a successful delivery of high-quality instructional design. Jacob's Ladder pre-production design tactic positively influenced a design team working to provide curriculum and instruction that meets the needs of a target population. Results support research findings that if designers fail to collaborate, a virtual learning game may be less efficient because of poorly blended subject content and gameplay (Alotaibi, 2014; Boyan & Sherry, 2011; Shelton & Scoresby, 2011). Previous researchers explored the philosophies, methods, and challenges of educational technology, and found a need for contributions from other disciplines to design virtual learning games (Hwang & Wu, 2012; Luo, 2011; Tsai & Fan, 2013). Researchers have explored game experts' perceptions of any number of tasks given to students, and have discovered the importance of collaborating to the design and development of relevant and exciting virtual learning environments (Johnston-Wilder, Tan, & Neill, 2013; Wu et al., 2014). Game companies and independent developers are often creative thinkers, but do not always make games with a primary focus on education, and developers may not possess the professional expertise to overcome integration challenges.

A clear and concise instructional design strategy helps organize the team work and should be easy to use. Before this research study, there were no studies showing how agile software team members described their experience of using the Jacob's Ladder pre-

production design tactic in virtual learning game design. Interdisciplinary collaboration is necessary to perceive the users' reality, and to replicate the important details that encapsulate what is popular to students (Marvel, 2012; Shelton, 2011; Wu, 2014). Using design tactics such as the Jacob's Ladderpre-production design tactic can help developers consider relevant information for game design while outlining the core game elements.

The Jacob's Ladder tactic promotes shared understanding of platform, limitations and performance. What designers identify as a beneficial characteristic of Jacob's Ladder Pre-Production Design Tactic for instructional design is a focus on learner capabilities, behavior, and outcomes. Design strategies help developers consider gameplay and instructional design to provide game play with both quality and style. Fundamentally, the tactic was successful in helping team members' focus on the on the technical aspects of game design – right side box (Hirumi, et al., 2010c) (Figure 1 in chapter 1). Design elements are factors that have some bearing on the effectiveness of students' knowledge acquisition and can impact levels of motivation and promote self-efficacy (Fisser, Voogt, and Bom, 2013; Reeve, 2009). Parts of any program require teamwork to establish programming design for overall contextual guidance within the user interface (Leffingwell, 2011; Leonard, 2010; Tsai et al, 2012). Design tactics promote shared understanding of platform, limitations, and performance while working collectively to create a virtual learning game. In this study, I heled to understand why development teams choose integration tools, such as Jacob's Ladder Pre-Production Tactic, to blend education and entertainment elements within a game.

Edutainment has a new opportunity to encourage students to connect with others within new social paradigms. The pre-production process prepares a team to prototype gameplay and instructional design identified game platform in early development, and recognize platform character limitations. Agile practices enhance the software group's shared understanding of the games appearance, response, and content within the context of the user interface (Bari & Ahamad, 2011; Hoda, Noble, & Marshall, 2013). According to Mangalaraj, Nerur, Mahapatra, & Price (2014), interdisciplinary teams need design-centric research that empirically examines the efficacy of modern software practices such as design patterns and pair designing. These presumptive shared understandings among design team members spur development of relationships and space within the games to simulate complex social context (Boyan, 2011; Dittman, Hawkes, Deokar, & Sarnikar, 2010; Siko & Barbour, 2014; Van Eck, 2011). Edutainment-based curriculum and instruction directly linked to social growth including; innovative learning strategies, the integration of curiosity and passion, professional growth, and increased cooperation and communication skills among interdisciplinary groups.

Influence on the individual experience

The Jacob's Ladder tactic provides opportunities to play various roles and encourages appreciation of diverse perspectives. The research findings for this study helped to clarify the role/title of individuals as less important than interchangeable skills; employing persons with a background in both education and entertainment may be a way to address interdisciplinary collaboration. Literature explained how design tactics that provide integration models might help support interdisciplinary collaboration and avoid

the dominance of educators or engineers in the development process, resulting in a game that may be neither fun nor entertaining (Hirumi, 2013; Hirumi, 2010c; Kickmeier-Rust & Albert, 2010). Design tactics promote recognition of prior experience and idea sharing and support flexibility and adaptation in collaboration. Previous research explored the philosophies, methods, and challenges of educational technology and found a need for contributions from other disciplines to design virtual learning games (Hwang & Wu, 2012; Luo, 2011; Tsai & Fan, 2013). The relevance of games in education is a growing topic of discourse because edutainment meets the needs of educators who may have diverse work experience with an increasing range of media.

A design strategy that addresses interdisciplinary collaboration provides opportunities to play various roles within the team and encourages appreciation of diverse perspectives of the Edutainment industry. Integration models support interdisciplinary collaboration by considering the different perspectives towards creating a real life context where students manipulate subject content (Leinonen, Durall, Kuikkaniemi, Mikkonen, Nelimarkka, Syvänen, & Toikkanen, 2014; Sobhani & Bagheri, 2014). The multiple roles of a virtual learning game design team provide spontaneous self-organizing team support that permits the tackling various projects. (Hoda, 2013; Roquilly, 2011). In an ideal world, software teams regularly engage in practices that enhance management systems, technical skills, and cross-functional proficiency (Hoda et al, 2013; Hirumi et al., 2010). The opinion towards design strategies and interdisciplinary collaboration changed during the process of working as a self-organized team.

The Jacob's Ladder tactic provides recognition of prior experience and idea sharing. Integration tools, such as Jacob's Ladder Pre-Production Tactic, are used to blend education and entertainment elements within a game, but experts may have a background in both fields. All participants described the difference between the instructional design and game design in viewing both as essential to virtual learning game design. Hirumi et al, (2010c) emphasized the consequence of having an equilibrium between education and entertainment, a balance between creative, experimental, and methodical approaches to design. A positive relationship between virtual learning game designers allows each contributor to share his or her expert experience within the design and development process (Delacruz, 2009; Siko & Barbour, 2014; Popa & Stănculea, 2012).Design teams manipulate subject area content and game strategy to create innovative learning experiences by blending the aspects of education and entertainment equitably (Blanco, Torrente, Marchiori, Martínez-ortiz, and Fernández-manjón 2012; Eseryel, 2014). The Jacob's Ladder Pre-Production Tactic promotes recognition of prior design experience and idea of sharing expertise in the virtual learning game design process.

Members of the software development team consistently identified activities related to pre-production as more influential in their perception of working with others and in knowledge acquisition. Interdisciplinary collaboration with documented outcomes supports each team member's roles based on his or her area of proficiency (Hoda et al., 2013; Shelton & Scoresby, 2011). Developers use concept prototyping and pre-existing engines to design game strategy based on shared experiences (De Castell, 2014; Marvel,

2012; Wu, 2014). Past research indicates that development teams need to institute a formal process to complete work, reach clear goals, and experience better communication among team members to develop innovative learning experiences (Dittman, Hawkes, Deokar, & Sarnikar, 2010; Goldstone, 2009). The communication process among team members is related to group dynamics because useful blueprints of designing become apparent during an exchange of ideas (Mangalaraj et al., 2014; Rapanta, Maina, Lotz, & Bacchelli, 2013). Communication among game development team members helps to outline the major aspects of the virtual learning game.

The Jacob's Ladder tactic provides flexibility and adaptation in collaboration. Integration tools, such as Jacob's Ladder Pre-Production Tactic, are used to blend education and entertainment elements within a game, but experts may have a background in both fields. Conversion from the literature review to the lived experience of software developers aided in the realization of individual experts who wish to specialize in virtual learning game design. Joint processes, such as using a design tactic, support communication infrastructures (Popa & Stănculea, 2012; Siko & Barbour, 2014). Specific tools and techniques, such as integration models, design patterns, and code refactoring improve the quality of collaboration and enhance project dexterity (Bari & Ahamad, 2011; Eseryel, 2014; Starks, 2014). Participants described a desire to act as experts in both disciplines and to engage with all the technical elements associated with creating a game.

The Edutainment industry relies on practical methods for integrating gaming and educational principles by focuses on getting the game finished on time and budge.

