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The Effects of Using the Social Elements of

Competition and Cooperation in a

Transformational Play-based Educational Video Game

by

Luke Erickson

A dissertation

submitted in partial fulfillment

of the requirements for degree of

Doctor of Philosophy in Instructional Design

Idaho State University

Spring 2018

Committee Approval

To the Graduate Faculty:

The members of the committee appointed to examine the dissertation of Luke Erickson find it satisfactory and recommend that it be accepted.

_____
Dr. Dorothy Sammons,
Major Advisor

_____
Dr. Robert Lion,
Committee Member

_____
Dr. Nancy Deringer,
Committee Member

_____
Dr. Beverly Ray,
Committee Member

_____
Dr. Bryan Gee,
Graduate Faculty Representative

Idaho State University
Human Subjects Committee
Notice of Action

Nov 30, 2017

Luke Erickson
College of Education
322 E. Front Street Ste 120K
Boise, ID 83702

RE: regarding study number IRB-FY2018-123: THE EFFECTS OF USING THE SOCIAL ELEMENTS OF COMPETITION AND COOPERATION IN A TRANSFORMATIONAL PLAY-BASED EDUCATIONAL VIDEO GAME

Dear Mr. Erickson:

I agree that this study qualifies as exempt from review under the following guideline: Category 1. Research conducted in established or commonly accepted educational settings, involving normal educational practices, such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.
This letter is your approval, please, keep this document in a safe place.

Notify the HSC of any adverse events. Serious, unexpected adverse events must be reported in writing within 10 business days.

You are granted permission to conduct your study effective immediately. The study is not subject to renewal.

Please note that any changes to the study as approved must be promptly reported and approved. Some changes may be approved by expedited review; others require full board review. Contact Tom Bailey (208-282-2179; fax 208-282-4723; email: humsubj@isu.edu) if you have any questions or require further information.

Sincerely,

Ralph Baergen, PhD, MPH, CIP
Human Subjects Chair

University *of* Idaho
Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010
Phone: 208-885-6162
Fax: 208-885-5752
irb@uidaho.edu

To: Lyle J. Hansen

Cc: Luke V. Erickson

From: Sharon Stoll
Chair, University of Idaho Institutional Review Board

Date: November 21, 2017

Title: Northwest Youth Financial Education Program
IRB #: 16-062

Submission Type: Protocol Amendment Request Form

Review Type: Process Administratively

Protocol Approval Date: 09/07/2016

Protocol Expiration Date: 09/06/2018

The Institutional Review Board has reviewed and **approved** the amendment to your above referenced Protocol.

This amendment is approved for the following modifications:

- Adding Luke as personnel

The amendment does not alter the approval period listed above and the study must be renewed at least 30 days before the expiration date if research is to continue beyond that time frame. Should there be significant changes in the protocol anticipated for this project, you are required to submit another protocol amendment request for review by the committee. Any unanticipated/adverse events or problems resulting from this investigation must be reported immediately to the University's Institutional Review Board.

University *of* Idaho
Office of Research Assurances
Institutional Review Board
875 Perimeter Drive, MS 3010
Moscow ID 83844-3010
Phone: 208-885-6162
Fax: 208-885-5752
irb@uidaho.edu

To: Lyle J. Hansen

From: Sharon Stoll
Chair, University of Idaho Institutional Review Board

Date: August 23, 2017
Title: Northwest Youth Financial Education Program

Project: 16-062
Approved: 08/23/2017
Expires: 09/06/2018

On behalf of the Institutional Review Board at the University of Idaho, I am pleased to inform you that the above-referenced non-exempt Expedite study is approved for another year in accordance with 45 CFR 46.111. The approval period is listed above. Research that has been approved by the IRB may be subject to further appropriate review and approval or disapproval by officials of the Institution.

This study may be conducted according to the protocol described in the application. Research that has been approved by the IRB may be subject to further appropriate review and approval or disapproval by officials of the Institution. Every effort should be made to ensure that the project is conducted in a manner consistent with the three fundamental principles identified in the Belmont Report: respect for persons; beneficence; and justice. As Principal Investigator, you are responsible for ensuring compliance with all applicable FERPA regulations, University of Idaho policies, state and federal regulations.

Federal regulations require researchers to follow specific procedures in a timely manner. For the protection of all concerned, the IRB calls your attention to the following obligations that you have as Principal Investigator of this study.

1. For any changes to the study (except to protect the safety of participants), an Amendment Application must be submitted to the IRB. The Amendment Application must be reviewed and approved before any changes can take place.

2. Any unanticipated/adverse events or problems occurring as a result of participation in this study must be reported immediately to the IRB.

3. Principal investigators are responsible for ensuring that informed consent is properly documented in accordance with 45 CFR 46.116.

4. A Continuing Renewal Application must be submitted and approved by the IRB prior to the expiration date else automatic termination of this study will occur. If the study expires, all research activities associated with the study must cease and a new application must be approved before any work can continue.

5. Please complete the Continuing Renewal/Closure form in VERAS when the project is completed.

6. Forms can be found at https://veras.uidaho.edu.

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Like any major undertaking, credit for completing this dissertation and associated doctoral degree is not mine alone but is shared with a long list of people. First, a warm and sincere thank you is owed to Dr. Dotty Sammons. I appreciate her work ethic and dedication, but even more, I appreciate her patience and persistent but gentle nudges to move forward. I am also thankful for the time and expertise of my committee members, Dr. Robert Lion, Dr. Nancy Deringer, Dr. Beverly Ray, and Dr. Bryan Gee.

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The Effects of Using the Social Elements of Competition and Cooperation in a Transformational Play-based Educational Video Game

Dissertation Abstract--Idaho State University (2018)

The purpose of this study was to explore the educational outcomes of four different methods of instruction: a traditional slideshow control group, and an educational video game played either individually, competitively in small groups, or cooperatively in small groups. The instructional tool of interest was an educational video game designed to teach a personal finance lesson on credit scores. The game was designed using a basic ADDIE model and was informed by an instructional design framework called *transformational play*. The research questions that guided this study focused on the differences in performance, engagement, or attitude that might result from playing the game in competitive or cooperative contexts. The participants in the study consisted of traditional extension and outreach audiences associated with a land-grant university located in the intermountain west. The results of this study indicated that, with one exception, there were no significant differences in outcomes between the four different methods of instruction. No differences in engagement or attitude were found among the four groups, and there were no differences in performance among three of the groups. The exception was the finding that the participants who learned in the traditional slideshow setting scored higher on a post-test performance assessment than those who played the educational video game competitively. Possible interpretations of this finding are discussed. This study and its findings are important because they add to the literature about learning through video games and in competitive and cooperative contexts. Specifically, much of the literature indicates that competition or cooperation in nearly

any form might lead to improved educational outcomes. However, the results of this study indicate that when using a precisely defined form of competition and cooperation in learning contexts, better educational outcomes are not a given. The broad interpretations of this study are that educational outcomes of using educational video games may not vary greatly based on social context when using more precise definitions of competition and cooperation. This may afford educators the freedom to choose among different social structures when using educational video games. And finally, while the instructional framework of transformational play still holds promise, future research must be carefully designed in order to determine the circumstances under which it is effective.
Key Words: transformational play, cooperation, competition, video games, education

CHAPTER I

Introduction

The U.S. financial crisis of 2007-2008 brought about renewed attention to personal finance education and, in some states, has even resulted in mandates that high schools add personal finance to their curricula. However, some research has indicated that financial education efforts are not effective in having a lasting impact on students (Mandell, 2006; Peng, Bartholomae & Cravener, 2007).

Though not unique to financial education, one significant challenge is balancing the need to provide relevant content with the need to maintain high levels of learner engagement. There is growing evidence that certain types of educational video games have potential to achieve this balance with personal finance topics (Liu, Franklin, Shelor, Ozercan, Reuter, Ye, & Moriarty, 2011; Richards, Williams, Smith, & Thyer, 2015). A relatively novel instructional design theory called *transformational play* put forth by Barab et al. (2009) provides a framework for creating educational video games that can be effectively applied to the domain of personal finance. Learning through play is transformational in the following sense: "From a design perspective, facilitating transformational play requires creating spaces that are responsive to players' decisions, such that both the game and the player change as game play progresses" (Barab, Gresalfi, Dodge, & Ingram-Goble, 2010, p. 527). That is to say, the learner's knowledge is transformed when he or she learns, and the situational learning environment presented through the game is also transformed according to the learner's progress.

The theory of transformational play is based on learning and changing the player through play, exploration, and experience in a situated digital environment. It is therefore not classified as gamification, which is the process of introducing game elements to a

traditional learning environment (Plass, Homer, & Kinzer, 2015). Rather, it can be classified as a combination of playful learning and game-based learning (Barab, Scott, Siyahhan, Goldstone, Ingram-Goble, Zuiker, & Warren, 2009; Plass, Homer, & Kinzer, 2015). Playful learning is presenting learners with a space of discovery, while game-based learning is the process of using game elements in these spaces of discovery (usually digital) to move the narratives and learning activities in a way that helps the learners accomplish specific learning objectives (Plass, Homer, & Kinzer, 2015). Game-based learning is a subset of serious games (games designed primarily for non-entertainment purposes). In short, learning scenarios based on the theory of transformational play share many similarities with video games in general, but have specific learning objectives, playful fictional environments, first-person navigation, and narratives driven by learners' in-game decisions.

Transformational Play Overview

The term "transformational play" is used to describe both an instructional strategy and a learning theory. Barab et al. (2012) defined the theory of transformational play as "a theory meant to communicate the power of games for positioning person, content, and context in a manner that supports deep and meaningful learning" (p. 519). In an earlier paper, Barab et al. (2009) described transformational play instruction as follows, "Most importantly, transformational play involves a sense of narrative, perceptual, interactive, and/or social immersion within a situation where the individual has some level of agency in terms of transforming the context and effects on how the events unfold" (p. 316).

Specific research-based explorations of the impact of transformational play are limited to educational video games, reportedly due to their unique capacity to allow learners to bind themselves to a course of action, experience consequences, and reflect on decisions (Barab et al., 2010). But not all video games, or even educational video games are instances of transformational play as illustrated by the following:

> Transformational play is not simply a theory about designing contexts in which players have transformational potential. It is a theory about the need to establish curricular experiences that position non-experts as change agents who, through their successful application of conceptual tools, can have experiences involving actually changing contexts at the same time they come to see themselves as people who successfully use academic experiences. (Barab et al., 2012, p. 532)

Playing transformationally is not about memorization or rehearsal of academic facts, and is not even really about gameplay, though many mechanics of gameplay may be present. Instead, it is about learning to use real academic knowledge to make a difference in the world, albeit a fictional world. In a fictionalized world, where the learner's avatar or character is situationally placed in a prime position to change that world, it is relatively easy for the learner to see and experience the positive and negative consequences of content driven decisions. Thus, experience becomes the means of instruction when learners play transformationally.

Existing literature supports the theory that human cognition and understanding are significantly aided by stories (Gadanidis & Hoogland, 2003; Ferguson et al, 1992; Kose, Koc, & Yucesoy, 2013; Schank & Berman, 2006; Ying-Shao, 2006). Barab et al. (2012) have demonstrated that simply presenting stories to learners is not as effective as placing

the learner within those stories and giving them opportunities to interact with story elements and characters. In so doing, the authors argue, the learner is given the opportunity to engage in personally meaningful, learner-directed experiences which appropriately challenge the learner's current levels of knowledge and understanding (Bruner, 1960; Dewey, 1938; Vygotsky, 1978). Barab et al. (2012) suggested using transformational play as the framework for effectively immersing the learner within narratives and for maximizing the benefits of constructive learning with narrative scaffolding. The theory of transformational play is comprised of three main elements: first-person direction, contextually legitimate content, and narrative consequentiality. Some research has suggested that a fourth element -- social interaction -- is supportive of the three main elements (Barab et al., 2009; Barab et al., 2012).

Social constructivist learning theory, on which the theory of transformational play is based, emphasizes social interactions in the learning process (Barab & Duffy, 2000; Dawley & Dede, 2014; Mitchell & Savill-Smith, 2004). Including social interactions as part of the learning process seem to result in significant learning gains (Ravenscroft & Matheson, 2002). Virtual worlds are no exception; they also show significant learning benefits when socio-collaborative features are present, and learners tend naturally to desire social interactions when playing games (Gee, 2012; Iqbal, Kankaanranta,, & Neittaanmaki, 2010).

Social interaction within serious games such as those based on transformational play can take place in two primary ways: competitive and cooperative play (Loparev, Lasecki, Murray, & Bigham, 2014). Competitive play is based on each individual player outperforming other players on some kind of in-game score or metric. Cooperative play is

based on each individual player's success being directly tied to the success of other players in the game who are on their "team," and players have the ability to help each other achieve success (Loparev et al. 2014).

Role of Competition and Cooperation. The commercial video gaming industry has recently surpassed Hollywood in annual revenue. Additionally, a highly cited Pew research report showed that 97% of students 18 and under have played video games for leisure (Lenhart, Kahne, Middaugh, Macgill, Evans, & Vitak, 2008). A more recent study found that 72% of teens report playing video games regularly on a console, computer, or cell phone, and interestingly, 78% of online teen gamers (42% of all teens) say that games help them feel more connected to their friends (Lenhart, Smith, Anderson, Duggan, & Perrin, 2015). These findings demonstrate that as a means of engagement, video games are generally very effective. The use of video games in education is only beginning to be explored and defined, though any digital implementation of the following terms is thought to fall under the umbrella of educational video games: gamification, playful learning, game-based learning, serious games, video games, transformational play, and others. Collectively, the literature indicates strong preliminary findings for the use of these types of video games for educational purposes (Gee, 2003; Richards, Williams, Smith, & Thyer, 2015; Squire, 2011; Xu & Zia, 2012). Still, the current literature lacks empirical evidence concerning the educational value of some video game elements like *competition* and *cooperation*. It is reasonable to assume that, since such elements are useful means of engagement in commercial video games, adding competitive or cooperative elements to transformational play-based learning has the

potential to increase learner engagement, knowledge, and attitudes related to personal finance content.

Theoretical Framework

The theory of transformational play is an instructional design theory with roots in several learning theories including constructivism, experiential learning, social learning, and situated learning. Barab, Gresalfi and Ingram-Goble (2010) argue that "experiential consequentiality" is the key to learning from instruction based on transformational play. Transformational play learning experiences allow the context to respond to learner actions with appropriate consequences; thus, the situation and resulting experiences become the primary means of instruction.

Situational learning posits that "all learning takes place within a specific context and the quality of the learning is a result of interactions among the people, places, objects, processes, and culture within and relative to that context" (Dawley & Dede, 2014, p. 2). Situations have been frequently referenced over the years as a powerful means of initiating learning sessions, helping learners gain knowledge, instilling deep meaning in learners, and indexing that knowledge so that it is more effectively recalled and applied (Brown et al., 1989; Gee, 2015; Lave & Wenger, 1991; Piaget, 1972). Barab and Duffy (2000) suggested that meanings are socially and culturally constructed and therefore the theory of transformational play seeks to situate the learner in an environment where social and cultural dynamics *influence* and are *influenced by* the learner.

Relatively new immersive technologies often associated with video games seem to align well pedagogically with situated and constructivist learning theories (Dawley &

Dede, 2014). The imaginary learning environments that are possible with these technologies have the capacity to provide a level of scaffolding and learner participation that is rarely available in the physical world (Dawley & Dede). These are the very same types of learning environments used by transformational play theorists to situate learning where important content can be brought to the forefront using dramatic narratives, vibrant audio-visuals, and a sense of conceptual play within a world governed by game-based rules (Barab et al., 2009). Such imaginative play provides opportunities for learning not usually found in the world and situations where even young learners can take on important societal roles, such as reporter, elected official, scientist, etc., and the associated responsibilities of these roles which, of course, are rarely entrusted to them in the real world (Barab et al., 2012). The opportunity to learn through imaginative role-playing is not unique to video games, but video game technology is becoming highly complementary to existing methods of delivery.

Noted experiential learning theorist David Kolb (1984) said, “Learning is the process whereby knowledge is created through the transformation of experience” (p. 38). In some cases, it can be very difficult to imagine learning content by any other means; for example, “Learning to ride a bike in text form is very different to the overall experience of pedaling, balancing, steering, braking, and contemplating traffic” (D’Arcy & D’Arcy, 2012, p. 11). Considering the works of scholars like John Dewey, Kurt Lewin, Jean Piaget, Lev Vygotsky, William James, Carl Jung, Paulo Freire, Carl Rogers, and Mary Parker Follett, it is clear that experiential learning is a long sought-after ideal in education (Kolb, 2014) and continues to be effective for increasing measures of both learning and attitude (Burch, Batchelor, Heller, Shaw, & Kendall, 2014).

Many classroom-based experiential learning programs include assignments that connect real life to course materials, and provide real-life scenarios but with mediated, or safe, consequences of failure (Lewis & Williams, 1994). Even beyond the tasks and environments provided by experiential learning, Vygotsky's social constructivist learning theory suggests that construction of social knowledge is inherent in experiential learning (Kolb & Kolb, 2009). What's more, with the advent of digital media, particularly video gaming technologies, such classroom-based experiences are, for the first time, becoming easily scalable, reusable, and conducive to meaningful standardized assessments (Beckem & Watkins, 2012).

The theory of transformational play is a theory of instruction, but was established on a solid foundation of learning theory. Its primary goal is to optimally situate the learner within pedagogically meaningful digital experiences that allow for knowledge to be socially constructed. It is a mechanism for helping learners live the literature, explore the roles and responsibilities of a society beyond their own, and to use interdisciplinary knowledge to solve personal and community problems (Barab et al., 2010; Barab, Gresalfi, & Ingram-Goble, 2010).

Background and Problem

While the use of gamification, playful learning, game-based learning, serious games, and video games in general for educational purposes seems to be gaining support in the literature and in the classroom, there is still much to be determined. For example, after observing cooperative interactions and slightly higher scores in their game-based experimental groups, Barab et al. (2009), and Barab et al. (2012) suggested that social elements can have a positive impact on learning and engagement when used to support

transformational play. One mechanism for increasing social interaction in transformational play-based learning is the use of competition, such as dividing students into groups to compete against each other, the use of scorekeeping, and other potential competitive elements. Another mechanism is cooperation, such as creating scenarios where in-game objectives can only be accomplished by students who work together with other students. Existing literature concerning the educational value of video game elements like competition and cooperation is incomplete. This study attempted to add to that literature by examining competition and cooperation in an educational video game environment.

Social-Competition and Video Games. Leading research on the use of competition to promote positive attitude and learning has produced some mixed results but overall seems to indicate significant benefits of learning and attitude. For example, Ciampa (2014) reported that among sixth grade students who used tablets for classroom learning, content mastery was a more motivating goal than competition, but competition did provide optimal challenges and regular feedback on progress toward mastery. A study by Vandercruysse, Vandewaetere, Cornillie, and Clarebout (2013) reported no significant difference in motivation, perceptions and learning outcomes between students who engaged in competition and those who didn't. However, a later study by Cagiltay, Ozcelik, and Ozcelik (2015) criticized the conclusions by Vandercruysse et al. (2013), saying that it was a major weakness to only consider competition against a virtual opponent. In contrast, Cagiltay, Ozcelik, and Ozcelik found that when serious games use social-competition, or learners competing against each other, motivation and post-test learning scores improve significantly. Williams and Clippinger (2002) further supported

the notion that there are more learning benefits in using social-competition (learners competing against each other) than in individual learners competing against a computer.

Zhi-Hong (2014) found that the element of competition can be effective when used against peers as well as self-competition where learners compete against themselves. Findings indicated that low-ability students have a greater preference for peer-competition than self-competition, but that higher-ability students showed an equal preference for peer- and self-competition. Admiraal, Huizenga, Akkerman, and Dam (2011) found that the more students were engaged in competition in a game about medieval Amsterdam, the more the students learned.

It would seem that content and context may partially drive the ultimate usefulness of the element of competition in a learning environment. Indeed, competition has never been discussed in the research on transformational play; however, additional research on video games in general suggests that competition has potential to enhance learning and development (De Simone, 2014; Yueh-Min, Yi-Wen, Shu-Hsein, & Hsin-Chin, 2014).

Social-Cooperation and Video Games. Individual success in cooperative video game play can only happen when players help others on their team also reach their goals (Greitemeyer, 2013). Though the stereotypical video game player is often thought of as antisocial, the research indicates that social gaming, and more specifically, cooperative game play, is becoming far more preferred by players than solo game play in recent years, and the cooperative nature of these games often has real-world benefits for players (Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2014).

Social skills like cooperation, collaboration, communication and negotiation are important in the 21st century, and serious games can effortlessly promote such skills by

testing and retesting a learner's ability to work with other learners to achieve in-game objectives (Shaffer & Gee, 2012; Shute & Ke, 2012). In an experiment with two games of identical content, Greitemeyer and Cox (2013) found that those who played a single player version were much less likely to successfully engage in subsequent cooperative behavior than those who played the game cooperatively as a team. The benefits of cooperative gameplay in some cases can be seen in as little as 15 minutes of gameplay, and while the marginal benefits of continued game-play exist, playing as little as one hour of cooperative video game-play can result in significant increases in team cohesion (Anderson & Hilton, 2015; Gretemeyer & Cox, 2013). Research (Sung & Hwang, 2013) suggests that cooperative gameplay significantly increases learning attitudes and motivation in addition to building real-world social skills.

In a rare study that compared learning in both cooperative and competitive gaming modes, it was found that the cooperative learning group demonstrated increased cognitive *and* affective learning outcomes compared to the control group, and the competitive learning group only demonstrated an increase in cognitive outcomes (Ke & Grabowski, 2007). There were no significant differences between the cooperative and competitive groups in cognitive measurements. However, the authors acknowledged that the cooperative group had the advantage of a 10-minute peer tutoring group which may have impacted perceived difficulty levels of the gaming session, thus affecting the attitudinal differences. The authors recommended additional study on comparison between competitive and cooperative gaming modes for learning and attitude (Ke & Grabowski, 2007).

Similar to the findings of Zhi-Hong (2014), who found that the benefits of competition in video-game learning were not equal for all demographic groups, Ke and Grabowski (2007) found that cooperative game-playing had a larger affective impact on socio-economically disadvantaged learners.

Problem Statement. The literature is limited and even contradictory at times concerning the impact that competitive or cooperative educational video games have on learning outcomes such as performance, attitudes, or engagement. Additionally, few studies have examined personal finance education delivered through video games, or in cooperative and competitive settings.

Digitally delivered education through video games has begun to earn a positive reputation for offering experiential scenarios while reducing time and costs associated with similar experiences in the real world. The theory of transformational play provides an instructional paradigm for effective experiential learning through video games. However, many things are still unknown about transformational play. For example, in commercial video games, competitive elements are often key to user motivation and game narratives. Additionally, cooperatively played video games are growing in popularity and are beginning to show educational benefits. The research findings have begun to establish learning by transformational play as superior in many ways to traditional learning as measured by learner attitude and knowledge gain. Additionally, traditional experiential learning is very social in nature, and many commercial video games have begun to integrate social components to their games. Unfortunately, not much is known from existing research about whether cooperative or competitive

transformational play would have significant impact on student performance, attitude or engagement.

Purpose of Study

There is growing evidence that delivering personal finance education through experiential activities, especially video games, can be very promising (Liu, Franklin, Shelor, Ozercan, Reuter, Ye, & Moriarty, 2011; Nosal, 2013; Richards, Williams, Smith, & Thyer, 2015). Video games are praised for their ability to promote experiential financial education with high levels of engagement, knowledge retention, and skill transfer. More research on video games and experiential learning in financial education is certainly needed, but the findings to date are very promising (Richards, Williams, Smith, Thyer, 2015). The purpose of this study was to identify the influence of the social elements of cooperation and competition on learner performance, engagement, and attitude in the context of an experiential financial literacy video game which was designed using the theory of transformational play.

Research Questions

The research questions were evaluated in terms of a specific transformational play-based video game called *Night of the Living Debt*, which was co-created by the author, and which is described in detail in Chapter III and Appendix A. The instruments that were used to measure the dependent variables included: a)aAn author constructed knowledge (performance) test; b) the Flow Experience questionnaire by Csikszentmihalyi and Csikszentmihalyi (1992) which is designed to measure engagement from the perspective of flow experience (Csikszentmihalyi,1997; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2014); and c) the learning attitude questionnaire by Hwang and

Chang (2011). Using *Night of the Living Debt* and these instruments, this research attempted to answer the following research questions:

> ***RQ_1:*** Is there a significant difference in performance, as measured by a researcher-created knowledge posttest, among adult participants in the four treatment conditions: Traditional learning control group, individual transformational play-based group, competitive transformational play-based learning, cooperative transformational play-based group?
>
> ***RQ_2:*** Is there a significant difference in learner, as measured by an engagement posttest developed by Csikszentmihalyi and Csikszentmihalyi (1992), among adult participants in the four experimental conditions: Traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group?
>
> ***RQ_3:*** Is there a significant difference in learner attitude, as measured by an adapted attitude posttest developed by Hwang and Chang (2011), among adult participants in the four experimental conditions: Traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group?

The null hypotheses for these research questions would state that there are no statistically significant differences between the four groups on these dependent measures. However, according to previous research it is expected that the cooperative transformational play group and competitive transformational play groups scores will be higher than both the traditional lecture control group and the individual transformational play group (Badatala et al., 2016; Goršič et al., 2017; Lim & Reeves, 2010; Novak et al.,

2014; Peng & Hsieh, 2012; Plass 2013; Smith & Chan, 2017; Trespalacios et al., 2011). The research suggests mixed or unknown differences between the competitive and cooperative transformational play groups (Lim & Reeves, 2010; Goršič et al., 2017; Novak et al., 2014; Plass, 2013; Short, 2016; Smith & Chan, 2017; Ter Vrugte, 2015).

Research Design

A posttest only, control group design was employed to answer the research questions in this study. The independent variable was *instructional method* with four levels: (a) traditional learning control group (TL); (b) individual transformational play group (ITP); (c) competitive transformational play group (CMTP), and (d) cooperative transformational play group (COTP). A brief description of each level of the independent variable is provided below.

TL: Content was presented using a traditional slideshow presentation projected to the group with bullet points and associated images. There was no gamification and no facilitated social interactions between participants.

ITP: The same content as TL was presented to the group using *Night of the Living Debt* (*NLD*) without the presence of any explicit social competitive or cooperative elements.

CMTP: *NLD* was shared with participants, the only difference from the ITP condition being the introduction of small groups and the use of point keeping to promote competition between group members.

COTP: *NLD* was shared with participants, the only difference from the ITP condition being the introduction of cooperative learning goals where each member of the

small group must achieve individual success in order for the group to achieve success as a whole.

The dependent variables consisted of (a) performance (b) engagement, and (c) attitude. ANOVA was used to determine if the instructional methods had a significant effect on the dependent variables.

Limitations

Limitations are present in any study, but steps can sometimes be taken to reduce the significance and scope of these limitations. This study used quasi-experimental design with random assignment of groups (classes), but without random selection. Therefore, selection bias may have influenced the outcome, since 12 adult community classes were arranged and chosen by the author to participate in the study. Since study participants were randomly assigned to one of the four study conditions as part of their existing community class unit, existing group dynamics and other previously existing differences between classes may have had some influence on the outcome of the study's findings. With 12 classes of participants, the average number of participants per group was about 45 participants. This was estimated to provide a sufficiently large number of participants to adequately gauge significance in statistical analysis and to be somewhat representative of a larger population. Additionally, it is possible that other measurement instruments of performance, engagement, and attitude could produce different results; however, the instruments for attitude and engagement used in this study were validated by the original authors, and the questions on performance were validated by other external content experts. The instrument to measure attitude was tested for reliability by several studies (see Chapter III). Previously published reliability data for the engagement and

performance instruments did not exist. Therefore, reliability for these two instruments was determined through two separate pilot studies using the instruments with two separate audiences (see Chapter III). Because data was self-reported by the participants themselves, it is a small possibility that some participants intentionally or subconsciously misrepresent their true responses. The game was in English and participants were from the Intermountain Western region of the United States, which may have led to regional biases in the outcomes. Additionally, this study examined only one game, played within one hour. It is possible that slightly different results would be found if other games were used, and if game-play was to occur multiple times or over a longer period of time. And last, the game was co-developed by the author of this study which may introduce bias to any subjective interpretations of the quantitative data. While these limitations are all present, none of them are expected to seriously impact the validity of this study.

Additionally, according to Campbell and Stanley (1963), there are eight main categories of threats to internal validity in experimental and quasi-experimental studies. In reality, there are certainly more than eight threats to internal validity to consider, however these eight were specifically examined and steps were taken to reduce these main threats. These potential threats and preventative measures are outlined below.

- History becomes a threat when events other than experimental conditions occur between measurements that may influence the outcome. In the instance that some external event, such a fire-drill for example, interrupts the natural flow of the experimental treatments those data would have been disregarded. There were no such instances during the course of data collection in the present study.

- Maturation deals with the passage of time, and the influence that this may have on experimental outcomes such as growing tired, hungry, etc. Since the duration of this experiment was limited to a single, hour-long class, any maturation effects were minimal and very similar between groups.
- Testing. A pre-test was not used in this study and an identical post-test was administered to all treatment conditions. Therefore, the threats of different stages of testing did not exist nor pose a threat to internal validity.
- Instrumentation. In some cases, the measurement instruments themselves can change with time, particularly with subjective observations. In this study, no subjective observations were made. The validity and reliability of the instruments for measuring attitude, engagement and performance were determined through a combination of prior literature and pilot tests.
- Statistical regression. This occurs when the participants are selected specifically because of their extreme scores on some variable. Over time these extremes generally regress toward the mean, thus invalidating the selection criteria. Participants in the present study were not selected due to any extreme scores or attributes.
- Biases in selecting experimental and control groups. Because the treatment conditions were randomly assigned to each class, there was no risk of bias in the selection of treatment groups.
- Experimental mortality. It is possible that the reason some participants choose to withdraw from participation in the intervention or the data collection is related to a variable directly related to the study, in which case the absence of these data

may prevent a complete understanding of the impact of a particular intervention. A potential weakness of the present study is that withdrawal rates were somewhat higher than expected, and not uniform between the different conditions. See Chapter III for a discussion of the experimental mortality that occurred in this study.

- Selection maturation interaction. If groups are selected specifically due to their differences, it may be difficult to separate the experimental effects from the maturation effects with the passage of time. This threat was minimized by the short term of the experimental interventions and the fact that treatment conditions were randomly assigned, and not intentionally chosen according to any sort of participant attributes.

Ethical considerations. The researcher of this study also served as a content and design contributor to the game *Night of the Living Debt* which was used in this study. Therefore, the researcher discloses a professional interest in seeing this game succeed, and therefore a potential bias in the results and interpretations of results of this study. However, since the game is free of charge, and the researcher receives no royalties, there is no financial interest in the game's success. The researcher made every effort to approach the design, implementation, and interpretation of this study in an unbiased manner, however, unintended bias may still exist, and results should be interpreted accordingly by readers.

Delimitations

Delimitations refer to the factors that inhibit generalizability of the study's findings to the larger population which the sample is meant to represent. Bracht and

Glass (1968) identified 12 threats to external validity that must be accounted for in experimental studies. They are outlined below along with a description of steps taken to minimize these threats in the present study.

- Experimentally Accessible Population vs. Target Population: The target population for this experiment includes adults in the U.S. Intermountain West. The reality is that due to the accessibility of participants to the researcher, populations were more likely to be associated with agriculture and extension programs, than the typical population. Ultimately the participants in this experiment were located and taught based on a certain level of convenience and accessibility, and without random sampling. While it is likely that the differences between the classes that ended up participating and those that didn't participant are relatively innocuous, these differences are nevertheless a threat to external validity, and that is an acknowledged weakness of this study. Attempts to generalize the findings of this study to a greater population must therefore be done with caution.
- Interaction of Personological Variables and Treatment Effects: Since there were a variety of participant demographics and descriptive variables between groups that participated in this study, it is possible that members of one treatment group would produce correspondingly different results based on descriptive variables rather than experimental effects. This possibility was mediated by including multiple classes in each treatment group and using random assignment for each class. Ultimately, additional studies need to be carried out with other samples and

other populations to verify that the findings are not based on groups' descriptive variables.

- Describing the Independent Variable Explicitly: A precise transcription of what was said by the instructor and detailed record of how the participants interacted with the treatments were not kept. Additionally, a single instructor was used for all treatments, ultimately making these precise experimental conditions non-replicable. However, the method for carrying out the different treatment groups is explained thoroughly in Chapter III, and any notable events that happened during the treatment experiments is described in Chapter IV.
- Multiple Treatment Interference: Only one treatment was administered per group thus minimizing the risk of multiple treatment interference.
- Hawthorne Effect: Participants were made aware that they are part of a study, but they were not told of the nature of the other treatment groups, or how their particular experience was different from those of other classes. This helped to minimize any focus on the treatment effect and thus any changes in behavior due to a Hawthorne effect.
- Novelty and Disruption Effects: It is possible that for some of the participants, video games and tablet-based games were a novel experience. However, this doesn't seem to be a deciding factor in the present study's experimental mortality rates because withdrawal rates were not higher among the groups that used the tablet-base games compared to the control group. Because the novelty effects cannot be fully isolated or explained, this is a potential weakness in this study's generalizability.

- Experimenter Effect: Only a single experimenter was used as the class facilitator, thus minimizing any differences between groups due to experimenter differences. However, this may affect the ability to replicate this study in the future with other researchers. This is an acknowledged potential weakness of this study.
- Pretest Sensitization: A pre-test was not part of the present study, and therefore pretest sensitization is not a threat.
- Post-test Sensitization: The post-test has the potential to bring out latent effects of the experiment that otherwise would not be manifest without the use of the post-test. While there is no evidence to suggest that this may be of significance to the results of this particular study, it is nevertheless a potential weakness that is acknowledged.
- Interaction of History and Treatment Effects: Due to the relatively short treatment periods, extraneous events were not a significant factor in this study.
- Measurement of the Dependent Variable: As discussed in Chapter III, there are many potential measurement instruments and scales that could have been used. Steps were taken to identify the scales most appropriate for the purposes of this study; however, the fact remains that using a different instrument may have produced different results. Future studies using other scales could help identify any potential measurement flaws of the instruments used in the present study.
- Interaction of Time of Measurement and Treatment Effects: Since this study is only interested in effects immediately after the treatment, future studies will be necessary to identify the effects of time or longitudinal results of the treatment effects.

Definitions of Terms

Performance in this study refers to a learner's ability to demonstrate learning through a test or assessment of some type. The operational definition for this study is the score on the performance post-test which occurred immediately following a treatment (See Appendix B).

Engagement is defined in the research by a variety of factors including but not limited to learner concentration, task focus, flow, distractions, persistence and enjoyment (Brom et al., 2016; Chen & Chiu, 2016; Echeverría et al., 2012; Lim & Reeves, 2010; Nebel, Schneider, & Rey, 2016). For this study, this definition is operationalized by 12 factors identified by Csikszentmihalyi and Csikszentmihalyi (1992), which include involvement, anxiety, understanding of goals, progress monitoring, stress, self-consciousness, boredom, concentration, enjoyment, distractions, passage of time, and enjoyment. These factors can be found in Appendix C as part of the questions on the engagement measurement instrument.

Attitude is an indicator of the overall value the learner places on program participations and the level of interest a learner has in the program, as well as the likelihood of recommending the program to others (Brom et al., 2016; Cagiltay et al., 2015; Chen et al.; Jong et al., 2013; Hwang & Chang, 2011; Lim & Reeves, 2010; Novak et al., 2014; Peng & Crouse, 2013; Sung, & Hwang, 2013). This variable is operationalized and measured through an adapted, seven-factor scale developed and validated by Hwang and Chang (2011) (See Appendix D). The factors include questions on the value of the lesson, value of the content as a whole, value of the main content

elements, future plans to continue using the content, and estimated value of the content for others.

Transformational Play is both an instructional design and learning theory, and is based on the concepts of situated and experiential learning in a video game setting. Transformational play learning involves video game experiences that specifically allow the narrative context to respond to learner actions with appropriate narrative consequences; thus, the situation and resulting experiences become the primary means of instruction (Barab, Gresalfi, & Ingram-Goble, 2010).

Video Game is defined by Beale, Kato, Marin-Bowling, Guthrie and Cole (2007) as "…an electronic or computerized game played by manipulating images on a video display or television screen." Video games are not device dependent and can include anything from computers to televisions, tablets, mobile phones, and so on. In this study the term is used to encompass all self-contained digital media programs with game elements. It is also used to refer to specific examples that fall under this umbrella. For example, *Night of the Living Debt* is one example of a video game, though it is a specific type of educational video game based on transformational play.

Serious Games are generally defined as "…games used for other purposes than mere entertainment" (Susi, Johannesson, & Backlund, 2007, p.1). However, for the purposes of this research, the "non-entertainment" use specifically meant "for educational purposes" as reflected in the following statement by Breuer and Bente (2010): "While serious games may have purposes other than learning and education, the majority of the games labelled 'serious' are used in educational settings of various kinds" (p. 20).

Competition is a term that loosely refers to any type of situation with a goal structure that requires that, for someone to be successful, someone or something else must lose (Johnson & Johnson, 1985). In this study, a competitive goal structure was used to facilitate social interaction among players in a transformational play-based video game, specifically, *NLD*. One of the four treatment conditions was facilitated specifically with a social-competitive goal structure in which members of a small group were required to compete with each other in order to be successful in the game.

Cooperation is a term that loosely refers to any type of situation where a goal structure requires that, for one to be successful, all players within a defined group must also be successful (Johnson & Johnson 1985). In the present study, a cooperative goal structure was used to facilitate social interaction among players in a transformational play-based video game, specifically, *NLD*. One of the four treatment conditions was facilitated specifically with a social-cooperative goal structure in which participants in a small learning group were required to cooperate with each other in order to be successful in the game.