Successful interdisciplinary teams clearly distinguish the roles and responsibilities of each team member. Respecting individual roles and autonomy helps experts overcome a constrained design approach to integrating game activity with educational goals (Shelton & Scoresby, 2011; Gunter et al, 2006). Using integration models can promote an exchange of ideas and greater interdisciplinary collaboration for instructional game design (Boyan & Sherry, 2011; Moore, 2005; Tucker & Armstrong, 2008. Educational entertainment uses technological advances and seeks to influence the media messages that children receive. In interviewing the participants, the way of thinking about self-organized teams and interdisciplinary roles changed somewhat. Conclusions from the analysis indicate that the Jacob's Ladder Pre-Production tactic positively influenced participants knowledge of instructional design versus game design factors, as well as enhancing their perceived expertise and varied individual experience.

Experiences related to benefits and hindrances

The Jacob's Ladder tactic supports communication, coordination, self-awareness and openness. Collaborative practices support interdisciplinary teams in the course of incorporating education and entertainment within virtual learning games. Participants described their virtual learning game design experiences in ways that showcased how pre-production design tactics necessitated an awareness of both curriculum and game development and how they were affected by the integration strategies. Since agile methods require cross-functional teams, practitioners must be self-motivated and reflective (Dittman, et al, 2010; Hoda, Babb, & Norbjerg, 2013). Hoda (2013) suggested using an agile coach and the importance of being aware of the self-

managing temperament of these functions to bring about their appearance rather than imposing them on team members. A playful and reflective game designer understands the consequences of each decision and encountering the unknown features of the production process (Zichermann, 2011). Design tactics support communication, coordination, self-awareness and openness among individuals who may wish to specialize in Edutainment. In this study, I helped bridge the gap between interdisciplinary groups and integration strategies for educational game design.

The Jacob's Ladder tactic is useful for concept illustration. Edutainment specialist is involved in putting together the idea/prototype document and coordinating the release of screenshots and demo disk. Findings extend the knowledge about virtual learning game design by building on previous notions of self-organizing teams, interdisciplinary roles, and the strategic planning necessary for the concept illustration. Conclusions from the analysis indicate that the Jacob's Ladder Pre-production tactic positively influenced designers knowledge of both education and entertainment elements, as well as enhancing their perceived level of teamwork. The long-term goal is to encourage innovative design by varying roles in the development of creative virtual learning environments (Gutierrez-Santos et al, 2012; Hoda et al., 2013). Reflective practice can encourage teamwork by helping teams value time devoted to professional development and recognize the valuable input of others (Hoda, Babb, & Norbjerg, 2013; Tan, 2010). An individual whom educational games would have a background in both education and entertainment; edutainment specialist, equipped for handling the

outsourcing of audio and visual elements and task involved the intended playing experience.

The study explored the perceptions of team members who had considered the influence of a design tactic on their level of interdisciplinary collaboration, and knowledge of virtual learning game design. This research in virtual learning game design explored common interactions, like interdisciplinary cooperation and helped explain how self-governing teams work well together. Design tactics, like the Jacob's Ladder Pre-Production Tactic, help software teams in the early stages of developing a virtual learning game. The analysis indicates that the Jacob's Ladder Pre-Production Tactic positively influenced their understanding of blending education with entertainment, as well as enhancing their perceived level of collaboration.

The Jacob's Ladder tactic takes more time and limited ability to address production needs. Using a design tactic made it easy for team members to keep in mind the importance of planning their production needs based on a clear layout. Indie software developers are working to facilitate the use of fun learning; this type of group structure and other aspects of edutainment are a consequence of innovative trends adapted as social norms. The Jacob's Ladder Pre-Production Design Tactic guides interdisciplinary collaboration among a self-organized team and is ideal for an indie development group. Most participants described the differences between the education and entertainment as less significant in viewing the overall similarities. An individual whom educational games would have a background in both teaching and entertainment; edutainment

specialist, equipped for handling the outsourcing of audio and visual elements and task involved describes the intended playing experience.

This particular model is focused on pre-production by design and is not intended to address production needs. There is a need for the potential development of other tools or extension of the model to address those needs by identifying the type of individual title/role best suited to speak to each area described on the Jacob's Ladder Pre-Production Tactic. As shown in Figure 2, an individual playing the role of game producer, product manager, creative director, game designer, programmer, digital animator, or audio engineer is could represent both instructional and entertainment design.

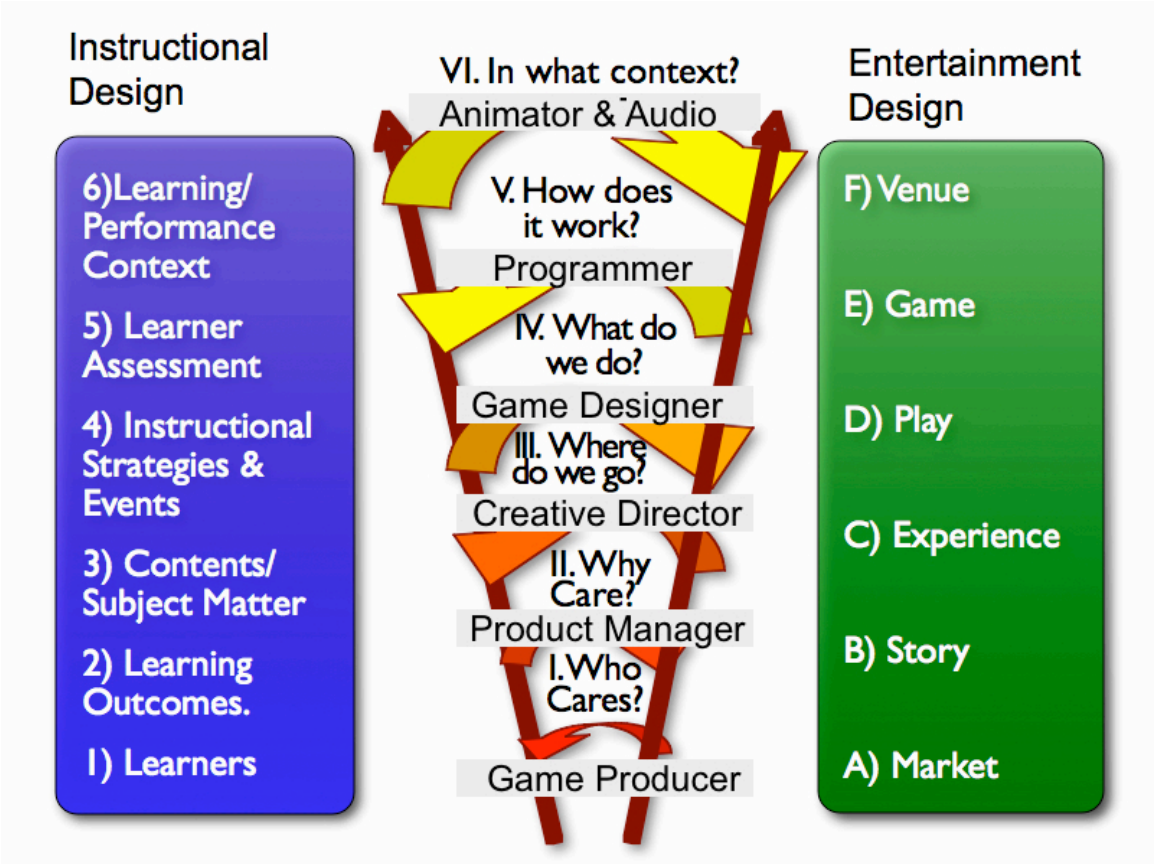


Figure 2. Jacob's Ladder pre-production tactic integration model for blending education and entertainment with Production Title/Role. Adapted from Hirumi, A., Appelman, B., Rieber, L., & Eck, R. Van for "Preparing Instructional Designers for Game-Based Learning: Part II." By A. Hirumi, B. Appelman, L. Rieber, and R. Van Eck, 2010, *TechTrends, 54*(3), p. 43. Used with permission of Atusi Hirumi, 2015.