Collaboration is a term closely related to cooperation and is often used interchangeably in existing research. However, Panitz (1999) defined collaborative learning as a philosophy that merely requires the student to, "…respect the abilities and contributions of their peers" (p 3). In the present research *cooperation* was used instead of *collaboration* due to the specific goal structure inherent in the term.

Individual play in this study is defined as the absence of any type of explicit social interaction during gameplay. Participants assigned to this condition were still

allowed to talk to each other of their own volition but were encouraged to complete the game without any type of explicit social interaction.

Gamification specifically refers to a non-game setting where game elements are introduced. For example, an online discussion board may use badges and star ratings (game-like elements) but the setting is not in-and-of-itself a game. Gamification does not always have learning as its primary goal.

Game-based learning is a self-contained game where specific learning objectives are the primary goal. This can include video games and non-video games.

Playful learning is an environment without a specific goal structure. Playful learning involves presenting the learner with a unique play space (digital or non-digital) and allowing him or her to gain understanding by simply exploring the environment on his or her own without any clear directions or incentives.

Experiential learning in its simplest form is learning by doing. This can include placing a learner in an authentic environment or a fictional environment. The environment can also be video-game based or traditional. It includes but is not limited to game-based learning and playful learning.

Financial literacy is defined as "the ability to make informed judgments and to take effective actions regarding the current and future use and management of money" (Basu, 2005, p. 1).

Significance of the Study

Due to the rapidly increasing use of video games for entertainment (Lenhart, Kahne, Middaugh, Macgill, Evans, & Vitak, 2008; Lenhart, Smith, Anderson, Duggan, & Perrin, 2015), and education (Gee, 2003; Richards, Williams, Smith, & Thyer, 2015;

Squire, 2011; Xu & Zia, 2012), more research needs to be conducted on the various elements of video games and exactly what makes them effective. The theory of transformational play has begun to identify and explore three specific elements that are useful in designing and delivering educational video games, namely context, content and first-person direction (Barab et al., 2009). An additional element of social engagement during gameplay seems to be of added value (Barab et al., 2009; Barab et al., 2012).

Among the primary mechanisms for encouraging social engagement in video games are cooperation and competition (Loparev, Lasecki, Murray, & Bigham, 2014). This study adds to the existing research by exploring some of the main educational impacts of cooperation and competition as mechanisms for social engagement and their added value to the transformational play-based educational video game experience. It also adds to the research that suggests that educational video games may be an effective method for teaching financial literacy content (Liu, Franklin, Shelor, Ozercan, Reuter, Ye, & Moriarty, 2011; Richards, Williams, Smith, & Thyer, 2015).

CHAPTER II

Review of Literature

This literature begins with a brief overview of the ability of video games to promote content learning. This is followed with a discussion of cooperation and competition in general educational settings, and is then followed by a more in depth look at primary research on cooperation and competition with educational video games and related contexts. Next, a specific model for designing and delivering educational video games is discussed. The factors of analysis (dependent variables) from previous studies were then examined. The gaps in the current literature are then discussed. Last, the relevant dependent variables for this study are considered along with a brief review of measurements of these constructs.

Relevant literature was identified primarily though Google Scholar which was linked to the digital article databases of the University of Idaho Library, which included Elsevier Science Direct Journals, EBSCOhost, Academic Search Premier, Wiley Online, JSTOR, and ERIC. In most cases the results were limited to the last seven years, with some exceptions when landmark research for additional context was desirable. Search terms used included combinations of the following key words: video games, play, education, games, story, experiential, transformational play, knowledge gain, attitudes, engagement, behavior, social, learning, competition, cooperation, and collaboration. The relevant research has been primarily interpreted through the lens of the previously discussed theory of transformational play which has roots in social constructivism, experiential learning, and situated learning.

Video Games and Education

A few studies have suggested the need to explore personal finance education through video games (Maynard, Mehta, Parker, Steinberg, 2012; Richards, Williams, Smith & Thyer, 2105; Way & Wong, 2010). Few, if any articles have rigorously undertaken the task of assessing educational outcomes that result from delivering personal finance education through video games. However, a broader search shows that there are a number of studies that demonstrate content learning and other educational outcomes across other diverse disciplines.

For example, a study by Beale et al. (2007) showed that those patients who played an educational video game periodically over several weeks had higher knowledge scores than the control group who played only a commercial video game. A similar study by Kato, Cole, Bradlyn, and Pollock (2008) found that an educational video game played by cancer patients increased adherence to a prescription regimen, and increased patient knowledge and self-efficacy over the control group.

A study by Papastergiou, 2009, found that students who played an educational video game to learn about memory scores significantly higher on a knowledge post-test than students who learned through a non-game application. Another study by Chittaro and Buttussi (2015) the authors demonstrated significantly increased knowledge scores on the topic of aviation safety both immediately after playing a game and one week later, compared to a control group that learned the same content through a pamphlet. Manero, Torrente, Serrano, Martínez-Ortiz, and Fernández-Manjón (2015) demonstrated that students learned and retained knowledge about a play (in a theater class) using a video

game approach. Engerman, MacAllan, & Carr-Chellman (2018), even found that using a commercial video game helped increase learning and engagement among boys.

However, learning through video games is not a given solution for all educational needs. Some studies have shown mixed results on learning through video games, including one by Masson, Bub and Lalonde (2011) who found that students learned some but not all content from a lesson in physics. Similarly, Sims and Mayer (2002), found improved spatial reasoning skills after playing a video game, but had limited transfer to other contexts. The fact remains that much is unknown about when, why or how video games can be used to promote content learning.

For some authors, video games are merely a digital extension of traditional experiential learning strategies (Dawley & Dede, 2014). The added benefit of experiential learning through video games is that they can connect real life to course materials, and provide meaningful learning scenarios but with mediated, or safe, consequences of failure (Lewis & Williams, 1994). What's more, with the advent of digital media, particularly video gaming technologies, such classroom-based experiences are, for the first time, becoming easily scalable, reusable, and conducive to meaningful standardized assessments (Beckem & Watkins, 2012).

Though some might argue that learning through video games is still a relatively unexplored or unproven method of education, there are enough studies with positive results and theoretical underpinnings to warrant further exploration.

Competition, Cooperation, and Social Interaction in Learning

Competition and cooperation have long been important elements of human social interaction (Bigelow, 1975), and have historically been important elements in learning

(Slavin, 1980). Landmark studies over the years continue to suggest that there are three main types of goal structures in learning: cooperative, competitive, and individualistic (Lewin, 1935; Loparev, Lasecki, Murray, & Bigham, 2014; Deutsch, 1949, 1962). Johnson and Johnson (1985) described cooperative goal structure as a positive correlation in goal attainment, competitive goal structure as a negative correlation in goal attainment, and individualistic goal structure as having no correlation. In short, this relationship was summarized by Slavin (1980) who said, **"**The opposite of competition is cooperation" (p. 316). By definition, competitive and cooperative learning structures exist when a purely individualistic learning goal structure is absent. Therefore, cooperative and competitive elements in learning are quite common, although often not intentionally included. For example, grading on the curve, a common grading practice, automatically creates a scarcity in rewards and consequently a negative correlation or competitive goal structure (Palomo-Duarte, Manuel Dodero, & García-Domínguez, 2014). Similarly, any type of group work which creates a reward that is achieved by working together is a positive correlation or cooperative goal structure.

The focus of this research is the intentional use of cooperative and competitive goal structures in a relatively new educational environment. Competitive and cooperative behaviors in learning are increasingly taking the form of intentional gamification, or even the creation of game-based learning environments, like video games (Gee, 2012). This literature review outlined the research on competitive and cooperative learning goal structures in the context of educational video games.

Competition

The documented use of competition in educational settings dates back several millennia. Beginning around 776 BC, the ancient Greeks famously used competition to promote development of athletic and military skills in their competitive Olympic Games. Plublius Ovidius Naso (43 BC – AD 17), a Roman poet once said, "A horse never runs so fast as when he has other horses to catch up and outpace" (Rong, 2013, p. 32). In following this line of thought, Marcus Verrius Flaccus (55 BC – AD 20), a noted Roman educator, used beautiful and valuable items, mostly books, as prizes to entice students to compete with one another in educational exercises such as declamations (King, 1888, p. 56). The Italian scholar Battista Guarino (1434-1513) criticized the physical punishments of students, and as an alternative, promoted pairing students off and stimulating their learning through competition with each other (Verhoeff, 1997, p. 4). The father of modern economics, Adam Smith (1723-1790), strongly believed that, "economic progress [is] connected with education" (Freeman, 1969, p. 174), and that the ability of educated consumers to engage in free competition of resources was vital to a successful economy. Indeed, the words of Murayama and Elliot (2012) seem to summarize the world we live in and its educational implications: "Competition is highly prevalent in human societies across the globe" (p. 1035) …. "[and] is a topic of widespread interest across scholarly disciplines and levels of analysis" (p. 1053).

Defining competition in learning. Today there continues to be perceived value in competition in educational settings. There is an idea that competition can elicit exceptional performance that cannot be produced by any other means, as expressed by

Verhoeff (1997), “A good competition should challenge the participants to give their best, or preferably more than that” (p. 7).

In a landmark publication on intrinsic motivation, Csikszentmihalyi (1990) made a distinction in competition between “measuring self against others,” and “measuring self against own ideals.” Ciampa (2014) has labeled these concepts as “direct competition” and “indirect competition” respectively (p 85). Indirect competition involves an individual or group striving to reach or beat some non-social standard, such as one’s previous high score, or some in-game threshold of success such as “beating the game.” Indirect competition can be quite complex and can even include artificial intelligence as an opponent, such as a man-vs-computer chess match. In most cases though, indirect competition sets a rigid standard by which the individual or group can assess whether or not they have “performed well.” Direct competition on the other hand, involves performance directly relative to other participants. Success in direct competition is fluid and is framed in terms of “winning” which can only be achieved by outperforming the other individuals or groups (Ciampa, 2014).

Brown, Cron, and Slocum (1998) further divided direct competition into three subcategories: trait competitiveness; perceived environmental competitiveness, and structural competition. Trait competitiveness focuses on personality traits, or individual tendencies to focus and even invent competitive situations with peers even when a competitive structure is not intended. Perceived environmental competitiveness lacks overt competitive structure, but may be a product of culture or environment that may influence some, but not all, to compete against each other. Last, structural competition is an intentionally created situation where two or more individuals or groups compete for

scarce, or mutually exclusive, rewards. In this case, the success of one individual or group comes at the direct cost of all other individuals or groups coming up short (Brown et al., 1998).

Stanne, Johnson, and Johnson (1999) introduced a concept of appropriate competition, which must meet the following four conditions:

(1) There is not a heavy emphasis on winning.

(2) Opponents are equally matched, creating a challenging competition, and providing each person with a realistic chance of winning.

(3) The rules of the competition are clear and straightforward, making for a fair competition.

(4) Participants are able to gauge their progress relative to their opponent, a concept also found in Peng & Hsieh (2012, p. 2104).

The primary type of competition of concern in this research can be classified as direct (social), structured (intentional), and appropriate. Most research on competition in education falls under this classification (Adams, 2014; Ciampa, 2014; Reeves & Read, 2013).

Competition in educational video games. When it comes to education and video games, the topic of competition is probably inevitable, because, as Nebel, Schneider, and Rey explained (2016), "competition with other players or with the game itself is one of the basic elements of videogames" (p 384). Reeves and Read (2013) explained that "competition is fun and familiar to gamers" (p 30) and, although the in-game consequences aren't real, psychological reactions to games can be "equally sensitive to real and virtual consequences" (p. 30). That is what makes competition in video games so

compelling. It is an opportunity to up the stakes, putting, “real egos, reputations, and feelings … on the line,” (p. 30), but which largely mitigates real world consequences, thus encouraging exploration, play, and experimentation, all of which are essential to many social constructivist approaches to learning (Ciampa, 2014; Reeves & Read, 2013).

Primary research on competition in educational video games. This section focuses on the relatively limited number of studies that examined competition in isolation from cooperative learning.

Lisk, Kaplancali, and Riggio (2012) explored the topic of transformational leadership development in the context of competitive massive multiplayer online games. Using self-report responses from 694 existing players from this gaming community the authors examined the type of leadership structure that existed in the game itself; the leadership presence these players held in their online roles; and how that leadership may have transferred to their workplace. The results indicated that socially competitive gaming communities do indeed employ both formal and informal leadership structures/roles that are unique to the games being played. However, there wasn’t sufficient evidence to suggest that these leadership roles or skills transfer to the workplace. Though this study did not address competition directly, it did illustrate that the environment of a socially competitive game can produce demands for certain beneficial behaviors like leadership.

With 20 participants, Zhang, Xu, Han, Liu, Lv, and He (2012) used an immersive exergame (video game that reacts to physical input such as an elliptical exercise machine) to teach concepts of Chinese history and culture. The authors compared three modes of play: a training mode (individual practice), a walkthrough mode (multiplayer practice),

and a competitive mode. Of the three, the competitive mode produced the highest learning scores and levels of satisfaction regardless of body fitness levels. Though this study was very limited in terms of participants and generalizability, it did demonstrate that a competitive mode of digital play can have learning and satisfaction benefits over individual and non-competitive social modes of play.

In a mixed methods study with 391 U.S. middle school students, Bernstein, Gibbone, and Rukavina (2015) wanted to test student perceptions of competition in several types of active games (exergames) based on the activity of dancing. The authors found that, overall, students enjoyed competitive structures in active games; however, lower skilled students (as rated by a state-based rubric) tended to favor emphasis on the activity itself and less on competitive elements. Students in general also reported that they disliked active games when they became overly competitive, people got injured, participants were unevenly matched, or students displayed poor sportsmanship. These findings reiterate two of the rules of Stanne et al. (1999) regarding appropriate competition. Rule 1 states that "There is not a heavy emphasis on winning," and Rule 2 states that, "Opponents are equally matched, creating a challenging competition, and providing each person with a realistic chance of winning." Both these rules were violated to some extent in the application of competition in this study, but the authors acknowledge this plainly. This study helped highlight some of the nuances of successful competition in educational video games, and the fact that the element of competition can be applied in many ways, some effective and some not so effective.

DiMenichi and Tricomi (2015) conducted two related experiments. In their first experiment, the authors tested how competition affected physical effort as measured by

initial and sustained press rates in a simple carnival-style water gun, video game. The authors recruited 129 undergraduate students from Rutgers University. In this experiment, the authors found that men were more influenced by the presence of a competitor than women and demonstrated significantly faster "first press rate-times" than women in the competition condition. The results indicated that social motivation, specifically competition in this study, can have strong effects on attention and memory, but that, "competition may have a more cloudy relationship with physical effort than our task was able to provide" (p 4). In the second experiment, the authors tested the presence of a competitor on working memory and memory retention using 124 undergraduate Rutgers students. The second experiment further suggested very complicated effects of competition in learning. The findings indicated that competition hindered working memory performance and immediate long-term memory for most participants, and that the presence of a female competitor tended to hinder memory. The authors provided several speculative explanations for these findings, but nothing conclusive. The strength of these experiments is they add to the literature on the complex nature of competition, particularly gender dynamics and the nature of attention, motivation, and memory when competition in used.

In a follow-up article, DiMenichi and Tricomi (2017) extended their examination of competition and memory in computer games with the use of advanced brain imaging to add to our understanding of why competition is so complex in learning. The authors recruited 21 right-handed adult female students from Rutgers University. The results indicated that parts of the brain related to "mentalizing about another person" and "self-referenced thoughts" were activated by competition in a simple educational computer

game, which may help explain the distraction effect caused by competition. There are many limitations to this study, but the use of brain imaging contributes to the understanding of the complexity of using competition in educational video games.

In a case study of a single participant with a voice disorder which required therapy, King, Davis, Lehman, and Ruddy (2012) tested the use of a competitive voice-controlled video game to aide in therapy objectives. Through face-to-face interviews with the subject and parents, and activity logs related to game use, the authors determined that the game was indeed effective particularly in motivation for the subject to participate in therapy sessions. The participant also reported that the graphics and competitive elements of the game were very appealing. The participant's parent reported observing a high level of motivation to complete all levels of the game and even to play without being asked. While certainly limited in generalizability, this study helps confirm that in certain situations competitive video games can be a powerful motivation to engage in learning or therapy sessions.

Brom, Šisler, Slussareff, Selmbacherová, and Hlávka (2016) delivered a lesson about the European Union policy agenda through three methods: a computer-based social role-playing competitive game, a non-computer social role-playing competitive game, and finally a non-game workshop. A total of 335 students participated from 14 high school classrooms and two college classrooms in the Czech Republic. The results indicated that both the digital and non-digital version of the competitive game produced higher positive affect and learning scores than the non-game instruction. The competitive elements in the game were found to influence positive affect and flow, but not learning scores directly, though positive affect itself showed some influence on higher learning

scores. The strengths of this study included the sample size and several variables that are related to those in the current study. Since a digital non-game comparison group was not used, it is difficult to separate completely the effects of competition and educational games in this study.

Ratan and Sah (2015) wanted to examine the effects of avatar genders on participants' scores in a competitive digital math game. Using a pool of 64 right-handed female undergraduate students, the authors found that those randomly assigned male avatars become more competitive and earned higher scores on the math game than those assigned female avatars. The strength of this study is in identifying that subtle differences in the way a competitive game is played can influence learning and performance.

With 134 Psychology students from University of California, Santa Barbara, DeLeeuw, and Mayer (2011) compared two versions of an otherwise identical video game, one with competitive features and the other without. The authors found that the game with competition did not increase deep learning (transfer), but did improve memory (retention). The findings contradict those of several of the previously mentioned studies illustrating the complex nature of competition in educational video games. Among male participants, the use of competition actually had a negative effect on deep learning while female participants improved deep learning under competition. The authors found that this difference was not directly due to increased cognitive load, which is often thought to be a negative byproduct of competition. This article is another to outline some of the complexities of the use of competition. One major limitation is that the structure of the video game was very basic. The authors suggested that future research should replicate the study with a more dynamic digital learning game, including narratives. The authors

also acknowledged that hiding participant scores from each other limits the extent to which competition was effectively implemented, and of course violates the fourth condition for appropriate competition that participants should be able to gauge their progress relative to others (Stanne et al., 1999).

Yu, Han, and Chan (2008) conducted research to test the difference between face-to-face and anonymous digital team-based competition on several learning variables. Using 68 fourth graders, the authors found that the networked but anonymous participants enjoyed greater satisfaction, and were better motivated than the networked but face-to-face participants. Though the authors call for further validating studies, these preliminary findings may reflect Stanne et al.'s (1999) 1st condition for appropriate competition that there is not a heavy emphasis on winning. Though perhaps unintentional face-to-face competition may bring about higher levels of competitiveness in participants, especially if the classmates already knew each other well. The finding that anonymity can mitigate the negative effects of losing is intriguing as this is often a common lament in much of the research on competition in learning.

In a two-part research study, Chou, Lu, and Chen (2013) used an artificial intelligence opponent to control how many times the participants won a competitive educational video game, though participants were led to believe that they were playing another human opponent. In the first experiment, the authors proved that such a prescriptive outcome was possible using their game and algorithm, while not being detected by the participants as a prescriptive outcome. In the second experiment, the authors wanted to test the extremes of potential outcomes using 29 4th graders. In the control group, it was nearly impossible for participants to ever win, while the

experimental group was programmed to win five matches and lose one. The results indicated that, “Some students preferred the expert opponent to feel challenged, some preferred the opponent with similar ability, and some preferred the less-able opponent so that they could defeat the opponent to attain a sense of achievement” (p. 241). However, whatever the player preferences, the general result falls in line with Stanne et al.’s (1999) 2nd condition of successful competition that the game remain challenging with a fair likelihood of winning.

Chen, Chou, Biswas, and Chan (2012) tested differences in avatar representation in competitive educational computer games. Using three versions of player representation -- a name only, a human-like avatar, and a pet-like avatar -- the authors tested players’ sense of achievement and failure with a group of 89 fifth graders. The results indicated that all three forms of player representation in the game produced a high sense of achievement, but that only the pet-avatar representation significantly limited the negative feelings associated with losing an in-game competition. This finding has intriguing implications that, as the authors put it, an “indirect” representation (competition through an “owned” pet), rather than direct competition (with an avatar meant to directly represent the player), can mitigate the negative effects of competition in an educational video game.

In a follow up to the previous study, and using the same educational game, Chen and Chen (2013) conducted a two-part study. In the first experiment, the authors tested the effects of using indirect avatars (pet-like avatar) on students’ learning motivation and learning achievement. The authors created three conditions: the first merely presented the content in non-game format, the second presented the content as a game, but without

competition, and the final condition presented the content as a competitive game. The first finding was that students who learned content through one of the game version experienced greater enjoyment than those who learned the content through the non-game condition. Second, the results indicated higher achievement and motivation scores in the competitive game than the noncompetitive game. This first experiment provided some similarity in design to the current study, and with encouraging results. In the second experiment, the authors compared the indirect competitive version of the game (pet-like avatar) to a direct competitive version of the game (human-like avatar). The authors found that in both versions of the game students attributed their success to effort spent, and not to luck. This is a critical distinction when dealing with competition in learning and in keeping in line with Stanne et al.'s (1999) second condition of appropriate competition that a player who puts in effort should be expect a certain degree of success. Again, the authors found that with indirect competition students did not take competitive failures as seriously as students who directly competed with human-like avatars. The authors described this type of indirect competition as a "protective mechanism to reduce negative effects" (p. 20).

Using the pet-avatar learning game, Chen (2014b) compared and examined social competition vs. self-competition (against one's previous performance) with 54 elementary students, age 11. The author found that low-ability students, as determined by previous class performance, preferred social competition, whereas medium and high-ability students had no preference. The author suggested that low-ability students emphasized the enjoyment aspect of the competitive learning activity, and medium- and high-ability students emphasized the interactive and performance aspects of the

competitive learning activity. The strength of this study is that it helps articulate the different learning preferences of varying ability students in digital competitive environments. It also illustrates that social competition is not always preferred by students decisively above self-competition and that enjoyment in this case was not significantly different in social competition. The major weakness of this study is that it does not address direct learning effects.

In a two-part study, Chen (2014a) again used the pet-avatar game to explore the influences of a competitive educational computer game on students' behavior. In the first part, Chen used a variation of the pet-avatar game with a group of 89 undergraduate students who were given 30 minutes of free-play in the game environment. Behavior patterns were categorized and examined. The results indicated that 56% of the time was spent in learning behavior, 25% in competition behavior, and the rest in game-specific mechanics, mostly related to non-competitive pet-caretaking. The implication of this exploratory experiment is that, for this particular game, even though competition was at the forefront in terms of motivation, learning was the priority, including the fact that their 30-minute sessions were considered undirected free-play. In other words, competition can be very complimentary to learning in educational video games. Chen's second experiment used a version of the pet-avatar game with 33 fourth graders also to study in-game behaviors and transitions between activities. The results indicated that students spent 72% of their time on competition-driven activities and 28% of their time on learning activities, without frequent transitions between activities. While the author did not speculate on the differences between group activities, there are many possibilities including a different type of categorization to different age groups and different contexts

and content for the educational activity. Overall this study adds more evidence about the complexities of using competition in educational video games.

Chen and Chiu (2016) designed a study with 58 sixth grade students to compare competitive and noncompetitive modes of play in a multi-touch design-based learning (DBL) platform. The findings indicated a statistically significant increase in student engagement, learning achievement, and creativity, with the intergroup competitive mode of play over the non-competitive mode of play. It would appear that the present study examined similar variables, but in a more dynamic, media intensive video game.

Nebel, Schneider, and Rey (2016) designed an experiment with four conditions: solo gameplay, one-on-one competitive gameplay, small group competitive gameplay, and small classroom gameplay. With 111 participants, the results indicated that social competition produced varied outcomes. For example, social competition seemed to produce stronger knowledge retention scores, increased engagement, and small increases in situational interest. However, social competition also seemed to produce higher cognitive load which resulted in lowered focused attention, and lowered instructional efficiency. Group size was difficult to separate from social competition, and some of the independent/dependent variable combinations were not discussed in much detail.

With 85 students, Nebel, Beege, Schneider, and Rey (2016) found that the use of leaderboards as a constant reminder of which players have the highest scores induced competitive effects including motivation and engagement. More in-game choices also led to greater motivation and feelings of empowerment. Consistent with Stanne et al.'s (1999) fourth guideline for appropriate competition (Stanne et al., 1999), this study further validates the need for players to gauge their progress compared to others.

Cagiltay, Ozcelik, and Ozcelik (2015) explored the game element of competition on learners using serious games. With 142 college students, the authors found that those who played serious games in a competitive environment had higher post-test learning sores, improved in-game performance, and improved motivation levels. The authors suggested replication to include different learning domains and delineating the many different types of competitive play, which is what the current study intends to do.

Summary of primary research on competition. Of the limited number of studies that examined competition in educational video games, the following is a synthesis of commonalities, themes, research gaps, and implications for the present study.

Among the most common independent variables across these studies were comparisons of competitive and noncompetitive gaming modes of various forms in educational video games (Brom et al., 2016; Cagiltay et al., 2015; Chen & Chen, 2013; Chen & Chiu, 2016; DeLeeuw & Mayer, 2011; King et al., 2012; Nebel, Schneider, & Rey, 2016; Zhang et al., 2012) or comparison of different types of competitive modes (Chen, 2014b; Chen et al., 2012; Chou, Lu, & Chen, 2013; DiMenichi & Tricomi, 2015; DiMenichi & Tricomi, 2017; Nebel, Beege, Schneider, & Rey, 2016; Yu et al., 2008). Occasionally the competitive structure of a digital learning game was only used as a context for examining other independent variables, such as avatar gender dynamics (Ratan & Sah, 2015) or leadership skills (Lisk et al., 2012).

In those studies where competition was directly manipulated, the dependent variables that were examined included cognitive load (DeLeeuw & Mayer, 2011; Nebel, Schneider, & Rey, 2016), engagement (Chen & Chiu, 2016; Nebel, Schneider, & Rey, 2016), situational interest (Nebel, Schneider, & Rey, 2016), general knowledge gain

(Brom et al., 2016; Cagiltay et al., 2015; Chen & Chiu, 2016; Nebel, Schneider, & Rey, 2016; Zhang et al., 2012), retention (DeLeeuw & Mayer, 2011; Nebel, Schneider, & Rey, 2016), transfer (DeLeeuw & Mayer, 2011; Nebel, Schneider, & Rey, 2016), instructional efficiency (Nebel, Schneider, & Rey, 2016), motivation (Cagiltay et al., 2015; Chen, 2014b; Chen & Chen, 2013; King et al., 2012; Yu et al., 2008), satisfaction (Cagiltay et al., 2015; Chen, 2014b; Yu et al., 2008), physical effort (DiMenichi & Tricomi, 2015; King et al., 2012), activity performance (Chen & Chen, 2013; DiMenichi & Tricomi, 2015; DiMenichi & Tricomi, 2017; Ratan & Sah, 2015), brain activity images (DiMenichi & Tricomi, 2017), in-game activity (Chen, 2014a; Chen & Chen, 2013; Chou et al., 2013), sense of achievement (Chen et al., 2012), perceptions of opponents (Yu et al., 2008), creativity (Chen & Chiu, 2016), affect (Brom et al., 2016), and flow (Brom et al., 2016).

A common theme among many of these studies was the idea that the use of competition in digital educational games is rife with complexities and not well understood (Chen, 2014; Chou et al., 2013; DeLeeuw and Mayer, 2011; DiMenichi & Tricomi, 2015; DiMenichi and Tricomi, 2017). Competition certainly produced some positive results (Brom et al., 2016; Cagiltay et al., 2015; Chen & Chen, 2013; Chen & Chiu, 2016; King et al., 2012; Nebel, Beege, Schneider, & Rey, 2016; Yu et al., 2008; Zhang et al., 2012). However, several instances of using competition also produced mixed and ambiguous results (Bernstein et al., 2015; DeLeeuw & Mayer, 2011; Chen, 2014a; Chen, 2014b, DiMenichi & Tricomi, 2015; Nebel, Schneider, & Rey, 2016). In many of these studies with mixed results, it was clear that one or more of Stanne et al.'s (1999) four conditions for appropriate competition was violated (Bernstein et al., 2015;

DeLeeuw & Mayer, 2011), thus leading to potentially false negatives due to poorly structured and weakly implemented forms of competition. Additionally, several clever implementations of competition by Chen and Chen (2013) and Chen et al. (2012) demonstrated that use of surrogate (pet-like) avatars can mitigate some of the potentially negative effects of using competition in a digital learning game. In summary, it seems that authors tend to loosely apply the label of "competition" to any mechanic that situates one learner against some kind of opponent. However, much of this competition does not fit the guidelines for "appropriate competition" as defined by Stanne et al. (1999). A gap in this research that the present study helped address was to implement carefully designed and executed forms of competition to ensure that the true potential positive benefits were maximized, and potentially negative effects were reduced.

As the existing research has indicated, ample opportunities exist for future research on competition in digital educational games. Among the suggestions for additional research are those that follow Stanne et al.'s (1999) guidelines on appropriate competition (Nebel, Beege, Schneider, & Rey, 2016), different domains (Cagiltay et al., 2015; Chen, 2014b; Chen & Chen, 2013), different genres of digital learning games (Chen, 2014a; Chen & Chen, 2013; King et al., 2012), games with dynamic mechanics (DiMenichi & Tricomi, 2017; King et al., 2012; Yu et al., 2008), games with high quality media elements (Chen & Chen, 2013; DeLeeuw & Mayer, 2011; DiMenichi & Tricomi, 2017; Yu et al., 2008), different demographics (Bernstein et al., 2015; Cagiltay et al., 2015; DiMenichi & Tricomi, 2015; Nebel, Schneider, & Rey, 2016), different methods of competition (Brom et al., 2016; Chen, 2014b; Chen & Chiu, 2016; Chen et al., 2012; DeLeeuw & Mayer, 2011; Ratan & Sah, 2015; Zhang et al., 2012), and additional

dependent variables particularly those related to education (Chen et al., 2012; Chou et al., 2013; DeLeeuw & Mayer, 2011; Nebel et al., 2016).

Cooperation

Ancient societies from Greece to China are reported to have used "learning groups" to help students learn from each other's experiences (Slavin, 1989). These types of cooperative learning groups are thought to be among the earliest and most widespread educational traditions to exist. One of the earliest documented examples of cooperative learning can be found in ancient Jewish tradition beginning about 3,000 years ago (Chevelen, 1998); the Talmud, a collection of Jewish stories, traditions, and laws, states that, in order to understand its teachings, "one must have a learning partner" (Johnson, Johnson, & Smith, 1998, p. 33). Nearly a thousand years later Roman educators began to articulate the benefits of cooperative learning: Seneca (4 BC - 65 AD), a well-known Roman philosopher of the first century said that, "When you teach, you learn twice" (Whitman, 1988); a sentiment echoed by his contemporary Quintilian (35 AD – 100 AD), a Roman educator and author who wrote of the benefits of having students teach one another. A millennium and a half later, Johan Amos Comenius (1592-1670), a Czech philosopher and educator, would adopt this student-teacher model in his quest for universal education (Keatinge, 1921). Through the next several centuries, a movement to establish an educational system based on mutual instruction and peer-tutoring took hold in Britain (Pachori, 1983). These ideas and philosophies were then brought to the United States by English educator Joseph Lancaster, who then extended the movement throughout North America and helped to establish schools for common citizens who were not wealthy or elite in social status (Cubberley, 1934). Throughout the 19th and early 20th

centuries, cooperative learning strategies were promoted by well-known educators like Colonel Frances Parker and John Dewey (Campbell, 1965; Dewey, 1928). Throughout the latter part of the 20th century, cooperative learning has been used and studied extensively. Perhaps Rand and Nowak (2013) summarized the history of cooperation in learning best by saying, "Understanding the evolutionary dynamics of cooperation has important implications for our conceptualization of ourselves as human beings. Research in this field helps to explain the widespread cooperation that is a cornerstone of our existence as a supremely social species" (p. 422). Li and Lam (2013) added that, "Cooperative learning is supported by one of the strongest research traditions in education, with thousands of studies conducted across a wide range of subject areas, age groups, ability levels and cultural backgrounds" (p. 10).

Defining cooperation in learning. Kapp (2012) defined cooperation as, "The act of working with others to achieve a mutually desirable and beneficial outcome" (p. 32). Similarly, Johnson, Johnson, and Smith (1998) offered the following description for cooperative learning: "Each student achieves his or her learning goal if and only if the other group members achieve theirs" (p. 28).

The term "cooperative learning" is often confused and used interchangeably with the term, "collaborative learning." While there is much conceptual overlap between these terms, in practice they do not share the same definition. Panitz (1999) defined collaborative learning as a philosophy that merely requires the student to "respect the abilities and contributions of their peers" (p 3). In contrast, Panitz defined cooperative learning as a structure that requires "a specific end-product or goal" (p. 3). Li and Lam (2013) echoed these ideas by outlining two cooperative learning methods. The first is

structured team learning, where individual learning and accountability are necessary for group success, and therefore team members have an incentive to support and help each other. The second is informal group learning where the outcome is less structured and is often determined by the strongest members of the group while the weakest members are less involved. Unfortunately, informal group learning can easily morph from cooperative learning to collaborative learning, or even individualistic or competitive learning, depending on the dynamics of the students' personalities within the group (Johnson et al., 1998; Panitz, 1999). Thus, a formal cooperative structure is usually preferred if cooperative learning is truly the goal (Johnson et al., 1998; Kapp, 2012; Panitz, 1999).

Slavin (1990) suggested that effective cooperative learning depends on two essential features. The first is small-group goals which are defined as some sort of indicator of group success such as a grade, a reward, or some other type of recognition. The second is individual accountability, where "the group's success must depend on the individual learning of all group members" (p 52). Slavin (1980) points out that, "there is very little theoretical distinction between pure group cooperation and competition between groups, in most cases" (p. 318). The indicator of small group success in cooperative learning can be, and often is the winning of some sort of intergroup competition. The fact that competition is sometimes present in cooperative learning does not detract from the fact that cooperation between group members was necessary for success (Loparev, Lasecki, Murray, & Bigham, 2014; Slavin, 1980). As indicated by Slavin (1980,1990), small group structure seems to be an important factor in cooperative learning. Johnson, Johnson, and Holubec (1994) agreed with this principle and said that,

"Cooperative learning is the instructional use of small groups so that students work together to maximize their own and each other's learning" (p. 9).

Of course, not all small group work is cooperative (Johnson & Johnson, 1999). According to both Johnson et al. (1998) and Johnson and Johnson (1999), five key elements are critical for appropriate cooperative learning to take place.

(1) Positive interdependence: Each student must perceive that his or her success can only occur if others also succeed.
(2) Individual accountability: Individual performance must be assessed, and group members must be accountable for their contributions to group success.
(3) Face-to-face promotive interaction: Group members should promote each other's success through helping, assisting, supporting, encouraging, and praising.
(4) Social skills: Group members must possess basic social skills such as leadership, decision-making, communication, conflict management, etc.
(5) Group processing: Group members must be able to gauge their collective progress and address deficiencies.

The type of cooperative learning of concern in this research can be classified as formally structured, small group, and appropriate. Most research on cooperation in education falls under this classification (Johnson & Johnson, 1999; Johnson et al., 1998; Panitz, 1999; Slavin, 1980; Slavin, 1990).

Cooperation in educational video games. Many video games allow players to choose a mode of play including various designs of competitive and cooperative modes (Adams, 2013), and individual or multiplayer modes (Peng & Hsieh, 2012). Cooperative

play mode in video games has been idealized for its social-cooperative implications. For example, it is thought to promote prosocial behaviors, mitigate anti-social behaviors, and aid in building constructive relationships, among other things (Greitemeyer & Cox, 2013; Kapp, 2012; Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2014). Video game technologies and environments can provide tools necessary for social constructivist theory-based learning (Cheng & Ku, 2009; Li & Lam, 2013). For example, a properly designed game can ensure appropriate individual group member contributions and avoid the tendency to over rely on stronger groups members which is often a danger in face-to-face cooperative settings (Jong, Lai, Hsia, Lin, & Lu, 2013). Franklin D. Roosevelt believed that cooperation was vital for a successful society. Likewise, it may be an important factor in successful use of video games for learning (Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2014).

Primary research on cooperation in educational video games. This section focuses on the relatively limited number of studies that examined cooperation in isolation from competitive learning.

Padrós, Romero, and Usart (2012) examined the knowledge gain that occurred with 70 graduate students who learned about finances through a computer-supported collaborative game. Using pre- and post-survey data, knowledge gain that resulted from playing the game was documented. However, the authors acknowledge that there was no other group in this study by which to compare this knowledge gain to other methods of learning.

Using surveys collected from 1432 Dutch university students, Bekebrede, Warmelink, and Mayer (2011) compared differences in responses between those in the

"net generation" - defined as those who frequently play games and use technology (25%) -- and other students (75%) about preferences concerning learning through gaming. The findings indicated that there were no clear differences in preferences between learners with or without a lot of previous experiences with technology and that, regardless of background and experience, learners preferred to work together in technology rich environments using active learning methods.

With 373 eighth grade students from five schools, Sánchez and Olivares (2011) compared students in classes who learned through mobile serious games with field trips and those who engaged in traditional classes. The results indicated that those students who learned through mobile serious games and field trips had more self-confidence in collaboration with others and more confidence to accomplish later tasks. While this study had many limitations mostly due to design, it suggests that learning through video games seems to naturally support cooperation.