Findings extend the knowledge about virtual learning game design because this study involved a diverse group of participants and did not contain any preconceived notions about the design team members or the process of designing a virtual learning game. All participants described the difference between previous experiences of interdisciplinary collaboration and the process of working with team members using a specific design tactic.

Limitations

Publicly available documents, including published organizational information and prototype materials, were used to inform the analysis. Therefore, a restriction of the study was that it did not consider the influence of this specific design tactic on the final outcomes of the design and development process. In this study, the results were provided to organizational members to showcase edutainment and the efforts of interdisciplinary experts, but at the core, there was no guarantee that the Jacob's Ladder Pre-Production Tactic use in the future. The major proposition of educational entertainment is a positive relationship between enjoyment and knowledge/ skill acquisition.

Many influential factors are shaping instructional design in all fields of learning; this research study notes how the perception of participants based on each individual's educational background and professional experience. The fear of damaging changes within the group dynamics is a reasonable limitation on the trustworthiness of participant responses to interview questions about their collaborative experiences. Perceptions of using the Jacob's Ladder Pre-Production Tactic could expand if team members were interviewed after all stages of development were complete, but this research was limited to the preproduction phase. Further research may be conducted to replicate or build on these findings within other design teams or by looking at experiences throughout all stages of design and development.

Recommendations

The practical contribution of this study is the improvement of learning through the growth and development of educational entertainment. Recommendations for further study are to understand the influence of such design strategies, not only on pre-production but also on the entire development process. Virtual learning game design is multifaceted, and building on prior research could influence how developers use design tactics in the course of creating virtual learning games. An examination of the conditions that causes organizations to implement a specific design strategy and the long-term impact on instructional design would be beneficial.

This industry is of interest to the educational psychologist who seeks to understand the connection between play and cognitive assimilation; the findings of this study may encourage both educators and entertainers to continue interdisciplinary

collaboration and extend research into other practices to support it. Stakeholders in virtual learning game design can also benefit from a further study into the need for minimum standards of best practices for software teams seeking to create a game that is both entertaining and educational. Previous research on developing virtual learning games did not provide insight into practitioner experiences with Jacob's Ladder Preproduction Design Tactic and its influence on active collaboration; future research could consider different types of design teams. Also, this study did not examine potential differences in the experiences of educators versus engineers. Additional research might uncover important distinctions in their experiences.

Advances in technology shape the way we communicate and affects human relations causing more students to be at risk in traditional learning environments. The role of teaching and learning leaves educators with the challenge of meeting socio emotional needs while supporting academic achievement. Further study to examine the relationship between a software design teams integration strategy and their ability to create an education game that engages students and helps students reach measurable learning goals. Also further study into the relationship between development cycles and the continued use of specific development strategies in comparison to others. Educational entertainment can simply be defined as making learning fun but with little statistical relevance without research that shows the impact of integration strategies on the formation of schema and modification of knowledge and skills to understand the outside world.

This study was limited to independent or small development groups, but I recommend further study to compare the design process within a self-organized team to

that of a more traditional software development company. There is a possibility the design process may influence collaborative teams differently when such teams are not composed of volunteers. Larger educational game companies might consider the practice of interdisciplinary collaboration among smaller departments or teams. I recommend further study to compare small teams with larger, more departmentalized companies. Continuing the conversation of what we learn while we are entertainment has significant implications on our society's growth of the Edutainment industry.

Many argue that the increased fun and enjoyment of learning games (edutainment) take place at the expense of education content, but the more we explore "play," (for example, Piaget, 1972) the easier it is to recognize its role in learning. A gap remains from existing studies and leaves a need for further exploration of how integration models influence design tactics within self-organized teams in comparison to larger departmentalized groups or perhaps examining the potential differences in experiences of engineers versus educators while using integration strategies. Organizational leaders might benefit from a further study into the need for design strategies and the influence of design on other forms of curriculum and instruction. Specifically, it is important to understand how today's teacher genuinely feels concerning the use of Edutainment as a part of curriculum and instruction.

Implications

Technological advances shape the future of teaching and learning. Therefore, we must design and develop emerging knowledge resources that display the best features of edutainment. The field of education is moving forward with greater opportunities for

change in teaching change and learning. Contemporary societal challenges we face in the area of education can overcome by embracing such change and the forces that operate to bring new development to pass. Schools are evolving institutions that constantly undergo socio-technical change by establishing new socio technical practices and implementing performance management systems.

The primary importance of this study was helping stakeholders involved in producing virtual learning games to understand, from a team member's perspective, how design tactics influence collaboration among interdisciplinary expert team members and ultimately affect the effectiveness of the game design. Software engineers are equipped to develop an engaging game, but the game will only be educational if there is an emphasis on instructional design and learning outcomes. As more educators embrace educational entertainment and subsequent alterations in a curriculum, these changes in society impact our daily lives and the advancement of our educational system. The future of virtual learning game development over the next twenty years may evolve effortlessly and inevitably as educators and engineers continue to work together.

Educational entertainment, used commonly outside the classroom, but indie software development teams are encouraged to apply game-based curriculum design because of positive beliefs associated with its impact on academic achievement. A general assumption exists that a virtual learning game increases engagement and thereby is useful for learning; In this study, I explored this hypothesis as it relates to best practices in curriculum and instruction. Advances in technology impact change in society that will continue to shape education and learning pedagogies. Technological and social

shifts in the wider environment can have major implications for teaching and learning pedagogies.

Methodological Implications

The Edutainment industry provides educators with the ability to evoke the essence of human expression and apply it to learning goals. The interviews with all seven research participants helped show why self-organizing groups might choose a specific design tactic to create a virtual learning game. In this study, I analyzed the use of this specific design tactic and the influences on an agile software development team. Many educators embrace edutainment as a way to incite interest, even when working with students in higher education. Curriculum and instruction that meets course objectives through an entertaining format are not limited to any given population; the practical applications are endless.

The study findings show a strong relationship between integration strategies and an agile software development teams positive interdisciplinary collaboration. The Jacob's Ladder Pre-Production Tactic may help software teams in the early stages of developing a virtual learning game. The development of educational games is an intricate process. Quantifying enjoyment is a hard topic of managing in experimental research. Just as play has baffled many educational psychologists, Edutainment is hard to frame into a single operational function perfectly.

Practical Implications

Findings support the notion that software development methods, such as using design tactics, can guide the self-organizing roles of an educational game design teams.

Individual team members consistently identified collaborative activities as most influential in their perception of working together and exchanging ideas. The partnerships between instructional and entertainment design establish the dependency on interdisciplinary collaboration and an ideal working environment for indie developers. Participants described their agile software design team experiences in ways that showcased how teamwork influenced by using the Jacob's Ladder Pre-Production Tactic. Participants described a desire to become experts in both disciplines and continue to engage with interdisciplinary experts from various backgrounds.

As small design teams and organizations responsible for creating virtual learning games review this study, they may consider the need to focus on using design tactics to help blend education and entertainment during the early stages of production. In this study, I found that design tactics influence interdisciplinary collaboration as well as designer's quality of subject content and gameplay integration. These recommendations were disseminated in an executive summary report to the research site organizational leaders and those who participated on the initial design team. The following future recommendations for working with an agile software team were presented:

- Focus on overall goals and user needs in different ways.
- Support flexible, adaptive cycles.
- Connect individuals and disciplines, with diversity in mind
- Encourage appreciation of diverse perspectives and roles.
- Foster sharing of ideas and enhanced cooperative learning.
- Improve communication and openness to other ideas.

- Encourage more self-awareness and promote contributions from all.
- Be prepared to take more time in the pre-production phase.

Positive Social Change

Today's digital generation demand dynamic experiences within the learning environment. Edutainment has the chore of ensuring that theses experiences are not only fun but also meet specific learning goals. When stakeholders consider the findings of this study, perhaps the use of integration strategies such as the Jacob's Ladder Pre-Production tactic will become more common.

Software development teams, who focus on educational technology, could add more interdisciplinary roles with consideration of diverse educational and professional backgrounds. Future research can continue to provide a voice to team members as a step forward in interdisciplinary collaboration for developing virtual learning games. Learner outcomes from educational games designed using design tactics could result in better designed games that truly impact learning. Many factors cause educators to turn to the entertainment industry for learning resources.