In a case study, Echeverría, García-Campo, Nussbaum, Gil, Villalta, Améstica, and Echeverría (2011) put nine students in three groups, for a total of 27, and had them play a collaborative learning game. The authors used video recording, observations, and pre- and post-tests on knowledge gain. While the authors did find statistically significant increases in knowledge from the pre- to post-tests, there was no control group used, so the knowledge cannot be definitively attributed to the collaborative design of the learning game. Using observation data, the authors suggested that the female participants especially liked the social aspects of the game, and that previous computer game experience did not have an impact on enjoyment or knowledge gain in this activity. It is worth noting that the authors used the term "collaborative learning" instead of

"cooperative learning" even though students had shared goals and in-game objectives that could only be accomplished together, thus fitting Panitz's (1999) definition of cooperative learning. This demonstrates the common mistaken tendency in research to use these terms interchangeably, though they do not share the same definition. The present study began to separate the pedagogy from the technology, and collaborative gameplay from individual gameplay and traditional methods of learning.

Twelve water management students, attending a university in the Netherlands, participated in a 30-hour collaborative serious game on aquaculture as part of the classroom curriculum. Hummel, Van Houcke, Nadolski, Van der Hiele, Kurvers, and Löhr (2011) measured student perceptions and knowledge performance both before and after the game. Case study findings indicated that students gained more insights and quality learning experiences as a result of the game, and that it was an effective way to have students work actively and experientially on problem situations. A strength of this study is that it differentiated between *ad hoc* collaboration to existing games, and a game specifically designed to be played collaboratively. A serious weakness of the study was that the collaboration took place with an artificial intelligence partner, not another human learner, which could have affected outcomes.

Greitemeyer and Cox (2013) also wanted to test the effects of cooperative video game play on later behavior in different contexts. Using 52 students at a British university, the authors found that playing a video game cooperatively produced feelings of cohesion and trust that were later demonstrated through increased cooperation in a subsequent task. This contrasted with those who played the video game individually and who did not show the same levels of cooperative behaviors in the subsequent task.

Because the game content was the same between conditions, the differences in later cooperation were attributed entirely to the way the game was played, not to the content of the game.

Greitemeyer, Traut-Mattausch, and Osswald (2012) tested several violent video games in cooperative or single player mode, with a neutral video game as a control group. The authors tested these games with German university students who played the games and were then asked to engage in a follow up activity that involved cooperative behavior. The authors found that playing the violent video games in cooperative multiplayer mode increased feelings of cohesion and cooperative behaviors in the follow-up activity. They also demonstrated that playing a violent video game cooperatively produced similar levels of subsequent prosocial behavior as playing a neutral video game in single player mode. In rough terms, this means that playing a violent video game cooperatively may reduce the antisocial impacts of that game.

In a three-part study with several hundred Chinese undergraduate students, Jin and Li (2017) tested the effects of playing a variety of video games in single player and cooperative modes on later cooperative behavior in a social dilemma game. The results indicated that subsequent cooperative behaviors were greater for those participants who previously played the game cooperatively. There was also no significant difference in the cooperative behaviors between the groups that played violent and neutral video games, suggesting that the cooperative nature of the game was more impactful on later prosocial behaviors than the content of that game. Additional findings on player experience levels were inconclusive, though cooperative behaviors in some situations may be reduced when large discrepancies in experience or ability exist between partners.

In their study with 64 undergraduate students, Yao and Yu (2016) examined the impacts of positive, neutral, and negative social news stories on subsequent participant social and anti-social behaviors in a digital version of the prisoners' dilemma game. The researchers found that positive social news increased subsequent collaborative behaviors during gameplay, even when their "partner" betrayed them.

Anderson and Hilton (2015) conducted a study to explore the effects of collaborative video game play and how much play time was needed to produce a significant impact on those playing. With a pre-test and post-test, the authors measured a variety of cohesion factors that produced a team cohesion score both before and after playing a collaborative video game. The authors found that as little as one hour of collaborative video game play was sufficient to produce a significantly increased level of cohesion between members of a group. The conclusion was that video game play even for a relatively short time was an effective team building exercise.

In a multicultural study, Noah, Yumie, Sotaro, Atsumichi, and Bronner (2015) measured the changes in stress and cooperation levels between players with an individualistic sociocultural background (American) with players from a collectivist sociocultural background (Japanese). There were 10 Japanese and eight American participants in this study. The results indicated that the Japanese participants experienced higher cooperation but also higher levels of stress. The authors speculated that these differences were due to the background of living in a collectivistic culture that encouraged Japanese participants to place group success over individual needs, thus leading to greater collaborative success, but also higher levels of stress. There were many limitations to this study including sample composition and sample size, but the results are

intriguing. In many cases, collaborative learning is portrayed as a positive thing, but this study identified a potentially negative side-effect of increased stress that may result from an overemphasis on cooperative thinking.

González-González, Toledo-Delgado, Collazos-Ordoñez, and González-Sánchez (2014) developed and tested a Massively Multiplayer Online Role-Playing Game (MMORPG) specifically designed for hospitalized children to increase their social interactions while learning. Using a case study methodology, the authors included the experiences of ten chronically ill children ages 9 to 16. The authors devised a scale whereby their observations of the children's interactions with the game could be quantified. They measured satisfaction, learnability, effectiveness, immersion, motivation, emotion, and socialization. The results indicated that all variables were "highly satisfactory" except for learnability. Overall the authors described the children's experiences as "very social and cooperative" (p. 609). This study was exploratory by nature, and therefore not rigorous enough to produce generalizable results; however, it does indicate that learning games played cooperatively have the potential to be useful for certain audiences with limited means of social interaction.

In a mixed methods study, Burton and Martin (2010) examined the learning and collaborative behaviors of 28 university students in a 3D virtual learning environment. The authors determined that the virtual learning environment increased the levels of student collaboration, and that the student collaboration in turn increased the amount of knowledge the students gained from the learning experience. The strength of this study is that free play with observation allowed the natural learning potential of 3D virtual

learning environments to be demonstrated, but because the case-study approach was used, the findings are not generalizable.

Price, Rogers, Scaife, Stanton, and Neale (2003) conducted a qualitative exploratory study on the use of physical artifacts that complement a digital learning game played collaboratively in pairs. The authors explored the experiences of 12 children ages 6-10 in England. Learning sessions were video recorded and later qualitatively analyzed and coded by the researchers. The authors determined through their qualitative analyses that the children were involved, excited, and engaged. They also found that the use of physical components in the digital learning game produced unanticipated social interactions and helping behaviors, such as turn-taking, sharing roles, and information and idea sharing. The sample size was small, there were some occasional glitches in the software, and the screen was sometimes difficult to share between partners as they moved about the room.

In a year-long ethnography, Bailey (2016) reported on a group of eleven 10-11 year-olds and their engagement with a virtual community built in "Minecraft" as part of an afterschool club. The virtual environment was closed, meaning that only the students from that club were allowed to build and interact there. The author focused the report on the way the children sang songs together as they interacted within the virtual environment. At first the author reported that the song was merely a peripheral activity to what was really going on in the virtual world, but that eventually the song and improvised lyrics started to affect their actions within the virtual world. As Bailey reported, "The song itself initially emerged as a reaction to an in-game event. Then, in turn, the physical enactment of song appeared to influence events, both in and out of the game" (p. 70). The

strength of this study was the specific analysis of the nature of interactions when both online and face-to-face interactions are happening simultaneously. The weakness is of course generalizability. Like several other studies, the author uses the terms collaborative learning and cooperative learning inconsistently; for example, occasionally the students are working together on a specific goal, which Panitz (1999) defined as cooperative learning, yet the Bailey refers to this activity as collaborative learning.

Using enjoyment as the dependent variable, Loparev, Lasecki, Murray, and Bigham (2014) tested a collaborative video game control mechanism with 26 participants aged 19-30. The authors devised a video game control system called WeGame where multiple players, each with their own game controller, would be automatically shuffled in at regular intervals to take control of the game. In this way, participants could play a single player video game collaboratively as they would each take turns controlling the in-game action for a minute or two before control switched to another player. The authors found that players' enjoyment significantly improved when playing the game with the WeGame system. They suggested that this system for collaborative play was more effective for learners overall than allowing a "team representative" to control game play. They further suggested that this system would be a useful learning tool for tutors and students to work together. Unfortunately, there were no measurements besides enjoyment. Further research could explore the effects of using this system on knowledge gain, and with a larger sample size.

In a study with 164 South Korean students ages 11-12, Baek and Touati (2017) examined the correlation between students' existing social collaboration skills and their achievement. The authors found that there was a positive correlation between

collaboration skills and achievement. The authors suggested that students with more positive collaboration skills had the tendency to accept and give assistance to other players, which in turn increased engagement and ultimately the persistence to achieve objectives within the game. The authors suggested that learning through play is complex, and that collaboration needs to be further researched in the context of educational video games.

González-González and Blanco-Izquierdo (2012) developed a prototype educational video game called Neverwinter Nights, and used variations of this prototype in educational exercises with three groups: 17 high school students, 45 first and second grade students, and 25 third year university students. As a result of this mixed methods study, the authors came to the following conclusions: a) lecture classes dominate our current educational culture; b) educational video games promote the development of technical skills and social skills that transfer to the real world; c) educational video games are highly motivational and promote experiential learning; and d) in addition to the content learning that takes place, the social learning and communities that develop around these games can be valuable for long-term knowledge gain and skill development. While this study had significant breadth, it lacked in-depth details on many of the aspects of the study.

Forty-six children ages 7-10 in Valencia, Spain, participated in a study by Martín-SanJosé, Juan, Torres, and Vicent (2014) to see whether playing an educational video game collaboratively or individually made a difference in the participants' self-reported levels of experienced fun, preferences, and knowledge gain. The pre-test and post-test scores indicated that both modes of play produced knowledge gain in participants;

however, scores of those who played the game collaboratively were statistically significantly higher than those who played individually. The children found both versions of the game fun and reported that they would recommend them to friends. The study also found that the children enjoyed using the Microsoft Kinect software because they were able to use their entire body to act out the actions in the video game.

In an exploratory study with mixed methods, Bressler and Bodzin (2013) investigated the factors related to student engagement while playing an augmented reality mobile learning game. Sixty-eight urban middle school students participated in the study, playing the game collaboratively in groups of three or four. Pre- and post-surveys were administered and the researcher also took notes while observing students playing the game, and chronicled dialogue when possible. Finally, the groups were interviewed after playing the game; the interviews were audio recorded, transcribed, and analyzed qualitatively by the researchers. From these data, the authors concluded that gaming attitude was a significant predictor of flow experience, but that gender and a previous interest in science was not significant. The nature of the mobile augmented reality (AR) game was interdependent meaning that players could only succeed by collaborating with others. The authors suggested that the AR game was an effective tool for teaching science and for teaching collaboration skills to students.

Echeverría, Améstica, Gil, Nussbaum, Barrios, and Leclerc (2012) had 41 11th grade students in Santiago, Chile participate in two types of collaborative educational games, one using augmented reality (AR) and the other using multiple computer mice technology. While the authors hypothesized that the AR version of the game would produce more knowledge gain due to higher sensory immersion, the findings indicated

that both modes of collaborative learning were equally effective. An additional finding was that boys had statistically significantly higher post-test scores than girls in the AR group, but that there were no significant differences between genders in the multiple mice group. The authors also observed that girls had more trouble learning how to use the AR technology, which they speculated had to do with differences in spatial abilities that previous research has identified. It is difficult to separate the effects of collaborative learning in this research, suggesting a need for further research that specifically compares different modes of collaborative learning with video games to traditional learning with video games.

Jong, Lai, Hsia, Lin, and Lu (2013) used a sample of 128 students from a Christian Chinese university and compared didactic learning to game-based cooperative learning. The authors found that the participants' scores in the game-based cooperative learning groups were significantly higher than those in the traditional learning groups. Students who learned through the cooperative learning game also demonstrated more positive learning attitudes and higher levels of motivation to keep up with the learning material.

Sung and Hwang (2013) compared collaborative game-based learning to traditional collaborative learning, and individual learning and the impacts of these three conditions on students' knowledge, self-efficacy, attitudes and motivation. The authors included 93 sixth grade students in their study. The authors administered a pre-test and post-test to measure each of the variables. The findings indicated that the collaborative game-based approach produced significantly higher scores on each of the dependent

variables above the two other groups. The present study added to these findings by testing cooperative learning with a different age group and content domain.

One hundred children between ages 8-11 were divided into three groups to test the differences between those who played an educational video game collaboratively in a large group, those who played collaboratively in pairs, and those who played individually (Martín-SanJosé, Juan, Seguí, & García-García, 2015). The pre- and post-test results indicated that all three groups learned the content well, however there were statistically significant differences in knowledge gain between both collaborative modes of play and the individual mode of play in favor of the collaborative modes. There were no significant differences between playing the game in large groups or in pairs.

Summary of primary research on cooperation. The following is a synthesis of commonalities, themes, research gaps, and implications for the present study from the studies that examined cooperative learning in video games.

Among the most common independent variables across these studies were comparisons of cooperative and individual play modes of various forms in educational video games (Greitemeyer & Cox, 2013; Greitemeyer et al., 2012; Jin & Li, 2017; Jong et al., 2013; Lin et al., 2013; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015; Sánchez & Olivares, 2011) or a comparison of different types of cooperative modes (Bekebrede et al., 2011; Echeverría et al., 2012; Hämäläinen & Oksanen, 2012; Hummel et al., 2011; Loparev et al., 2014; Martín-SanJosé, 2015; Noah et al., 2015; Sung, & Hwang, 2013; Yao & Yu, 2016).

Cooperative learning was merely a peripheral concept in a few studies (Bressler & Bodzin, 2013; Burton & Martin, 2010) or used as a context for exploratory and mixed

methods studies on digital learning, but without a control group (Anderson & Hilton, 2015; Bailey, 2016; Bressler & Bodzin, 2013; Echeverría et al., 2011; González-González & Blanco-Izquierdo, 2012; González-González et al., 2014; Padrós et al., 2012; Price et al., 2003; Yao & Yu, 2016).

In studies that directly manipulated cooperation the dependent variables included subsequent cooperative behavior on a different task (Greitemeyer & Cox, 2013; Greitemeyer et al., 2012; Jin & Li, 2017; Yao & Yu, 2016), attitude (Jong et al., 2013; Sung, & Hwang, 2013), motivation (Jong et al., 2013; Sung, & Hwang, 2013), knowledge gain (Echeverría et al., 2012; Hummel et al., 2011; Jong et al., 2013; Lin et al., 2013; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015; Sung, & Hwang, 2013), enjoyment (Loparev et al., 2014; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015), usability/preferences (Bekebrede et al., 2011; Hummel et al., 2011; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015), would recommend to friends (Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015), problem solving (Hämäläinen & Oksanen, 2012; Sánchez & Olivares, 2011), confidence (Sánchez & Olivares, 2011), engagement (Echeverría et al., 2012), in-game performance (Noah et al., 2015), stress (Noah et al. 2015), and group learning (Sung & Hwang, 2013).

A common theme among many of these studies is that using cooperative learning strategies in video games produces significant gains in dependent variables such as enjoyment (Loparev et al., 2014; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015) knowledge gain (Echeverría et al., 2012; Hummel et al., 2011; Jong et al., 2013; Lin et al., 2013; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015; Sung & Hwang, 2013), subsequent behaviors (Greitemeyer & Cox, 2013; Greitemeyer et al.,

2012; Jin & Li, 2017; Yao & Yu, 2016) and others with very few noteworthy downsides. In fact, there was only one study that directly mentioned a negative byproduct of using cooperation in an educational video game setting—that of stress which resulted from cultural expectations of cooperation (Noah et al., 2015). However, it was also the case that many of the studies lacked rigorous experimental design and/or control groups for generalizability (Baek & Touati, 2017; Bailey, 2016; Burton & Martin, 2010; Echeverría et al., 2011; Echeverría, 2012; González-González et al., 2014; Hummel et al., 2011; Padrós et al., 2012; Price, 2003). Another commonality across studies is that the term cooperation is used loosely and often interchangeably with the term collaboration (e.g., Bailey, 2016; Echevarria, 2011), even though according to Panitz (1999), there are notable differences in the meanings between the terms. The present study helped close this gap by articulating the differences between cooperative and collaborative learning, and also carefully followed Johnson and Johnson's (1999) five key elements of appropriate cooperative learning so that the study can be replicated, and results can be directly attributed a specific type of digital cooperative learning.

Collectively, the findings and results of these studies provided many implications for future research on cooperative learning with video games. These include the social interaction aspects of cooperation (Loparev et al., 2014), exploring other domains (Sung & Hwang, 2013), real-time views of partner's actions (Price et al., 2003), testing other demographics (Jong et al., 2013), more dynamic aesthetics, storylines and game designs (Bressler & Bodzin, 2013; Echeverría et al., 2011; Jong et al., 2013; Sánchez & Olivares, 2011; Yao & Yu, 2016), testing subsequent cooperative behaviors at different time intervals and in different contexts (Anderson & Hilton, 2015; Padrós et al., 2012), testing

in-game performance (Greitemeyer & Cox, 2013), combinations of group sizes in cooperative play (Jin & Li, 2017), use of different pedagogies and technologies (Echeverría et al., 2011; Martín-SanJosé et al., 2014; Sánchez & Olivares, 2011), use of clearly defined cooperative goal structure (Bailey, 2016; Bekebrede et al., 2011) more precise measurements of dependent variables (González-González & Blanco-Izquierdo, 2012; Noah,et al., 2015), gender dynamics in group composition (Bressler & Bodzin, 2013), different modes of cooperative learning (Echevarria, 2012; Hämäläinen & Oksanen, 2012; Hummel et al., 2011), and impact of avatar representations (Burton & Martin, 2010).

Cooperation and Competition in Educational Video Games

Cooperation and competition are two distinct methods of social interaction that can occur with any educational context including educational video games (Kapp, 2012). Adams (2013) has suggested that the difference between competition and cooperation is in goal structure, "Competition occurs when players have conflicting interests, that is, when the players try to accomplish mutually exclusive goals. Cooperation occurs when the players try to achieve the same or related goals by working together" (p. 11). Cooperative and competitive learning scenarios are increasingly being considered preferable over individual learning scenarios due to the many social benefits that can result from them (Velez, Greitemeyer, Whitaker, Ewoldsen, & Bushman, 2014). Attle and Baker (2007) suggested that students usually come to genuinely appreciate cooperative and competitive exercises as valuable learning experiences. Granic, Lobel, & Engels (2014) attempted to explain why such competitive and cooperative learning scenarios are considered to be valuable, "…video games … can include competitive and

cooperative objectives, players immerse themselves in pretend worlds that are safe contexts in which negative emotions can be worked out, and games allow a sense of control with just enough unpredictability to feel deep satisfaction and intense pride when formidable goals are finally reached" (p. 76). There seems to be little question as to whether or not there is educational value in competitive and cooperatively played video games, however, the questions of which is more effective for learning is one that researchers have only begun to examine.

Primary research comparing cooperation and competition in video games. A small collection of studies exist which compare the use of competition and cooperation in educational video games. The following section shares the highlights of these studies.

Badatala, Leddo, Islam, Patel, and Surapaneni (2016) divided a sample of 60 middle school boys into three groups to play the commercial video game *Call of Duty: Modern Warfare 3*. One group played the game cooperatively with other players, the second group played the game competitively, and the last group played the game alone as a control group. Several weeks later the researchers brought the boys back together to engage in a teamwork and trust exercise known as the "prisoner's dilemma." The results indicate that those participants who had played the video game cooperatively scored higher on measures of teamwork than those who played the game competitively or alone. The strength of this study is that it shows that by playing a video game socially and cooperatively, even a violent one, can have positive benefits in later teamwork and cooperative activity. The authors suggested a need to examine the later impacts of cooperative and competitive video game play using other genres of video games

including educational video games. They also suggested that additional dependent variables also need to be examined, which is a gap that the present study helped address.

Thirty-four university students participated in a study by Lim and Reeves (2010) that used a 2x2 design to test the differences between playing a video game competitively or cooperatively and those playing with/against other players or a computer controlled agent (avatar). The authors found that playing with/against another participant was more physiologically arousing than playing against a computer controlled opponent. There were no differences in presence, likability or valence between playing competitively or cooperatively with other co-players, but when playing with/against a computer controlled agent competitive play led to higher scores for valence, presence and likability. Overall, the authors concluded that having participants play cooperatively with a computer agent was relatively more engaging than having them play competitively against an agent. And likewise, playing the game competitively against other players was relatively more engaging than playing cooperatively. The main strength of this study is that it demonstrates that the same or similar actions in a video game can have very different outcomes depending on the social environment of the game. It's not only about the actions of playing a game cooperatively or competitively that impacts the outcomes on players, it's also about the human and social elements. Gameplay in this study was short: only two minutes, which the authors admit provides a limited experience for players. Lim and Reeves suggest that future studies use a larger sample with greater varieties of activities and a longer time frame for gameplay as well as more social cooperative and competitive gameplay modes.

In an effort to improve exercise habits and promote weight loss, Staiano, Abraham, and Calvert (2012) studied 54 African American teens who were classified as overweight or obese. Using an exergame, where physical activity controlled the players' actions in a video game, the authors compared the differences between participants who played the game competitively and cooperatively, and also compared the results to a control group that did not play the game. The results indicated that youths who played the exergame competitively had higher scores measuring executive functions, and significant weight loss over a 10-week period. These executive function skills included task switching, speed of visual search, attention, visual–motor function, temporal sequencing, and mental flexibility. Those in the group who played cooperatively and those in the control group did not show significant gains in executive functions scores nor significant weight loss. The strength of this study is in its application in a specific domain of health and weight loss, and in its impacts over a period of ten week as opposed to a one-time gaming session which is often the case in studies. The authors suggested that future studies should explore other domains both within exergaming and in other genres of educational video games.

Vang and Fox (2014) wanted to test how players were assessed and treated when using avatars with different racial features, particularly African American. Ninety-nine white students were recruited from a large Midwestern university to participate in the study. The students were randomly placed into a competitive or cooperative word scramble game, where their co-player was randomly represented as either a white or black avatar. After playing the game students reported their feelings, thoughts, and beliefs about the other player, and were also asked questions about who they thought was

really controlling the avatar. Contrary to the authors' hypothesis, black avatars had more positive evaluations than did white avatars regardless of the mode of play. The authors did not have a strong explanation for these findings, but suggested that, in a virtual environment, players may be less motivated to make assessments about race. These findings need to be further analyzed with different populations. Different cooperative and competitive games should also be analyzed. The findings don't really add much additional understanding to the nature of cooperative and competitive learning.

With 152 university students, Peng and Crouse (2013) examined measures of enjoyment, motivation to play the game again in the future, and physical activity intensity in an exergame. Students were randomly assigned to play the exergame in one of three conditions: single player mode, cooperative mode with other players in the same room, and competitive mode with players in separate locations. The findings indicated that competitive play produced the highest levels of enjoyment, motivation to play the game again, and greater levels of physical exertion, even though it was played at a distance by players. The authors also did not find any difference between performance of group members who were friends or strangers, regardless of condition. In terms of motivation, these findings suggest that playing in multiplayer mode – whether with friends or strangers -- is more effective than playing the game alone. Unfortunately, the cooperative groups and competitive groups were not directly comparable because the cooperative group participants played in the same physical space, and the competitive group participants played online and at a distance. The authors suggest that future research should include different genres of video games and a more representative sample from the general population than university students.

In a similar study, Peng and Hsieh (2012) sampled 158 university students and tested competitive and cooperative modes of play in a motor-activity centered video game. Contrary to the results from Peng and Crouse (2013), Peng and Hsieh found that the cooperative mode of play lead to higher motivation than the competitive mode of play. The authors also found that playing with friends rather than strangers led to a higher level of commitment but only in the cooperative mode. Participants from both the cooperative and competitive modes performed better than those who played the game alone. This study was limited to a single session of play and a motor activity game. The authors suggested that future studies could compare intrinsic and extrinsic goal structures of competitive and cooperative play modes. The game used simple motor actions, but the authors suggested that the study should be replicated with more complex motor actions. Last, they suggested that future studies could also examine conversation patterns between players during gameplay.

The subject of a study by Goršič, Cikajlo, and Novak (2017) was a rehabilitation game designed to motivate people with chronic arm impairment to engage in beneficial exercise. Motivation to play and exercise intensity were examined as dependent variables. Participants were those who had previously experienced a health condition which affected arm use such as strokes, brain tumors, and other physical and mental impairments. Each participant played four games in a single session, and their preferences and motivations were measured with a questionnaire, and their exercise intensity was measured with wearable inertial sensors. Of the 29 participants, 12 preferred the competitive exercise game and 12 preferred the cooperative exercise game while 5 preferred playing the exercise game alone. Competitive and cooperative

gameplay were both found to increase motivation to exercise over traditional therapy but only competitive game play increased exercise intensity. This study only focused on rehabilitation improvements. The authors suggested that it would be useful to examine learning variables in the future and that it would be useful to examine the impacts of multiple sessions of gaming over a long period of time.

In another study that compared cooperative and competitive gameplay modes on a game designed to aid in rehabilitation of those with arm impairment, Novak, Nagle, Keller, and Riener (2014) examined the motivations, preferences, and personalities of 30 participants. Of these 30 participants, only eight had arm impairments. The game utilized hardware and software that detected arm motion that transferred directly to actions on a video game with mechanics similar to air hockey. The authors found that in general participants prefer the multiplayer game modes, and that the competitive game mode tended to produce the highest levels of exercise intensity among participants. There were, however, some participants who did not perform well in competitive mode, citing reasons like a general dislike for competitive situations or a fear of disappointing the other player. The authors concluded that, because different personalities preferred different gameplay modes, rehabilitation efforts should include a library of gameplay options. The strength of this study is that it sheds light on the idea that success at playing a serious game cooperatively or competitively may come down to preferences, and how much someone likes competitive or cooperative situations. The limitations include a small sample size, limited game-type, and limited dependent variables not directly related to knowledge gain or other classic learning variables. The authors also suggested exploring a more wide-

scale implementation of rehabilitation games through internet-based online play with patients from multiple clinics.

In an effort to understand that nature of violent video games, Velez, Greitemeyer, Whitaker, Ewoldsen, and Bushman (2016) examined 126 college students who played a violent game cooperatively, competitively, or alone. The authors found that those who played the game cooperatively exhibited less aggressive behaviors and more helping behaviors in subsequent activities than either those who played competitively or alone. They also found evidence that these behaviors can translate into later social situations as well. The authors suggested that playing a game cooperatively can offset the aggression-increasing effects of violent video games. The main limitation of this study is that it didn't measure variables related to learning or education, though the findings still have some value to my study. The strength is that the independent variables used are very similar in my study.

In a similar study, Ewoldsen, Eno, Okdie, Velez, Guadagno, and DeCoster (2012) tested the effects of playing a violent video game cooperatively, competitively and alone on later aggressive behavior using 119 university students as participants. Cooperative behaviors were significantly higher in the subsequent activity among participants who played the game cooperatively. One limitation is that most of the participants were male.

Waddell and Peng (2014) also examined the effects of playing a violent video game cooperatively and competitively, but wanted to study the effects of playing these different game modes with friends and with strangers. Using 144 undergraduate students, the authors found that there were no significant differences in participants' subsequent activities between playing a violent video game with friends or strangers. This held true

for both cooperative and competitive gameplay modes. The strength of this study is that is looked at four combinations of social play between competitive/cooperative and friend/stranger. It also contributed additional evidence that in the prisoner's dilemma follow-up activity those who previously played the game cooperatively demonstrated more cooperative behaviors regardless of whether or not the game was played with friends or strangers. A potentially significant limitation is that those classified as strangers may have still been acquaintances among the university students, and most participants were in the same life stage, and shared many demographics. Testing differences between friends and strangers might be more pronounced with more diverse groups of participants. Different video games need to be assessed, including non-violent and educational games. Also, players were only given about 10 minutes of play time. The effects may be stronger with a longer period or multiple periods of gameplay.

Because many students claim that they play video games to reduce stress, Roy and Ferguson (2016) created an experiment to examine this claim. The authors created a stress-inducing activity for 100 university students who then played the video game *Lego: Marvel Superheroes* either competitively or cooperatively to see if gameplay helped reduce their stress. Participant physical behaviors and verbal cues were observed during gameplay. Blood pressure and heart rate were monitored as physiological measures of stress, and participants were asked to self-report their stress and attitudes after completing the game. By all measures, playing the video game after the stressful activity helped reduce stress among participants, with no significant differences between playing the game competitively or cooperatively. This study contributes understanding to the research of the benefits of playing video games, even for leisure, that could carry into

other aspects of life. The authors point out that, across video games, the terms cooperative and competitive are sometimes loosely defined. Because there was no comparison group, it is difficult to say definitively that the reduction in stress was due to gameplay or simply a function of the time that elapsed since the stressful activity. The authors pointed out that in this study, the partner/competitor was a single female confederate, with potential personality and gender effects that could be eliminated in future studies by using other participants as the partner.

Chanel, Kivikangas and Ravaja (2012) recruited 48 Finnish adults in pairs who were considered friends with each other to participate in a study which measured psychological and physiological similarities between partners when playing a video game competitively or cooperatively. The findings suggested that partners had more physiological similarities when playing the game competitively than when they played cooperatively. The authors interpreted this to mean that social presence and were more similar in competitive situations than cooperative situations. A limitation to the study is that, even though it was found that physiological reactions were more unified between partners while playing the game, there is not a clear benefit to the players from such unity. Also, it seems that some of the differences may be explained by the way the competitive and cooperative gameplay modes were structured; the authors suggested that there was not much difference between playing the game cooperatively than playing alone, due to the dynamics of the game. These findings should be tested with another game, and with pairs who do not already know each other.

Thirty-two participants played either a competitive or cooperative version of a specialized exergame for stroke victims as their brain activity was mapped (Le Bouc &

Pessiglione, 2013). The grip force on the player's impaired hand was measured using specialized hardware that controlled certain actions in the game. The study found that cooperative gameplay activated different parts of the brain compared to competitive play. The activated areas were consistent with previous research on cooperation and competition with brain imaging. This study was limited by the game itself which the authors described as very simplistic. They suggested the use of a more complex video game in the future. They also suggested further research on participants with different social relationships, because their participants were all strangers to each other.

Schmierbach, Xu, Oeldorf-Hirsch, and Dardis (2012) examined the level of enjoyment participants experienced while playing *Madden 08*, a football video game. Enjoyment was measured using a previously established scale. A confederate partner was used by the authors to play the role of a friendly or unfriendly partner. The authors used 139 participants, and found that enjoyment was significantly enhanced with a combination of a friendly partner and playing the game competitively. The cooperative play mode was found to be significantly less enjoyable with both a friendly and unfriendly partner. The authors speculated that in the context of this specific game, a player may have felt limited when having their success tethered to another player and thus found the game less enjoyable. The authors have suggested that a different game with different competitive and cooperative gameplay mechanics may result in different outcomes, so future studies should examine different games to compare to their study. The authors also suggested examining different modes of communication between players during gameplay such as face-to-face and online communication. The authors also detected some preliminary evidence that victory or defeat in the game effected

enjoyment levels, but there was not enough evidence to make solid conclusions, and that was suggested as a topic for future examination. The authors suggested that enjoyment of a video game is complex and influenced by a variety of factors, including playing cooperatively or competitively.

Short (2016) examined a virtual world with limited resources where players could behave competitively or cooperatively. The study was not very rigorous. For example, it was not clear how many participants were examined in the study, and all data was from author's observations. The author generally observed that the scarcer the tools and resources in the environment the more players competed for those resources. Cooperation began to emerge more when resources become more abundant. The author concluded that competition is the base human instinct, but that cooperation can be established through communication and wise use of tools. This study had many limitations and was not very rigorous, and seems to cast a negative light on competition, at least in an uncontrolled environment. The current research examined cooperative and competitive behaviors in a more controlled environment.

In a study with 72 middle school students, Trespalacios, Chamberlin, and Gallagher (2011) examined students' preferences when playing educational video games, particularly with different multiplayer and single player modes. This study was qualitative and through their observations four different categories emerged: companionship, collaboration, competition, and challenge. The results indicated a strong motivation for multiplayer games. Players responded with the reasons they preferred multiplayer gaming including 34% who simply like playing with friends, 30% who liked the collaborate with partners to reach goals within the game, 25% who preferred to

compete against their partner, and 8% who enjoyed the challenge of the in-game situations with multiple players. The strength of this study is that it demonstrates that in spite of the popular stereotype that video games are isolating, middle schoolers much prefer to play socially, and the social aspects can be very enjoyable including playing cooperative and competitively. The sample was limited, and the qualitative aspects of this study do not lead to much generalizability, therefore quantitative studies should follow up on these findings.

Smith and Chan (2017) used a game called Space Race to teach computing to 485 first year engineering students. The game was played with groups of four on a tablet who had to collaborate to compete against other groups in the class. Pre- and post-knowledge quizzes were administered, as well as a survey about students' experience, attitude, and performance during the game. The findings showed statistically significant improvements in knowledge gain and test performance over those who did not play the game. The authors found that such advantages of knowledge retention lasted at least seven weeks. Among the conclusions the authors made from the data were that social competition can contribute to the motivation and enjoyment of students, and the collaborative component further motivates students, particularly those who do not prefer competition, and overall computer games are significantly more motivating and effective for knowledge gain than traditional learning. One limitation is that the gameplay included four extra hours over a period of four weeks that traditional learners didn't have. So, some of the increases in knowledge may have simply resulted from more time spent with the content and not necessarily the gameplay itself. Thus, future studies should ensure equal amounts of time for control groups, as the present study explicitly did. The authors suggested that there

are vast numbers of potential game deigns and learning content that could be explored in the future to see if these results hold true. The present study focused on both a relatively unexplored transformational play-based game design and personal finance game content.

Peppler, Danish, and Phelps (2013) tested a game called HIVEMIND with 40 early elementary students ages 6-9. The authors used qualitative observations to determine how effective competitive and cooperative play was for the students. The authors suggested that cooperative play produced more positive comments among students, more on-topic conversations, and were more likely to discuss scientific content than those in the competitive play mode. The authors suggested that the content of the game – bees and their hive communities – was very conducive to the cooperative mode of play, but that other content might be more conducive to a competitive mode of play. They suggested that future research should consider the natural mapping of content to determine the optimal mode of gameplay. This study was limited by the qualitative nature which affects generalizability, and the presence of observers may have affected the behavior of the students. The authors suggested that games do more than add enjoyment to the learning experience, they also influence classroom culture, students' interactions with each other, and elucidate important aspects of the content being studied.

In a game with competitive and cooperative modes of play, McGloin, Hull, and Christensen (2016) manipulated the performance feedback to understand its impact on players. The difference in real points achieved and the manipulated scores ranged up to 31%. Three-hundred and thirty-three university students participated in the study. Participants were told that they were participating in an asynchronous turn-based game and that the other player had recently completed their turn. Overall the participants who

played the game cooperatively enjoyed the game more. But the authors found that players who played competitively and were told that they lost the game and those who played cooperatively and were told that they won had rated the other player more favorably. Conversely, players who played competitively and were told that they won and those who played cooperatively and were told that they lost rated the other player less favorably. The authors suggested that success or failure in a game can affect its potential educational value. They suggested that future studies should explore other game genres and replay-ability of games with different success/failure scenarios.

Plass, Homer, Case, O'Keefe, Hayward, Stein, and Pedin (2013) examined the difference that resulted from playing a mathematics learning game cooperatively, competitively or individually. Fifty-eight 6th, 7th, and 8th grade students played the game. The results indicated that playing the game competitively increased in-game performance over the collaborative and individual play modes. There were no major differences in post-game learning. Competitive and collaborative play resulted in greater enjoyment, situational interest and mastery goal orientation over individual play. And collaborative play resulted in a greater in more motivation to play the game again. The authors describe the findings and complex nature of competition and collaboration, pointing out that the collaborative play mode resulted in positive attitudes toward the game, but also resulted in the most inefficient use of strategy and in-game learning. The strength of this study is the illustration of the complexity and game and context specific differences that can arise when playing video games collaboratively and competitively. Other game genres and other domains need to be similarly examined, the authors suggested that the particular game they examined was likely to be very conducive to cooperative play.

Ter Vrugte, de Jong, Vandercruysse, Wouters, van Oostendorp, and Elen (2015) studied the performance of 242 prevocational students in competitive and cooperative play modes in a mathematics learning video game. An overall increase in performance was detected between pre-test and a post-test performance scores, but no differences were found between playing the game cooperatively or competitively. Informal observations also indicated that students in the collaborative play mode were more focused on the activity and easier to manage. Attrition was reported a problem in the study, and other domains need to be examined according to the authors. The present study examined a different domain and examined additional dependent variables.

Hainey, Connolly, Stansfield, and Boyle (2011) tested the effects of different modes of multiplayer games and also examined these effects in the contexts of online and offline gaming. A large sample of 2226 players was collected over a four-year period with an age range of 17-77, and a mean age of 26. The strength of this study is that it articulated how cooperation and competition are the main instruments of social interaction in multiplayer and online games. Using longitudinal techniques with relatively large sample sizes, this study consistently found that video games were used frequently, were effective for motivation in educational contexts, students generally had a good attitude towards video games, and cooperation and competition were the preferred mechanisms to keep the game engaging and motivating especially in multiplayer and online games. This study was not experimental and there was no control group, just self-reported data from participants. And participants were all from a single university, which limits generalizability.

A study by Admiraal, Huizenga, Akkerman, and Ten Dam (2011) sampled 216 secondary school students spread over 10 classes at five different schools in the Netherlands. Over a period of 10 days, groups of four were arranged, each composed of two teams. The game included historical lessons on medieval Amsterdam, and the students were observed while they played the game and given a knowledge test at the conclusion of playing the game. Generally, it was found that students showed evidence of flow experiences while engaged in the learning game. It was found that students who were more engaged in competition with other groups gained more knowledge. One weakness of the study is that technology issues frequently seemed to interrupt the flow of students' learning. The authors suggested that future studies eliminate potentially distracting problems with the technology. Another weakness is that competitive and cooperative learning, while part of the study, are not at the forefront, thus limiting the value of this study in this regard.

Summary of the primary research on cooperation and competition in educational video games. Of the studies that examined competition and cooperation in educational video games, the following is a synthesis of commonalities, themes, research gaps, and implications for the present study.