When integration strategies were used, it was good to have experts from both the education and entertainment field. Also, research findings suggest a possible new discipline with individuals who specialize in edutainment. Edutainment may help student's gain the critical thinking skills to analyze, interpret, and make predictions about the world around them. The better we understand the processes used in the edutainment world, and the more we can improve collaboration among diverse team members creating educational games, the better chance we have of improving such products for learners

and thereby impacting learning success. This study and previous literature explained how integration models might help support interdisciplinary collaboration and avoid the dominance of educators or engineers in the development process.

Future research in design tactics might help interdisciplinary development teams collaborate with a greater focus on disciplines outside of the education and entertainment field. Research that results in the expansion of the Edutainment industry must rely on the ability to measure curriculum content designed to mirror the learning process and understand the role of those with increasingly diverse backgrounds in developing effective learning games. Analysis of the data aligns shows a development team member's understanding of instructional design determined the ability to implement game mechanics effectively. Integration models can help a design team consider subject content and game strategy during interdisciplinary collaboration.

Jacob's Ladder Pre-Production Tactic is an integration model that can influence the design process of educators and engineers. In today's world, it is normal for people of all ages and various walks of life to participate in the entertainment offered by various multimedia devices. The edutainment industry itself may challenge the traditional roles played by educators versus engineers in designing games and indeed help us think differently about roles played in educating learners.

Conclusion

Our society understands more about the world through advances in educational technology. The Entertainment industry exists to integrate knowledge and skills into media devices. As research findings on integration strategies for game design is

suggested, these techniques focus on communication, self-awareness, and connectivity to improve project agility. Educational entertainment is changing learning into a contemporary form. This study provided evidence that the Jacob's Ladder Pre-Production Tactic may be linked to designing a virtual learning game that is equally educational and entertaining.

Educational game development teams have expanded game-based learning during recent years, and research results show a need to continue evolving the roles of diverse individuals in developing effective learning through games. Giving attention to the distinctive nature of learning is fundamental to our educational system. A growing number of educators embrace the Edutainment industry in search of tools and resources that foster understanding and meaning for individualized instruction. By linking integration strategies to interdisciplinary collaboration, findings from this study may be used by organizational leaders to consider best practices in team building for virtual learning game design, which will further support the growth of the edutainment industry.

The use of educational entertainment continues to grow in environments of teaching and learning. This study was important because the data analysis provided the evidence necessary to support design tactics that address the challenge of blending education with entertainment, working within self-organizing groups, and collaborating with interdisciplinary experts. Educational game design team members illustrate why design frameworks provide a schematic view of how core element of design guide students through a particular set of emotions and instincts, as this study described. The educational game design team members described the makeup and the pattern of game

assignments built into virtual learning games and echoed literature, which suggested that learner's interest, involvement, and scholarly accomplishment are significantly affected by design and that design is strengthened through systematic interdisciplinary collaboration.

Literature explained why software development team members should be equipped with a variety of skills to use emerging technologies. In this study, I reveal how individual team members guide best practices and rely on each other for consultant expertise. Educational game development teams understand the integration strategies needed to address both obvious and ambiguous characteristics of the virtual learning game design. The design and development of virtual learning games are a result of educators working to improve the learning experience, now with the assistance of engineers and others.

References

Ahlers, C. (2009). Edutainment Science: Electrostatics. *Teaching Science - the Journal of the Australian Science Teachers Association*, *55*(1), 54-56.

Allam, C. (2008). Creative activity and its impact on student learning - issues of implementation. *Innovations in Education & Teaching International*, *45*(3), 281-288. doi:10.1080/14703290802176196.

Alotaibi, M. B. (2014). Multimodal Metaphors for Edutainment in E-Learning Interfaces: A Usability Evaluation of Learnability and Experienced User Performance. *Journal Of Software*, *9*(6), 1412-1420. doi:10.4304/jsw.9.6.1412-1422

Aspire Innovative Learning, Inc. (2016, January 1). Retrieved February 8, 2016, from http://www.aspireil.org/team

Ahmad, M., Rahim, L. A., & Arshad, N. I. (2015). An Analysis of Educational Games Design from Software Engineering Perspective. *Journal Of Information & Communication Technology*, *14,* 123-151.

Avouris, N., & Yiannoutsou, N. (2012). A review of mobile location-based games for learning across physical and virtual spaces. *Journal of Universal Computer Science*, *18*(15), 2120–2142.

Bailey, L. F. (2014). The origin and success of qualitative research. *International Journal of Market Research*, *56*(2), 167. doi:10.2501/IJMR-2014-013

Balloffet, P., Courvoisier, F., & Lagier, J. (n.d). From Museum to Amusement Park: The Opportunities and Risks of Edutainment. International Journal Of Arts Management, *16*(2), 4-18.

Bari, M. a, & Ahamad, S. (2011). Managing knowledge in development of agile software. *International Journal of Advanced Computer Science and Applications*, *2*, 72–76. Retrieved from http://research.ijcaonline.org/irafit/number9/irafit1072.pdf

Bennedsen, J. Caspersen, M. (2008). Optimist have more fun, but do they learn better?: On the influence of emotional and social factors on learning introductory computer science. *Computer Science Education, 18*.

Benedettini, O., Tjahjono, B. (2008). "Towards an improved tool to facilitate simulation modeling of complex manufacturing systems." *International Journal of Advanced Manufacturing Technology, 43*(1/2), 191–9.

Blanco, A., Torrente, J., Marchiori, E. J., Martínez-Ortiz, I., & Fernández-Manjón, B. (2012). A Framework for Simplifying Educator Tasks Related to the Integration of Games in the Learning Flow, *Educational Technology & Society 15*, 305–318.

Bonner, N. A. (2010). Predicting Leadership Success in Agile Environment: An Inquiring Systems Approach. *Academy Of Information & Management Sciences Journal*, *13*(2), 83-103.

Boyan, A., & Sherry, J. L. (2011). The challenge in creating games for education: Aligning mental models with game models. *Child Development Perspectives*, *5*(2), 82–87. doi:10.1111/j.1750-8606.2011.00160.x

Bruner, J (2006). *In search of pedagogy: The selected works of Jerome Bruner, 1957-1978.* NewYork, NY: Routledge.

Cela-Ranilla, J. M., Esteve-Mon, F. M., Esteve-González, V., & Gisbert-Cervera, M. (2014). Developing self-management and teamwork using digital games in 3D simulations. *Australasian Journal of Educational Technology*, *30*(6).

Celedón-Pattichis, S., LópezLeiva, C., Pattichis, M., & Llamocca, D. (2013). An interdisciplinary collaboration between computer engineering and mathematics/bilingual education to develop a curriculum for underrepresented middle school students. *Cultural Studies Of Science Education*, *8*(4), 873-887. doi:10.1007/s11422-013-9516-5

Charsky, D., & Ressler, W. (2011). "Games are made for fun": Lessons on the effects of concept maps in the classroom use of computer games. *Computers & Education*, *56*(3), 604-615. doi:10.1016/j.compedu.2010.10.001

Clinton, G., & Rieber, L. (2010). The Studio experience at the University of Georgia: an example of constructionist learning for adults. *Educational Technology Research & Development*, *58*(6), 755-780. doi:10.1007/s11423-010-9165-2

Collier, Ken W. (2011). *Agile Analytics: A value-driven approach to business intelligence and data warehousing*. Upper Saddle River, NJ: Pearson Education.

Craver, G. A. (2014). Not just for beginners - A review of successful qualitative research: A practical guide for beginners. *Qualitative Report*, *19*(48), 1-4.

De Castell, S., Jenson, J., & Thumlert, K. (2014). From simulation to imitation: Controllers, corporeality, and mimetic play. *Simulation & Gaming*, *45*(3), 332–355. doi:10.1177/1046878114542316

Delacruz, E. (2009). Art Education Aims in the Age of New Media: Moving Toward Global Civil Society. *Art Education*, *62*(5), 13-18.

Deshpande, S. (2015). Stakeholder orientation in behaviour change marketing initiatives. Social Business, 5(3), 229-236. doi:10.1362/204440815X14441363902393

Dillon, R. (2012) Teaching games through the AGE framework. *IGDA Perspectives Newsletter* 2012: 1-7.

Dittman, D., Hawkes, M., Deokar, A., & Sarnikar, S. (2010). Improving Virtual Team Collaboration Outcomes through Collaboration Process Structuring. *Quarterly Review of Distance, 11*, 195–209. Retrieved from http://www.eric.ed.gov/ERICWebPortal/recordDetail?accno=EJ947301

Domjan, M. (2014). *The principles of learning and behavior*. Cengage Learning.

Downey, S. (2011). i-MMOLE: Instructional framework for creating virtual world lessons. *TechTrends*, *55*(6), 33–41. doi:10.1007/s11528-011-0539-z

Englander, M. (2012). The interview: Data collection in descriptive phenomenological human scientific research*. *Journal of Phenomenological Psychology*, *43*(1), 13-35.

Eseryel, D., Law, V., Ifenthaler, D., Ge, X., & Miller, R. (2014). An Investigation of the Interrelationships between Motivation, Engagement, and Complex Problem Solving in Game-Based Learning. *Educational Technology & Society*, *17*(1), 42-53.

Fahser-Herro, D. (2010). Exploring student practices, teacher perspectives, and complex learning with Web 2.0 technologies*: A socio-constructivist approach*. United States -- Wisconsin.

Gerber, H. R. (2014). Problems and Possibilities of Gamifying Learning: A Conceptual Review. Internet Learning Journal, 3(2), 46.

Goldstone, W. (2009). *Unity Game Development Essentials*. *Image* Rochester NY (Vol. 10). Retrieved from http://www.enucomp.com.br/conteudos/minicursos/unity.pdf

Gunter, G. a, Kenny, R. F., & Vick, E. H. (2006). A case for a formal design paradigm for serious games. *The Journal of the International Digital Media and Arts Association*, *3*(2004), 1–19. Retrieved from http://citeseerx.ist.psu.edu/

Gutierrez-Santos, S., Mavrikis, M., & Magoulas, G. D. (2012). A separation of concerns for engineering intelligent support for exploratory learning environments. *Journal of Research and Practice in Information Technology*, *44*(3), 347.

Hirumi, A. (September 21, 2015). Personal email communication with Dr. Christine Sorensen

Hirumi, A., Appelman, B., Rieber, L., & Eck, R. Van. (2010a). Game design as a collaborative process. *TechTrends*, *54*(5). Retrieved from http://link.springer.com/article/10.1007/s11528-010-0435-y

Hirumi, A., Appelman, B., Rieber, L., & Eck, R. Van. (2010b). Preparing instructional designers for game-based learning: Part I. *TechTrends*, (June), 27–38. Retrieved from http://link.springer.com/article/10.1007/s11528-010-0400-9

Hirumi, A., Appelman, B., Rieber, L., & Eck, R. Van. (2010c). Preparing instructional designers for game-based learning: Part II. *TechTrends*, *54*(3), 27–37. doi:10.1007/s11528-010-0400-9

Hirumi, A., Sivo, S., & Pounds, K. (2012). Storytelling to enhance teaching and learning: the systematic design, development, and testing of two online courses. *International Journal On E-Learning*, (2), 125.

Hirumi, A. '. (2013). Three levels of planned elearning interactions: a framework for grounding research and the design of elearning programs. *Quarterly Review Of Distance Education*, (1), 1.

Hirumi, A. '. (personal communication, October 8, 2015).

Hoda, R., Babb, J., & Norbjerg, J. (2013). Toward Learning Teams. *IEEE Software*, *30*(4), 95-98. doi:10.1109/MS.2013.90

Hoda, R., Noble, J., & Marshall, S. (2013). Self-organizing roles on agile software development teams. *IEEE Transactions on Software Engineering*, *39*(3), 422–444. doi:10.1109/TSE.2012.30

Hoffer.H., George.J., &Vlacich. J (2006).Modern Systems Analysis and Design. *Pearson Prentice Hall*

Hunicke, R., LeBlanc, M., & Zubek, R. (2004, July). MDA: A formal approach to game design and game research. In *Proceedings of the AAAI Workshop on Challenges in Game AI* (pp. 04-04).

Husserl, E. (2012). *Ideas: General introduction to pure phenomenology*. Routledge.

Hwang, G.-J., & Wu, P.-H. (2012). Advancements and trends in digital game-based learning research: a review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *43*(1), E6–E10. doi:10.1111/j.1467-8535.2011.01242.x

Irvine, A. (2011). Duration, dominance, and depth in telephone and face-to-face interviews: A comparative exploration. *International Journal of Qualitative Methods 10*(3), 202-220.

Jarvin, L (2015). Edutainment, Games, and the Future of Education in the Digital World. New Directions For Child & Adolescent Development 2015(147).33. doi:10.1002/cad.20082

Jin, S.-A. A. (2012). "Toward Integrative Models of Flow": Effects of performance, skill, challenge, playfulness, and presence on flow in video games. *Journal of Broadcasting & Electronic Media*, *56*(2), 169–186. doi:10.1080/08838151.2012.678516

Kay, R., & Knaack, L. (2007). Evaluating the Use of Learning Objects for Secondary School Science. *Journal of Computers in Mathematics & Science Teaching*, *26*(4), 261-289.

Kickmeier-Rust, M. D., & Albert, D. (2010). Micro-adaptivity: Protecting immersion in didactically adaptive digital educational games. *Journal of Computer Assisted Learning*, *26*(2), 95–105. doi:10.1111/j.1365-2729.2009.00332.x

Korkusuz, M. E., & Karmete, A. (2013). Educational Game Development Models. *Necatibey Faculty Of Education Electronic Journal Of Science & Mathematics Education*, *7*(2), 78-109. doi:10.12973/nefmed203

Kuh, G.D., Cruce, T.M. and R. Shoup. 2008. Unmasking the Effects of Student Engagement on First-Year College Grades and Persistence. The Journal of Higher Education, Vol.79, 540-563.

Leffingwell, D. (2011). *Agile software requirements: lean requirements practices for teams, programs, and the enterprise*. *The Agile software development series*.

Leinonen, T., Durall, E., Kuikkaniemi, K., Mikkonen, T., Nelimarkka, M., Syvänen, A. & Toikkanen, T. (2014). Design for Learning: Enhancing Participation in Learning through Design Thinking. In Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications 2014 (pp. 659-662). Chesapeake, VA: AACE.

Levine, K. J., & Hoffner, C. A. (2006). Adolescents' conceptions of work: What is learned from different sources during anticipatory socialization?. Journal of Adolescent Research, 21, 647-669. doi: 10.1177/0743558406293963

Lombardi, M. (2007). Authentic learning for the 21st century: An overview. *EduCause Learning Initiative.* ELI Paper

Luo, H. (2011). Qualitative research on educational technology: Philosophies, methods, and challenges. *International Journal of Education*. doi:10.5296/ije.v3i2.857

Majgaard, G. (2014). The playful and reflective game designer. *Electronic Journal of E-Learning*, *12*(3), 271-280.

Malliarakis, C., Satratzemi, M., & Xinogalos, S. (2014). Designing Educational Games for Computer Programming: A holistic Framework. *Electronic Journal Of E-Learning*, *12*(3), 281-298.

Malterud, K. (2001). "Qualitative research: Standards, challenges and guidelines." The Lancet.358: pp. 483-488.

Mangalaraj, G., Nerur, S., Mahapatra, R., & Price, K. H. (2014). Distributed cognition in software design: An experimental investigation of the role of design patterns and collaboration. *MIS Quarterly*, *38*(1), 249-A5.

Mattheiss, E., Kickmeier-rust, M., Steiner, C., & Albert, D. (2010). Motivation in game-based learning : It ' s More than ' Flow. In *Elearning* (pp. 77–84). Retrieved from http://wundt.uni-graz.at/publicdocs/publications/file1264407190.pdf

Maxwell, J. 1996. *Qualitative research design: An interactive approach.* Thousand Oaks CA: Sage Publications.