The most common independent variables from these studies were direct comparisons of competitive and cooperative gameplay modes, often including a control group such as traditional learning or solo gameplay (Badatala et al., 2016; Chanel et al., 2012; Goršič et al., 2017; Le Bouc & Pessiglione, 2013; McGloin et al., 2016; Novak et al., 2014; Peng & Crouse, 2013; Peng & Hsieh, 2012; Peppler et al., 2013; Plass et al., 2013; Roy & Ferguson, 2016; Staiano et al., 2012; Ter Vrugte et al., 2015; Velez et al.,

2016). A few studies examined competitive and cooperative learning along with additional independent variables including computer vs human players (Lim & Reeves, 2010), playing with friends or strangers (Waddell & Peng, 2014), playing with avatars of different races (Vang & Fox, 2014), playing with a friendly or unfriendly co-player (Schmierbach et al., 2012). One study compared two forms of competitive play to cooperative play and a control group (Ewoldsen et al., 2012). In several studies, competitive and cooperative learning simply emerged as variables of interest along with other variables (Admiraal et al., 2011; Hainey et al., 2011; Short, 2016; Trespalacios et al., 2011). Finally, one study included cooperative and competitive learning, but did not directly compare the two (Smith & Chan, 2017).

In those studies where cooperative and competitive gameplay were directly compared, the dependent variables that were examined included subsequent behavior in follow-up activity (Badatala et al., 2016; Velez et al., 2016, Waddell & Peng, 2014), physiological measures of in-game behavior (Chanel et al., 2012; Lim & Reeves, 2010), motivation (Goršič et al., 2017; Novak et al., 2014; Peng & Crouse, 2013; Peng & Hsieh, 2012), game-related exercise intensity (Goršič et al., 2017; Le Bouc & Pessiglione, 2013; Peng & Crouse, 2013; Schmierbach et al., 2012), brain image activity (Le Bouc & Pessiglione, 2013); enjoyment (Lim & Reeves, 2010; Peng & Crouse, 2013; Plass et al., 2013; Schmierbach et al., 2012); engagement (Lim & Reeves, 2010), coplayer likability (Lim & Reeves, 2010; Roy & Ferguson, 2016, Vang & Fox, 2014), in-game performance/perceived performance (McGloin et al., 2016; Peng & Hsieh, 2012; Plass et al., 2013), game preferences (Novak et al., 2014; Plass et al., 2013), goal achievement (Peng & Hsieh, 2012; Peppler et al., 2013), player interactions (Peppler et al., 2013);

knowledge gain (Plass et al., 2013; Ter Vrugte et al., 2015), desire to replay the game (Plass et al., 2013; Schmierbach et al., 2012), stress levels (Roy & Ferguson, 2016); weight loss (Staiano et al., 2012), and cognitive skills (Staiano et al., 2012).

The first common theme among these studies is that multiplayer modes were almost always advantageous compared to traditional learning or individual play (Badatala et al., 2016; Goršič et al., 2017; Lim & Reeves, 2010; Novak et al., 2014; Peng & Hsieh, 2012; Plass 2013; Smith & Chan, 2017; Trespalacios et al., 2011). And there seemed to be little significant difference in playing in multiplayer mode with friends or with strangers (Peng & Crouse, 2013; Peng & Hsieh, 2012; Waddell & Peng, 2014). Many of the studies which compared cooperative learning to competitive learning seem to suggest that cooperative learning is advantageous (Badatala et al., 2016; Ewoldsen et al., 2012; Peng & Hsieh, 2012; Peppler et al., 2013; Velez et al., 2016; Waddell & Peng, 2014). However, there were also a number of studies that came to the opposite conclusion, that competition had greater benefits (Admiraal, 2011; Chanel et al., 2012; McGloin et al., 2016; Peng & Crouse, 2013; Schmierbach et al., 2012; Staiano et al., 2012). Some studies found mixed results suggesting that the advantages of competitive or cooperative learning in video games were dependent on the specific variables in question such as human and social elements, personalities, preferences, and scarcity of in-game resources (Lim & Reeves, 2010; Goršič et al., 2017; Novak et al., 2014; Plass, 2013; Short, 2016; Smith & Chan, 2017; Ter Vrugte, 2015). Collectively, the research seems to slightly favor cooperative modes of gameplay over competitive modes; however, the true result is that video game play, whether competitive or cooperative, is complex and seems to have context-based benefits and limitations.

As a result of the complexity of these findings there was no shortage of suggestions for future research from the authors. Some of the more significant suggestions included using educational video games instead of commercial video games (Badatala, 2016; Peng & Hsieh, 2012; Velez et al., 2016; Waddell & Peng, 2014), use of other game genres, particularly nonviolent video games (Chanel et al., 2012; Ewoldsen et al., 2012; Le Bouc & Pessiglione, 2013; McGloin et al., 2016; Novak et al., 2014; Plass et al., 2013; Schmierbach et al., 2012; Smith & Chan, 2017; Staiano et al., 2012; Waddell & Peng, 2014), application to other domains (Peppler et al., 2013; Plass et al., 2013; Smith & Chan, 2017; Staiano et al., 2012; Ter Vrugte et al., 2015), equally represented experimental and control groups (Admiraal et al., 2011; Chanel et al., 2012; Hainey et al., 2011; Peng & Crouse, 2013; Roy & Ferguson, 2016; Schmierbach et al., 2012; Short, 2016; Smith & Chan, 2017), strong dependent variables related to education (Badatala, 2016; Chanel et al., 2012; Ewoldsen et al., 2012; Goršič et al., 2017; Novak et al., 2014; Ter Vrugte et al., 2015; Velez et al., 2016; Waddell & Peng, 2014), longitudinal data (Badatala, 2016; Peng & Hsieh, 2012) sufficient time for full immersion in gameplay (Lim & Reeves, 2010; Goršič et al., 2017; Waddell & Peng, 2014), larger, more diverse sample size for greater generalizability (Chanel et al., 2012; Ewoldsen et al., 2012; Hainey et al., 2011; Le Bouc & Pessiglione, 2013; Lim & Reeves, 2010; Novak et al., 2014; Peppler et al., 2013; Peng & Crouse, 2013; Roy & Ferguson, 2016; Trespalacios et al., 2011;Waddell & Peng, 2014), different modes of social interaction (Novak et al., 2014; Schmierbach et al., 2012), clearly defined cooperative and competitive independent variables (Roy & Ferguson, 2016), more quantitative methods (Peppler et al., 2013; Trespalacios et al., 2011).

Transformational Play

A definition and description of transformational play, along with a justification for use of this instructional design theory can be found in Chapter I. Included in this review of literature is an account of the findings of the relatively few research studies on transformational play, and a discussion of the implications of these studies on the present research.

Primary research on transformational play. The theory of transformational play is relatively new and unexplored. Consequently, the number of studies that ground the theory in real world examples accompanied by experimental analysis are few. This is a brief review of those studies.

Barab et al. (2009) compared four different experimental groups using 51 undergraduate participants. The four conditions included learning from an expository electronic textbook (ET), the second was simplistic framing (SF) which consisted of a third-person 3D narrative not controlled by the participants, the third condition consisted of a first-person directed immersive world condition based on the theory of transformational play (TP) which was played in pairs, and the last was the immersive world condition played individually (ITP). The results indicated that the students in the TP and ITP conditions performed better than the ET group on standardized tests of knowledge gain. Those in the TP condition also performed better than the SF group on those same tests. The TP group also performed significantly better on a performance-based transfer task than the ET and SF groups. These results indicate that educational games designed using the theory of transformational play were generally more effective for learning than a simple 3D experience or electronic textbook. It also illustrated certain

benefits of playing a transformational play-based game socially as opposed to playing individually. Gaps to be addressed in future studies include exploring different game genres with different populations, and different dependent variables and with different social structures.

In a study with 65 seventh grade students form an inner-city school, Barab, Pettyjohn, Gresalfi, Volk, and Solomou (2012) examined a story-based educational game designed according to the principles of transformational play. This game was compared to a control group using a traditional novel to illustrate the same lessons. The students were then asked to draft persuasive arguments based on their experiences with the two different programs. The authors used pre-test and post-test data as well as observational data from video recordings of the learning session along with student interviews. The results of this data indicated that while both groups had significant learning gains, the game-based participants demonstrated significantly more learning by comparison. The game-based group also showed higher levels of engagement and motivation, and needed fewer reprimands to stay on task. The authors suggested that the gains of the game-based group occurred because the game allowed students to experience the story as opposed to simply hearing a story, which increased engagement, motivation and learning. This experiment occurred with a relative small sample and population. The present study expanded on the knowledge of transformational play-base programs by exploring different populations, contexts, and domains.

Barab, Dodge, Ingram-Goble, Pettyjohn, Peppler, Volk, and Solomou, (2010), reported on the results of two preliminary studies that were informed by the theory of transformational play. In the first study the authors developed and examined a game that

was based on the classic novel, *Frankenstein*, by Mary Shelley. Using one classroom of fourth grade students, the authors qualitatively assessed the experiences, and levels of engagement and motivation among participants. The authors reported that the students showed real engagement with the game, and perceived themselves to be actively involved with the story, as compared to reading a novel passively. The authors suggested that the players not only understood and retained the content but that it helped them explore their own biases and perspectives on moral and ethical issues related to how the creature, Frankenstein, was treated. The second reported study used in-person and online qualitatively interviews to examine the experiences of 44 after-school participants who played a video game designed to teach students about architecture and design. The game not only focused on the architectural and design choices, but also on the social implications of these choices. The authors presented qualitative evidence of high levels of student engagement and learning as a result of program participation. Together these two studies add to our understanding of games based on transformational play which are narratively rich and provide experiences to learners through a digital medium. The studies further illustrate that a student's motivation, engagement and knowledge retention, and a deeper understanding of real life dynamics like ethics and public opinion can all benefit from playing these types of educational games. Unfortunately, neither of the studies in this research article were very rigorous. There were no control groups used and it can be argued that qualitative assessment of the participants was subjective and therefore inconclusive. The samples were relatively small, and no differentiation was made between those interviewed face-to-face and online. The present study helped add

understanding to the strength of transformational play-based learning by quantitatively assessing the benefits of playing educational games informed by the theory.

Barab, Gresalfi, and Ingram-Goble (2010) conducted isolated qualitative interviews of students who participated in experimental transformational play experiences. There were two units assessed in this study. The first game, called *Taiga Fishkill*, was set in a fictitious national park where the participants had to identify the reasons why the park's fish were dying. Four classes of sixth grade students were placed into a control group and an experimental group, and their knowledge gains were assessed using pre- and post-tests. While both groups showed knowledge gain as a result of the program, the transformational play group learned significantly more than the control group. An additional assessment was conducted eight weeks after program participation and the transformational play group showed significantly more knowledge retention and a deeper understanding of the concepts covered in the program. When students were asked why they were participating in the educational activity, 97% of the members of the control group said it was because they were required to do it, whereas only 36% of those in the experimental group cited that reason. The other 64% said it was because they wanted to do it. Additionally, 91% of the experimental group participants logged on to the program outside of class, and 75% completed extra credit assignments. In contrast less than 10% of those from the control group logged on outside of class or completed any extra credit. In the second study, the authors again examined the game based on the Frankenstein story by Mary Shelley, which was also examined in Barab, Dodge et al., (2010). This time the population consisted of high-need seventh grade students from an inner-city school in North Carolina. The students were assigned to either a

transformational play group or a control group where the original book was used as the instructional material. The persuasive writing scores of the students from the two groups, as well as the engagement and motivational levels of the students, were assessed. The authors reported that the persuasive writing scores for the students in the transformational play group were significantly higher than for those in the control group. Those in the transformational play group showed significantly higher levels of engagement and motivation, and 86% of those in the transformational play group reported that they enjoyed the activity while only 22% of those in the treatment group reported enjoying the activity. Only 5% of the control group participants cited a reason besides grades for doing the activity, while 65% of the transformational play group reported other reasons. The strengths of these two studies include a longitudinal assessment of knowledge retention in the first study, and an overall assessment that transformational play activities are more effective than traditional methods for capturing students' interest, time, commitment, and passion. The main weaknesses of these studies were that the dependent variables were, for the most part, subjective and focused on relatively small populations. The present study focused on different and larger populations and used quantitative measurement instruments.

Lundblad, Malmberg, Areskoug, and Jönsson (2012) used the three main elements of the theory of transformational play to design an augmented reality science educational program for college students. The program focused on the impacts of electrical transformers and used virtual characters and measurements in conjunction with the real electrical grid and transformers to help students understand the scientific and social implications. A final total of 20 students participated in the full program along with

interviews and were asked about their experiences and impressions. The results of the interview data suggest that the program was effective at helping students understand how electrical grid components work, and also their social implications. The authors suggested that using transformational play to design and guide learning produced very effective learning opportunities for the students. The strength of the method is not only in presenting targeted material to students but allowing students to explore the implications of the content beyond its central principles. While this study adds to our understanding of the strengths of transformational play to increase motivation and engagement, it did not directly assess learning gains, and was limited to a small group of college students. The present study closed some of the gaps of this study by examining transformational play-based learning in different contexts, with different content and different age groups of learners.

Summary of the primary research on transformational play. The term "video game" is broad and encompassing (Gee, 2014), but the pedagogical value of video games has been fairly well established in the literature (Adams, 2013; Burch et al., 2014; Gee, 2014; Koster, 2013; Plass et al., 2015; Shaffer & Gee, 2012). However, the theory of transformational play is a more narrowly defined type of educational video game. It is based on situating learners within a fictional narrative where the educational content, along with the decisions and actions of the learner drive the game narrative.

Collectively, the preliminary research studies on transformational play seem to suggest that learning through games based on transformational play are more engaging and motivating than traditional types of learning (Barab, Dodge et al, 2010; Barab, Gresalfi, & Ingram-Goble, 2010; Lundblad et al., 2012). It has been demonstrated to

increase knowledge gain of participants significantly over traditional learning (Barab, Gresalfi, & Ingram-Goble, 2010; Barab et al., 2012) and even other technology based learning methods such as a 3D experience or electronic textbook (Barab et al., 2009). The authors also suggested that the game experiences helped students explore related moral, ethical and social impacts of the learned content (Barab, Dodge et al., 2010; Lundblad et al., 2012). One study also found that knowledge gain was relatively strong even after eight weeks passed (Barab, Gresalfi & Ingram-Goble, 2010). Barab, Gresalfi and Ingram-Goble found that learners who participated in transformational play-based learning were significantly less likely than traditional learning groups to be motivated by grades to participate in the learning activities.

The main limitations of the studies are experimental design weaknesses like small and homogenous samples of participants (Barab, Gresalfi, & Ingram-Goble, 2010; Barab et al., 2012). One study lacked a specified control group (Lundblad et al., 2012). And most of the studies did not specify measurement instruments for dependent variables which resulted in many of the results appearing to be subjective in nature (Barab, Dodge et al, 2010; Barab, Gresalfi, & Ingram-Goble, 2010; Barab et al., 2009).

The implication then, is for the present study to use larger more diverse samples, with strong experimental design including control and treatment groups as well as specified quantitative measurements of dependent variables. The existing research on transformational play also suggests that there are benefits of social interactions that may occur while playing educational games designed with the principles of transformational play but does not examine specific modes of play designed to foster social interactions

such as competitive or cooperative play. The present study then explores the impacts of playing transformational play-based games with these types of social structures.

Justification for the Present Study

One of the major themes of the studies in this review of the literature is that cooperation and competition can be very important tools for increasing the social interactions between players during gameplay, and also for increasing player engagement with the game content (Kapp, 2012; Reeves & Read, 2013; Rand & Nowak, 2013; Velez et al., 2014). In the previously cited research, no fewer than 51 dependent variables were examined, and there were at least 33 distinct suggestions for future research. While it is impossible to close the gap in needed research in all areas with a single study, the present research addresses many of the more commonly suggested needs for research in this area as described below.

First, one of the main weaknesses of the literature is that few studies adequately defined the type of cooperation or competition that was being implemented and examined. A few studies acknowledged this flaw directly (Nebel, Beege, Schneider, & Rey, 2016; Roy & Ferguson, 2016), yet most seemed to simply accept the vague notion that all competition and cooperation should be treated the same, regardless of differences in conceptualization and implementation. Therefore, it is of high importance that future studies follow standardized definitions of competition and cooperation. The present study examined competition that can be classified as direct (social) (Ciampa, 2014) or structured (intentional) (Brown et al., 1998), and followed the guidelines of appropriate competition as outline by Stanne et al. (1999). The present study also examined cooperation that can be defined as formally structured (Johnson et al., 1998; Kapp, 2012;

Panitz, 1999), small group (Slavin, 1980), and followed the guidelines of appropriate cooperation as outlined by Johnson and Johnson (1999) and Johnson et al. (1998).

Many of the studies examined dependent variables that were not directly related to or useful for education (Badatala, 2016; Chanel et al., 2012; Chen et al., 2012; Chou et al., 2013; DeLeeuw & Mayer, 2011; Ewoldsen et al., 2012; González-González & Blanco-Izquierdo, 2012; Goršič et al., 2017; Nebel et al., 2016; Noah et al., 2015; Novak et al., 2014; Ter Vrugte et al., 2015; Velez et al., 2016; Waddell & Peng, 2014). The present study added to the literature by examining dependent variables specifically useful for educational purposes.

The literature frequently examined the impacts of commercial video games, likely due to convenience or limited resources. Especially when examining education-related dependent variables, it is requisite that the game itself be specifically designed for educational purposes (Badatala, 2016; Peng & Hsieh, 2012; Velez et al., 2016; Waddell & Peng, 2014). In the present study, the game that was examined is called *Night of the Living Debt*, (*NLD*). While pilot tests show that students find *NLD* entertaining and enjoyable, it was designed first and foremost around its educational goals including the transformational nature of the play experience it provides. It is not sold as a commercial game, but rather is distributed via iTunes, free of charge to students, educators and members of the general public.

A significant portion of the video games examined in the research were classified by the authors as violent, while many others were classified as action/motor based, where the reaction time and motor skills were important to in-game success (Chen, 2014a; Chen & Chen, 2013; Chanel et al., 2012; Ewoldsen et al., 2012; King et al., 2012; Le Bouc &

Pessiglione, 2013; McGloin et al., 2016; Novak et al., 2014; Plass et al., 2013; Schmierbach et al., 2012; Smith & Chan, 2017; Staiano et al., 2012; Waddell & Peng, 2014). The goal of the present research was to avoid violent/questionable content as well as game mechanics that require impulse actions. While genres are not strictly defined in any of the research, *NLD* could be loosely classified as a hybrid graphic adventure/role-playing game which also meets the criteria of the theory of transformational play.

Many authors suggested applying research to a variety of domains, since content sometimes seems to influence the outcome of competitively and cooperatively played games (Cagiltay et al., 2015; Chen, 2014b; Chen & Chen, 2013; Peppler et al., 2013; Plass et al., 2013; Smith & Chan, 2017; Staiano et al., 2012; Sung & Hwang, 2013; Ter Vrugte et al., 2015). The domain of *NLD* is personal finance, more specifically the building and maintaining of credit scores. A few studies have examined the domain of personal finance in educational video games, but none have been examined in the context of cooperative and competitive play (Carlson, 2014; deCos, 2015; Jones & Chang, 2014; Nosal, 2013).