Maxwell, J. A. (2013). *Applied Social Research Methods Series: Vol. 41. Qualitative research design: An interactive approach* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014). Effectiveness of virtual reality-based instruction on students' learning outcomes in K-12 and higher education: A meta-analysis. *Computers & Education*, *70*, 29–40. doi:10.1016/j.compedu.2013.07.033

Meyer, B. (2013). Game-based language learning for pre-school children: A design perspective. *Electronic Journal of E-Learning*, *11*(1), 39–48.

Miller, D. J., & Robertson, D. P. (2010). Using a games console in the primary classroom: Effects of "Brain Training" program on computation and self-esteem. *British Journal of Educational Technology*, *41*(2), 242–255. doi: 10.1111/j.1467-8535.2008.00918.x

Miles, M. B., Huberman, A. M., & Saldana, J.(2014). *Qualitative data analysis: A Methods sourcebook* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Moe, R. (2015). OER as online edutainment resources: a critical look at open content, branded content, and how both affect the OER movement. Learning, Media & Technology, 40(3), 350-364.

Moran, D. (2001). Introduction to Phenomenology, Robert Sokolowski. *Journal of the British Society for Phenomenology*, *32*(1), 109-112.

Moultrie, J. & Maier, A.M. (2014) 'A simplified approach to design for assembly' in *Journal of Engineering Design*, **25** (1-3), 44-63

Murphy, C., Science, A., & Thorndike, E. (2010). Why Games Work and the Science of Learning. Title of Periodical, xx, pp-pp.

Mysirlaki, S., & Paraskeva, F. (2012). Leadership in MMOGs : A Field of Research on Virtual Teams Leadership in Virtual Teams : The case of MMOGs, *10*(2), 223–234.

Nancarrow, S. A., Booth, A., Ariss, S., Smith, T., Enderby, P., & Roots, A. (2013). Ten principles of good interdisciplinary team work. *Human Resources for Health*, *11*, 19. http://doi.org/10.1186/1478-4491-11-19

Orbe, P. (2009). Phenomenology. In S. Littlejohn, & K. Foss (Eds.), Encyclopedia of communication theory. (pp. 750-752). Thousand Oaks, CA: SAGE Publications, Inc.

Oblinger, D. G. (2004). The next generation of educational engagement. *Journal of Interactive Media in Education*, *2004*(8), 1–18. Retrieved from http://www-jime.open.ac.uk/article/2004-8-oblinger/198

Panoutsopoulos, H., & Sampson, D. G. (2012). A Study on Exploiting Commercial Digital Games into School Context, *15*, 15–27.

Patton, M. Q. (2002). *Qualitative research & evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.

Pernsteiner, S. M., Boyer, D. M., & Akcaoğlu, M. (2010). Understanding player activity in a Game-based Virtual Learning Environment: A Case for Data-Driven Instructional Design. *World Conference on ELearning in Corporate Government Healthcare and Higher Education 2010*. Retrieved from http://www.editlib.org/p/35641

Piaget, J. (1999). *Play, Dreams and Imitation in Childhood*. Florence, KY: Routledge. Retrieved from http://site.ebrary.com/lib/waldenu/docDetail.action?docID=10017405

Pirola-Merlo, A. (2010). Agile innovation: The role of team climate in rapid research and development. *Journal Of Occupational & Organizational Psychology*, *83*(4), 1075-1084 10p. doi:10.1348/096317909X480653

Popa, E., & Stănculea, L. (2012). What is Good e-Learning?. *Journal Knowledge Management, Economics & Information Technology*, *2*(4), 180-186.

Phoenix, D. A. (2014). How to Add Replay Value to Your Educational Game. *Journal Of Applied Learning Technology*, *4*(1), 20-23.

Rapanta, C., Maina, M., Lotz, N., & Bacchelli, A. (2013). Team design communication patterns in e-learning design and development. *Educational Technology Research & Development*, *61*(4), 581-605. doi:10.1007/s11423-013-9306-5

Reeve, J (2009). *Understanding motivation and emotion* (5 ed.). Hoboken, NJ: Wiley.

Romero, M. (2013). Game Based Learning MOOC. Promoting Entrepreneurship Education. *eLearning Papers*, *33*, 1–5. Retrieved from http://www.xxxxx.xxx

Roquilly, C. (2011). Control Over Virtual Worlds by Game Companies: Issues and Recommendations. *MIS Quarterly*, *35*(3), 653–671. Retrieved from http://content.ebscohost.com

Ross, S. M., Morrison, G. R., & Lowther, D. L. (2010). Educational Technology Research Past and Present : Balancing Rigor and Relevance to Impact School Learning. *Contemporary Educational Technology*, *1*, 17–35. doi:10.1177/0002764208321354

Rubin, M.; Watt, S. E.; Ramelli, M. (2012). "Immigrants' social integration as a function of approach-avoidance orientation and problem-solving style". *International Journal of Intercultural Relations* **36**: 498–505. doi:10.1016/j.ijintrel.2011.12.009.

Shelton, B. E., & Scoresby, J. (2011). Aligning game activity with educational goals: following a constrained design approach to instructional computer games. *Educational Technology Research and Development*, *59*(1), 113–138. doi:10.1007/s11423-010-9175-0

Shen, L., Wang, M., & Shen, R. (2009). Affective e-Learning : Using " Emotional " Data to Improve Learning in Pervasive Learning Environment Related Work and the Pervasive e-Learning Platform. *Educational Technology & Society*, *12*, 176–189.

Shute, V. J., Rieber, L., & Van Eck, R. (2011). . *Trends and issues in instructional design and technology*, Games and learning *3*.

Siko, J. P. (2013). Are They Climbing the Pyramid? Rating Student-Generated Questions in a Game Design Project. *Canadian Journal of Learning and Technology*, *39*(1), n1.

Siko, J., & Barbour, M. (2014). Design Research Using Game Design as an Instructional Strategy. *Journal of Interactive Learning Research*, *25*(3), 427-448.

Sobhani, M., & Bagheri, M. S. (2014). Attitudes toward the Effectiveness of Communicative and Educational Language Games and Fun Activities in Teaching and Learning English. *Theory and Practice in Language Studies*, *4*(5), 1066-1073.

Starks, K. (2014). Cognitive behavioral game design: A unified model for designing serious games. *Frontiers in Psychology*, *5*(FEB). doi:10.3389/fpsyg.2014.00028

Stumm, Sophie; Hell, Benedikt; Chamorro-Premuzic, Tomas (2011). "The Hungry Mind: Intellectual Curiosity Is the Third Pillar of Academic Performance". *Perspective*

on Psychological Science **6** (6): 574–588. doi:10.1177/1745691611421204. Retrieved February 11, 2012.

Su, C., & Cheng, C. (2013). 3D Game-Based Learning System for Improving Learning Achievement in Software Engineering Curriculum. *Turkish Online Journal Of Educational Technology - TOJET*, *12*(2), 1-12.

Szalvay, V. (2004). An introduction to agile software development. *Danube Technologies*. Retrieved from http://www.danube.com/docs/Intro_to_Agile.pdf

Tsai, F., Yu1, K., and Hsiao, H. (2012). Exploring the Factors Influencing Learning Effectiveness in Digital Game-based Learning. Educational Technology & Society, 15 (3), 240–250.

Tsai, C.-W., & Fan, Y.-T. (2013). Research trends in game-based learning research in online learning environments: A review of studies published in SSCI-indexed journals from 2003 to 2012. *British Journal of Educational Technology*, *44*(5), E115–E119. doi:10.1111/bjet.12031

Tucker, J., & Armstrong, G. (2008). Introducing International Issues: Facility Location. *Decision Sciences Journal of Innovative Education*, *6*(2), 297-303. doi:10.1111/j.1540-4609.2008.00175.x.

Ulicsak, M. (2010). Games in Education: Serious Games. *A FutureLab Literature Review*, 139. Retrieved from http://www.futurelab.org.uk/projects/games-in-education

U.S. Department of Education, National Educational Technology Plan. (2013). *Executive Summary*. Retrieved from: http://www.ed.gov/technology/netp-2010/executive-summary

Van Eck, R. (2006). Digital Game-Based Learning: It's Not Just the Digital Natives Who Are Restless. *EDUCAUSE Review*, *41*(2), 16–30. http://doi:10.1145/950566.950596

Van Eck, R. N. (2011). I. Bringing "Discipline" to the study of games and learning. *Information Design Journal*, *19*(2), 181–187. http://doi:10.1075/idj.19.2.11eck

Van Van Manen, M. (2014). *Phenomenology of practice: Meaning-giving methods in phenomenological research and writing* (Vol. 13). Left Coast Press.

Wang, L., & Chen, M. (2010). The effects of game strategy and preference-matching on flow experience and programming performance in game-based learning. *Innovations in Education and Teaching International*, *47*(1), 39–52. doi:10.1080/14703290903525838

Whitton, N. (2012). The place of game-based learning in an age of austerity. *Electronic Journal of E-Learning*, *10*(2), 249–256.

Whitton, N. (2014). *Game Theory for Learning & Teaching: Research and Theory*. Routledge.

Wu, M. L., Richards, K., & Saw, G. K. (2014). Examining a Massive Multiplayer Online Role-Playing Game as a Digital Game-Based Learning Platform. *Computers in the Schools*, *31*(1-2), 65–83. doi:10.1080/07380569.2013.878975

Wu, W.-H., Hsiao, H.-C., Wu, P.-L., Lin, C.-H., & Huang, S.-H. (2012). Investigating the learning-theory foundations of game-based learning: a meta-analysis. *Journal of Computer Assisted Learning*, *28*(3), 265–279. doi:10.1111/j.1365-2729.2011.00437.x

Yu, X., & Petter, S. (2014). Understanding agile software development practices using shared mental models theory. *Information and Software Technology*, *56*(8), 911–921. doi:10.1016/j.infsof.2014.02.010

Zinn, W. (2008). Making Fun of School, or Why does Learning have to be Such a Drag?: Six Key Elements for Motivating Learning. *International Journal of Learning*, *15*(8), 153-160.

Appendix A: Invitation to Participate in Research

Be part of an important study about

how integration models influence agile software teams

as they create virtual learning games.

1. Are you an active member of Aspire Innovative Learning, Inc?

2. Do you participate on an educational game design team?

3. Are you an expert in an area of education or engineering?

4. Do you use the Jacob's Ladder Pre-Production Design Tactic tool for virtual learning game design?

If you answered YES to these questions, you may be eligible to participate in a study about developers' perceptions of Jacob's Ladder Pre-Production Design Tactic. Participation would involve a one to one and a half hour interview.

If interested please contact Ms. Turner

Mobile: XXX-XXX-XXXX

Email: jasmine.turner@waldenu.edu

Ms. Jasmine Turner, a Walden University Student, will conduct this study.

Appendix B: Data Collection Tool

Date

Location

Name of Interviewer

Interview #____

Job description

Prototype input

Anticipated interview length is one to one and a half hours.

Influence on team experience (Questions 1-4)

1.What words would you use to describe Jacob's Ladder Pre-Production Design Tactic?
2. From your experience, what does it mean to use this tactic within an agile software team?
3. Describe your experiences with interdisciplinary collaboration as you design games using the tactic.
4. In what ways does the Jacob Ladder's Pre-Production Design Tactic influence the work of the agile group?

Influence on individual experience (Questions 5-8)

5. How did you participate in the virtual learning game design process?
6. What role did others play in the virtual learning game deign process?
7. Describe your feelings, attitudes, or opinions about the interdisciplinary collaboration process in agile groups?
8. What else can you tell me about your experience in using Jacob's Ladder design tactic while designing games?

Benefits and hindrances experienced (Questions 9-11).

9. In what ways does Jacob's Ladder Pre-Production Tactic influence communication?
10. Based on your experience, what do you like the most about the Jacob's Ladder Pre-Production Design Tactic? Why?
11. What do you like least about the Jacob's Ladder Pre-Production Design Tactic? Why?

Summary question (Question 12).

Is there something in addition you would like to share about the process of working in an agile team using Jacob's Ladder Pre-Production Tactic

Appendix C: Interview Protocol

Date:

Location:

Participant:

Job description:

Prototype input:

Interview length:

• Thank you for coming today

• Introduction of facilitator (myself)

My name is Jasmine Turner

I am a student at Walden University

Currently a candidate for a Doctorate degree in Philosophy of Education, specializing in Educational Technology

In case of problems or concerns provide contact Dr. Leilani Endicott, a Walden University representative at the information provided on your consent form.

• Purpose of the discussion:

The purpose of today's discussion is to better understand Game Developers' Perceptions of the Jacob's Ladder Pre-Production Design Tactic.

• Informed consent

You replied, "I consent" to an email to participate in an interview that is expected to last an hour to an hour and a half. Some time after the interview, you will be asked to participate in a follow-up meeting to review the transcript of the interview to ensure its accuracy and the accuracy of my interpretation. This is called member checking and should take 30 minutes up to an hour. With your permission, the audio portion of the

interview will be recoded; no video will be recorded. No personally identifiable information will be shared on audio recordings or notes from the interview. For follow-up meetings with participants, I will meet face-to-face or through videoconference at locations and times suitable for the participant. With each participant, I will review interview transcripts and perform member checks (confirming validity of researcher's interpretations). Your identity will not be linked to your responses. That is, I will not report any information that could potentially make you identifiable, like your name or personal characteristics. The data I collect will remain confidential. You have the right to review the interview transcript, the material that is collected, and the data that has been gathered as the result of this session. You have the right to withdraw from the study at any time without prejudice. You can choose to leave or not answer any questions asked should you feel uncomfortable at any time during our discussion of your experiences.

• Check for understanding and obtain consent:
Are there any questions about the informed consent information?
Do I have your consent to proceed with this interview?

• Confirm permission to record the session
To help me in my analysis I would like to record our session.
I am the only person who will access audio-recordings. Transcripts, that do not contain names, will only be available to members involved directly with the research. Instead of names I will use job title/descriptors in the transcripts. As I reflect, summarize, and report on what we have discussed, I will never share information that would allow you to be identified.

• Check for Understanding and obtain consent:
Are there any questions about the intent to record our session?
Do I have your consent to record our session?

• Ground rules:

There are no right or wrong answers—I am interested in your perceptions and experiences. Please let me know if you wish to stop or take a break at any time

• Check for Understanding:

Are there any questions regarding the ground rules that were just shared?

• Questions:

Influence on team experience (Questions 1-4)

1.What words would you use to describe Jacob's Ladder Pre-Production Design Tactic?

2. From your experience, what does it mean to use this tactic within an agile software team?

3. Describe your experiences with interdisciplinary collaboration as you design games using the tactic.

4. In what ways does the Jacob Ladder's Pre-Production Design Tactic influence the work of the agile group?

Influence on individual experience (Questions 5-8)

5. How did you participate in the virtual learning game design process?

6. What role did others play in the virtual learning game deign process?

7. Describe your feelings, attitudes, or opinions about the interdisciplinary collaboration process in agile groups?

8. What else can you tell me about your experience in using Jacob's Ladder design tactic while designing games?

Benefits and hindrances experienced (Questions 9-11).

9. In what ways does Jacob's Ladder Pre-Production Tactic influence communication?

10. Based on your experience, what do you like the most about the Jacob's Ladder Pre-Production Design Tactic? Why?

11. What do you like least about the Jacob's Ladder Pre-Production Design Tactic? Why?

Summary question (Question 12).

Is there something in addition you would like to share about the process of working in an agile team using Jacob's Ladder Pre-Production Tactic?

• Wrap-Up:

Thank you for participating in this research study

Remember that the thoughts you shared with me today will be used to understand Game Developers' Perceptions of the The Jacob's Ladder pre-production design tactic

Remember that your identity will remain private. What was said during this interview will remain confidential

Confirm contact information—for further contact, questions, and/or concerns please email me at jasmine.turner@waldenu.edu. Remembers, I will contact you again for to review your interview transcripts and perform a member check.

Appendix D: Data Analysis Matrix

How does Jacob's Ladder Pre-Production Design Tactic influence the experience of agile software teams as they create virtual learning games?

Codes	Categories	Themes
Code 1 computer code	Category 1 Focus on core elements	Theme 1 Jacob's Ladder Pre-Production Design Tactic keeps the team focus on common goals and learner needs.
Code 2 strong image		
Code 3 game feel		
Code 4 movement and sound track	Category 2 Work towards successful delivery	
Code 5 game story	Category 3 Consider relevant information for game design	Theme 2 Within an agile software team, a design tactic helps organize the teamwork and is easy to use.
Code 6 outline the game feel		
Code 7 note computer code needs		
Code 8 discuss movement	Category 4 Outline core game elements	
Code 9 establish soundtrack		
Code 10 brand marketing to target students	Category 5 Consider commercially successful idea for education and entertainment	Theme 3 The design tactic supports interdisciplinary collaboration across diverse disciplines.
Code 11 controls the game play to measure learner outcomes	Category 6 Examine game contents with game play and instructional design	
Code 12 music, sound effects, and character voices for the story line		
Code 13 consider behavior capabilities of the user	Category 7 Provides game play with both quality and style	
Code 14 consider behavior capabilities of the game engine		
Code 15 information	Category 8	Theme 4

needed to predict game sales	Prepares team to prototype game play	Jacob Ladder's Pre-Production Design Tactic promotes shared understanding of platform, limitations, and performance
Code 16 easy to explain to a publisher	Category 9 Identified game platform in early development	
Code 17 propose task for artwork, music, and audio assets		
Code 18 considers the necessary spoken instructions and ambient effects.	Category 10 Recognize platform character limitations	

How do agile software team members describe their experience in using Jacob's Ladder Pre-Production Design Tactic in designing virtual learning games?

Codes	Categories	Themes
Code 1 incorporates and adapts any ready-made code libraries	Category 1 Plans and define all the elements of a game: its setting; structure; rules; story flow; characters.	Theme 1 Provides opportunities to play various roles within the team and encourages appreciation of diverse perspectives.
Code 2 gives life to game characters and other elements		
Code 3 produces a sound design for the game		
Code 4 liaises between organizational leaders	Category 2 Role is to help maximize the sale	
Code 5 focuses on the quality and style of the game		
Code 6 writes custom code as required.	Category 3 Liaises between organizational leaders and the game development team.	Theme 2 Promotes recognition of prior experience in the virtual learning game design process and idea sharing in the virtual learning game design process.
Code 7 makes sure that the finished game fulfils the initial goals.		
Code 8 distribution of the game.	Category 4 The objects, props, vehicles, and devices available to the characters; interface design;	
Code 9 such as objects, scenery, vegetation and		

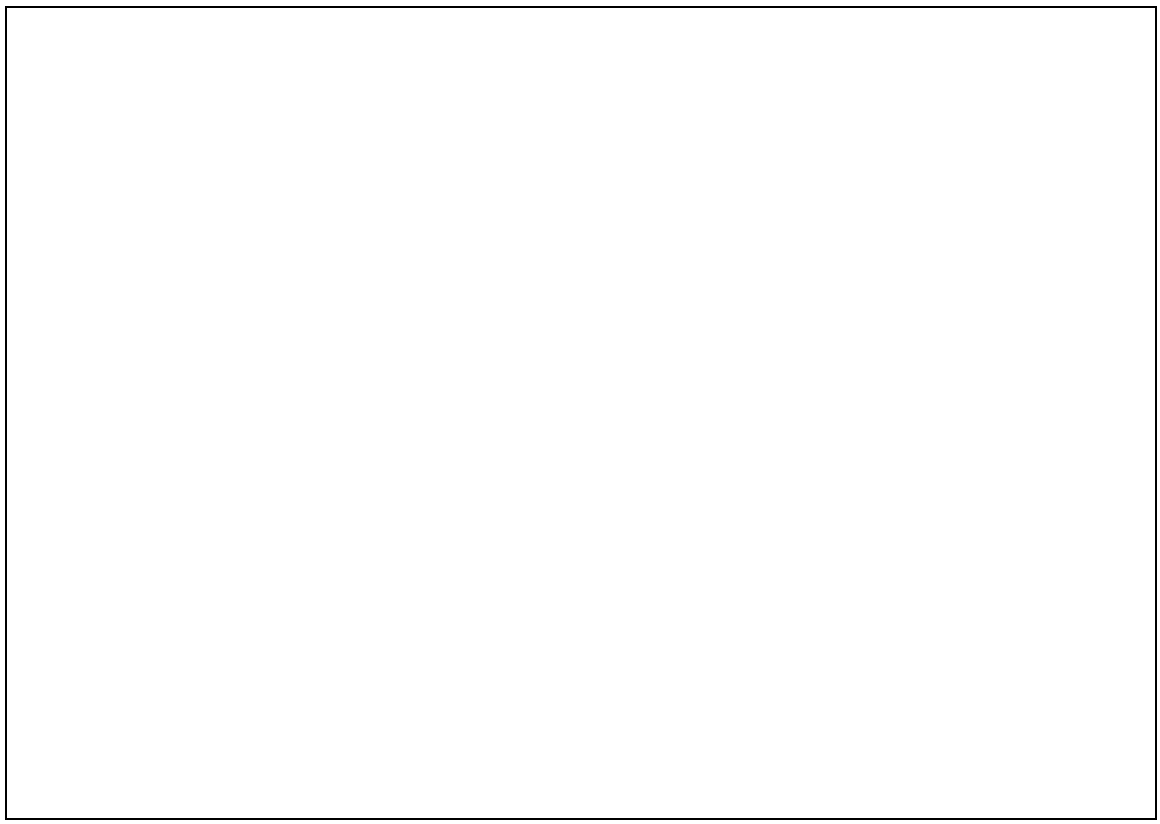
environmental effects, and the composing, scoring and recording of music.	and modes of play.	
Code 10 Working closely with the game's project manager	Category 5 Focuses on getting the game finished on time and on budget.	Theme 3 Supports flexibility and adaptation in interdisciplinary collaboration.
Code 11 Working with the creative director time.		
Code 12 Working with the game designer		
Code 13 Working at the heart of the game	Category 6 The objects, props, vehicles, and devices available to the characters programmers	
Code 14 Working with the audio engineer, the animator outlines the number of key frames used		
Code 15 Working with the animator, the audio engineer is responsible for sourcing any sound effects and edits		

What benefits and/or hindrances do agile software team members experience when using Jacob's Ladder Pre-Production Design Tactic?

Codes	Categories	Themes
Code 1 liaise between development team members, managing the marketing budget	Category 1 Task involved putting together the concept/prototype document	Theme 1 Supports communication and coordination, self awareness and openness
Code 2 Task involved defining the framework of the game		
Code 3 Task involved test the code, fix bugs		
Code 4 Task involved using the animation tools and techniques and improving or creating sound effects	Category 2 Task involved coordinating the release of screenshots and demo disks	

Code 5 Task involved budget, formulate feedback on game's unique concept	Category 3 Task involved handling the outsourcing of audio and visual elements	Theme 2 Useful for concept illustration Being useful for concept illustration
Code 6 providing cross-platform graphics rendering, game physics.	Category 4 Task involved describes the intended playing experience.	
Code 7 Task involved explore technical advances		
Code 8 provided by the selected 3D animation software package, make extensive libraries		
Code 9 lip syncing animation to re-versioning game in other languages		
Code 10 edit/cut scenes, and running focus tests.	Category 5 Addressing technical options for a non-linear game environment.	Theme 3 Taking more time and has limited depth and ability to address all production needs
Code 11 reusable animations for each character, and creating an underlying structure/skinning of the characters.	Category 6 Redesign characters and scenarios, and promote games dynamic features.	
Code 12 rendering, game physics, sound management, AI, and other specialist tools.		
Code 13 Creation and distribution of packaging and marketing materials	Category 7 Changing and updating to reflect production and technical decisions taken during the production cycle for the game.	
Code 14 Handle intellectual property licensors.		

Appendix E: Human Research Protections Training Certificate



Appendix F: Permission to use the Jacob's Ladder Pre-Production Tactic