Unfortunately, many of the studies previously cited did not use effective experimental methods, including the use of control groups and equal comparisons between cooperative and competitive learning groups, which left room for errors in results and interpretations (Admiraal et al., 2011; Chanel et al., 2012; Hainey et al., 2011; Peng & Crouse, 2013; Roy & Ferguson, 2016; Schmierbach et al., 2012; Short, 2016; Smith & Chan, 2017). As previously described, this study attempted to avoid such deficiencies by implementing strong and equal experimental and control groups.

Some studies allowed for just a few minutes of playtime which may have resulted in inadequate experimental conditions (Goršič et al., 2017; Lim & Reeves, 2010; Waddell & Peng, 2014). The present study allowed for adequate playtime for the full potential educational impact to take place. Additionally, far too many studies lacked a large and diverse enough sample for adequate generalizability (Chanel et al., 2012; Ewoldsen et al., 2012; Hainey et al., 2011; Le Bouc & Pessiglione, 2013; Lim & Reeves, 2010; Novak et al., 2014; Peng & Crouse, 2013; Peppler et al., 2013; Roy & Ferguson, 2016; Trespalacios et al., 2011; Waddell & Peng, 2014). The present study sought to include a sufficiently large sample with some diversity for better generalizability. Further, a number of the studies were qualitative and exploratory in nature, paving the way for more quantitative analysis which the present study implemented (Peppler et al., 2013; Trespalacios et al., 2011).

Many of the studies used simple games with rudimentary game mechanics and media elements (Bressler & Bodzin, 2013; Chen & Chen, 2013; DeLeeuw & Mayer, 2011; DiMenichi & Tricomi, 2017; DiMenichi & Tricomi, 2017; Echeverría et al., 2011; Jong et al., 2013; King et al., 2012; Sánchez & Olivares, 2011; Yao & Yu, 2016; Yu et al., 2008). The game mechanics in *NLD* were designed around the domain content of financial credit scores using methods and principles of transformational play. The mechanics are somewhat complex and directly aid learning. The media elements are of relatively high quality particularly for an educational game. Several authors also suggested that different pedagogies and technologies should be explored (Echeverría et al., 2011; Martín-SanJosé et al., 2014; Sánchez & Olivares, 2011). Few studies used iPad

tablets as the technology platform for game delivery, and none of those games were designed using transformational play.

Dependent variables. The literature reviewed as part of the present study examined many important dependent variables. And while most of these variables are valuable and contributed to our understanding of educational video games, the present study focused on variables directly related to education. Among the most commonly cited educational variables were those related to knowledge gain (Barab et al., 2009; Barab et al, 2012; Barab, Gresalfi, & Ingram-Goble, 2010; Brom et al., 2016; Cagiltay et al., 2015; Chen & Chiu, 2016; Echeverría et al., 2012; Hummel et al., 2011; Jong et al., 2013; Lin et al., 2013; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015; Nebel, Schneider, & Rey, 2016; Plass et al., 2013; Staiano et al., 2012; Sung, & Hwang, 2013; Ter Vrugte et al., 2015; Zhang et al., 2012), learner engagement (Barab et al, 2012; Barab, Dodge et al., 2010; Barab, Gresalfi, & Ingram-Goble, 2010; Bekebrede et al., 2011; Brom et al., 2016; Chen & Chiu, 2016; Echeverría et al., 2012; Goršič et al., 2017; Hummel et al., 2011; Lim & Reeves, 2010; Loparev et al., 2014; Lundblad et al., 2012; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015; Nebel, Schneider, & Rey, 2016; Novak et al., 2014; Peng & Crouse, 2013; Peng & Hsieh, 2012; Peng & Hsieh, 2012; Peppler et al., 2013), and general attitudes (Barab et al., 2009; Barab, Dodge et al., 2010; Barab, Gresalfi, & Ingram-Goble, 2010; Brom et al., 2016; Cagiltay et al., 2015; Chen et al., 2012; Chen, 2014b; Chen & Chen, 2013; Jong et al., 2013; King et al., 2012; Lim & Reeves, 2010; Lundblad et al., 2012; Martín-SanJosé et al., 2014; Martín-SanJosé et al., 2015; Novak et al., 2014; Peng & Crouse, 2013; Plass et al., 2013; Sánchez & Olivares, 2011; Schmierbach et al., 2012; Sung, & Hwang, 2013; Yu et al., 2008). Therefore, while

there are certainly other dependent variables worthy of examination, the present study focused on performance, engagement, and attitude as representative variables of overall instructional effectiveness of the independent variable in question.

CHAPTER III

Methods

The purpose of this study was to explore the effects of competition and cooperation on learning variables among participants in a land-grant university outreach program located in the U.S. Intermountain West. The context of the study was an educational video game which teaches personal finance principles, and which was designed using the theory of transformational play. This chapter outlines the methods for collecting, analyzing and interpreting the data collected from participants. The following three research questions guided the study:

RQ_1: Is there a significant difference in performance, as measured by a researcher-created knowledge posttest, among participants in the four treatment conditions: Traditional learning control group, individual transformational play-based group, competitive transformational play-based learning, cooperative transformational play-based learning?

RQ_2: Is there a significant difference in learner engagement, as measured by an engagement posttest developed by Csikszentmihalyi and Csikszentmihalyi (1992), among participants in the four experimental conditions: Traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group?

RQ_3: Is there a significant difference in learner attitude, as measured by an adapted attitude posttest developed by Hwang and Chang (2011), among participants in the four experimental conditions: Traditional lecture control group,

individual transformational play group, competitive transformational play group, and cooperative transformational play group?

Research Design

A quasi-experimental control group posttest only design was used to answer these three research questions with the results from post-test measurements of participant knowledge, engagement levels, and attitudes. The study included one independent variable: class type. The four class types included: (a) traditional lecture control (TL), (b) individual transformational play (ITP), (c) competitive transformational play (CMTP), and (d) cooperative transformational play (COTP). The dependent variables consisted of measures of (a) knowledge performance, (b) engagement, and (c) attitude. ANOVAs and similar nonparametric analyses were used to determine the overall effect of the instructional method on the dependent variables. Table 1 provides a simple illustration of the research design.

Table 1

Research Design for the Proposed Study

Traditional Lecture Control Group (TL)	R_1	X_1	O_1
Transformational Play Group (ITP)	R_1	X_2	O_1
Competitive Transformational Play Group (CMTP)	R_1	X_3	O_1
Cooperative Transformational Play Group (COTP)	R_1	X_4	O_1

Note. X_i represents the different type of instruction that each group received. And O_1 represents the single post-test measuring knowledge, engagement, and attitude that was administered after participants experienced their assigned condition.

Materials

Night of the Living Debt (*NLD*) was developed as part of the Northwest Youth Financial Education (NYFE) initiative, which began in 2014 when University of Idaho

Extension received financial support from agricultural lenders, Northwest Farm Credit Services and CoBank, to promote youth financial education in the Pacific Northwestern States of Alaska, Idaho, Montana, Washington, and Oregon. An advisory board was immediately formed and educators from each of these states served as representatives on the board. Program priorities were identified, including the topic of credit and credit scores. NYFE program leaders began development of a program in response to this need by contracting services with the New Mexico State University Extension Learning Games Lab. Together, the group went through an instructional design process, guided by the principles of the theory of Transformational Play (See Appendix A). The game was completed and released to the public in the spring of 2016. To date it has been downloaded 23,920 times, primarily in the U.S., but with a small portion of downloads occurring in foreign countries. The game has been used by educators in the Pacific Northwest and the rest of the U.S. as well (Erickson & Hansen, 2017). The game has won several international awards at serious games conferences (Foreman, 2016; Meaningful Play, 2016). This program has been delivered to various audiences as part of an outreach and extension program. Preliminary evaluation results have shown that participants like the game and have reported knowledge gain and intended behavior change as a result of playing the game (See Appendix A). This game has not yet been used in any previously published research studies, so this study will partially serve as validation of the game itself.

Participants and Sampling

The population for this study was comprised of traditional adult audiences from a land-grant university outreach and extension program. *Night of the Living Debt* (*NLD*),

the educational program that was examined in this research, was specifically designed for high school seniors, but in pilot trials with different age groups, was found to also work well with adult audiences.

Participants in this study were included as part of the traditional outreach and extension programming offered through a land-grant institution in the intermountain west. The limitations of this type of convenience sampling method were discussed in Chapter I.

A power analysis was conducted to determine an appropriate *N* for this study (See Appendix E). A statistical power analysis is useful in determining the minimum sample size that is needed to detect an effect in research. This helps reduce the possibility that incorrect conclusions will be drawn based on an insufficient sample size in research. It also prevents the researcher from spending unnecessary resources on data collection when the additional data produces little or no marginal benefits (Cohen, 1992). In order to determine an appropriate minimum sample size, the three elements related to the research in question were identified: Effect size, significance level (Type 1 error, or probability of finding an effect that is not there), and power (Type II error, or the probability of not finding an effect that is there) (Cohen 1992).

Based on data from completed assessments from pilot study I, which compared three proposed game conditions (but without a control condition), an effect size of 0.288 was found and considered to be a medium effect size according to Cohen (1988). With this effect size, along with an alpha = .05 and power = 0.80 (Cohen, 1988), the estimated minimum sample size was approximately 120, or 40 per condition. Since the present study included a control group, with a minimum of 40 per condition, it was estimated that

a total *n* of at least 160 would be required to answer the research questions in this study. Considering natural attrition rates, it was estimated that at least 250 program participants would be needed to produce the minimum of 160 completed post-tests. The actual sample numbers, participation and attrition rates, etc., for this study are discussed in detail in Chapter IV.

Instruments

Three instruments were used in the post-test assessment to measure knowledge, engagement, and attitude. The psychometrics, or procedures for measurement, for each of these instruments are discussed individually, with a focus on the key concepts of validity and reliability of each instrument.

D1: Performance measure. A researcher-created written test comprised of 19 multiple choice questions was specifically designed as a performance measure for this research. This instrument can be found in Appendix B. The justification for using researcher-created questions is that the game itself was designed and created by the researcher along with several other colleagues. Therefore, there are no alternative existing performance assessments that would adequately align with and capture the knowledge performance related to the primary objectives of this educational program. There were three primary objectives in mind throughout the design of the game. They included: (1) understanding why a credit card can be the most effective way to build credit; (2) understanding that subprime/payday loans will always damage credit even when used responsibly; and (3) understanding that missing payments is the worst thing possible for a person's credit. Table 2 shows how each of the 19 question aligns with the three learning objectives and with levels of Bloom's Taxonomy.

The post-test questions were written specifically to align with these three primary learning objectives as well as several secondary objectives. The questions were also reviewed by five content experts and adjusted according to their feedback to ensure content validity of the instrument. Since the intervention described in this study was estimated to last one hour or less, the objectives and associated questions were not intended to produce or measure higher order thinking skills (Andersen, et al., 2001). Additionally, the performance instrument developed for this study was designed to produce quantitative data for statistical use in answering the study's research questions, thus limiting the ability for participants to demonstrate high order thinking skills as a result of program participation. Nevertheless, Table 2 includes question alignment with Bloom's revised taxonomy, showing some measurement of learner progression toward high order thinking skills from this short intervention (Anderson, Krathwohl, Airasian, Cruikshank, Mayer, Pintrich, Raths & Wittrock, 2001).

Table 2

Alignment of Questions with Objectives and Bloom's Revised Taxonomy

Question	Objective	Bloom's Revised Taxonomy
Q1	(1)	Understand
Q2	(2)	Understand
Q3	(3)	Remember
Q4	(3)	Apply
Q5	(1)	Remember
Q6	(1)	Apply
Q7	(2)	Understand
Q8	(1)	Remember
Q9	(3)	Remember
Q10	(2)	Remember
Q11	(1)	Remember
Q12	(2)	Understand
Q13	(3)	Apply
Q14	(2)	Understand
Q15	(1)	Understand
Q16	(Secondary Objective)	Apply
Q17	(2)	Understand
Q18	(Secondary Objective)	Remember
Q19	(1)	Apply

A KR-20 analysis was done to determine the reliability of the final questions on the assessment. The process began with a pilot study of 20 questions. Using data collected in this original pilot study, it was determined that several of the questions would need to be reworked to improve reliability to acceptable levels ($\alpha > .7$) (Nunnally, 1978). See Appendix F for the KR-20 results of the pilot I version of the performance post-test.

Based on the results of the first pilot test, it was determined that the questions should be reworked, and a second pilot test was conducted in order to test the reliability of these new rewritten questions. The findings of this second pilot study can be found in Appendix G. These findings indicated that, with the exclusion of one question, the

reworked assessment was sufficiently reliable ($\alpha > .763$) for the purposes of this research. Therefore, the final instrument used 19 questions to measure performance.

D2: Engagement measure. Nine previously designed and validated learning engagement scales were considered for use in this study (Bellotti, Kapralos, Lee, Moreno-Ger, & Berta, 2013; Brockmyer, Fox, Curtiss, McBroom, Burkhart & Pidruzny, 2009; Csikszentmihalyi & Csikszentmihalyi, 1992, Fu, Su, and Yu, 2009; Jackson & Marsh,1996; Jennett, Cox, Cairns, Dhoparee, Epps, Tijs, & Walton, 2008; Rheinberg, Vollmeyer & Engeser, 2003; Vollmeyer & Rheinberg, 2006; Whitton, 2007). Selection criteria included the assessment length, question simplicity, and the degree to which the assessment would need to be changed to fit the needs of the present study. Based on these criteria, the engagement scale created and validated by Csikszentmihalyi and Csikszentmihalyi (1992) and Csikszentmihalyi, Rathunde, and Whalen (1997) was the best fit. The only adjustments made to the questions in this scale were from present tense to past tense to be more congruent with the post-test administration of the scale. Therefore, a series of twelve Likert-type questions were used to measure a composite engagement score for participants in each of the study's conditions (See Appendix C). The twelve questions were meant to reflect the 12 dimensions of the flow experience (Mayers, 1978), and were rated on an 8-point scale ranging between strongly agree to strongly disagree. This instrument has been used in a number of previous studies (Brown, 2006; Delle Fave, & Massimini, 1988; Laing, Apperley, & Masoodian, 2017; Whitmire, 1991); however only Csikszentmihalyi, Rathunde, and Whalen (1997) reported any statistical analysis of reliability, finding a mean alpha index of .82, which indicates good reliability. They also used a slightly abbreviated form of the original instrument which

included only 11 questions instead of the original 12. Permission to use the instrument from the original author can be found in Appendix H. Data collected in pilot study I using this instrument was analyzed using the split half reliability method. A Cronbach's alpha of .782 was found but only after removal of several weak questions. Therefore, results indicated some weaknesses in several of the reverse coded questions (See Appendix I). It is possible that the age of the participants and the reduced time period for participation and taking the written assessment of 45 minutes (compared to an hour which was allocated for the main study) caused the participants to be less accurate in responses than might typically be found. Nevertheless, with permission from the original author (See Appendix J), synonyms were added to two of these questions for the sake of clarity (See Appendix K), and the instrument was tested again in a second pilot test using college-age participants. In this second pilot test the scale was found to have good reliability, $\alpha = .798$ (See Appendix L).

D3: Attitude measure. Five previously designed and validated attitude measurement scales were evaluated for potential use in this study (Afari, Aldridge, Fraser, & Khine, 2013; Hwang & Chang, 2011; Liang, Wu, & Tsai, 2011; Liu, Chun-Yi, & Jen-Huang, 2013; Snow, Allen, Jacovina, & McNamara, 2015). Selection criteria included the assessment length, question simplicity and applicability, and the degree to which the assessment would need to be changed to fit the needs of the present study. Based on these criteria, a seven-question attitude scale developed by Hwang and Chang (2011) was found to be the best fit. The reported alpha index of this instrument was .79, indicating acceptable reliability (Hwang & Chang, 2011). Other studies using this instrument reported acceptable Cronbach's alpha values of 0.732 (Lin, Wen, Jou & Wu,

2014) and 0.72 (Lin & Lin, 2016). It was adapted slightly to align with the content of this study and was used to measure the affective differences among participants. Permission from the original author to use this adapted instrument can be found in Appendix M.

See Table 3 for a summarized description of these three instruments and their purposes in the present study. All three measures, as well as demographic items usually collected as part of outreach and extension programs, were delivered to participants as a single post-treatment assessment.

Table 3

Description of Dependent Variables

Variable	Description	Indicator
Performance	A nineteen-question posttest, which was reviewed by content experts.	Differences between group post-test scores.
Engagement	A twelve-item questionnaire developed and validated by Csikszentmihalyi and Csikszentmihalyi (1992) to be completed as part of the post-test.	8 item Likert scale responses.
Attitude	A seven-item questionnaire developed and validated by Hwang and Chang (2011) and adapted for this lesson on credit scores.	4 item Likert scale responses.

Procedures

At the beginning of the class period, the researcher introduced the program, explained the informed consent procedures (see Appendix N), answered any questions the participants had, and then began a 40-minute period to implement the treatments as described below (See Appendix O). The previously described game, *Night of the Living Debt* (*NLD*), was used as the transformational play-based educational game in the

treatment groups of this experiment. All classes were allocated with a similar number and quality of prizes including game-branded water bottles, t-shirts, and hats, but the structure of those prizes in the reward/badge system were different as described below in each treatment group. It is important to note that, while performance indirectly played a part in the participants' overall experiences, their in-game scores were not directly part of the analysis at any point in this study. Random assignment to one of the four conditions occurred with the first treatment group and proceeded in a predetermined order for the first round of assignments. Because classes ranged significantly in size, succeeding classes were automatically assigned to the conditions with the fewest completed evaluations at that particular given point in time. This predetermined system continued until at least 40 usable samples were collected for each of the four treatment conditions.

TL group. This treatment condition was the control group. Participants received a standard slide-projected lecture designed to last approximately 40-minutes which was about the same amount of time that was required for the gameplay treatments and was designed to cover identical content in a non-game format. The lecture did not include any of the visual or other media elements from the game. Content of the slides was limited to bullet points and some stock images as visual aids. Prizes were awarded randomly by drawing names at a ratio similar to the CMTP and COPT groups.

ITP group. In the second treatment group, the game was intentionally facilitated without the social elements that were present in the cooperative and competitive experimental conditions. Each student in the class received a tablet, just like the other experimental groups; however, they were not divided into small groups. Instead, they were instructed to complete the game on their own. Socializing and interactions between

players was gently discouraged. No mention of cooperation or competition while playing the game was made by the session facilitator, and such behavior was neither encouraged nor discouraged other than an occasional gentle reminder to complete gameplay individually. Prizes were awarded randomly by drawing names at a ratio similar to the CMTP and COPT groups.

CMTP group. In the third treatment group, participants were instructed to play the game competitively. Consistent with the cooperative transformational play group, small groups of 3-4 participants were formed. The rules were clearly explained that each participant should play on his or her own tablet, and that participants should compete against each other for the highest score within their small group. Those participants who achieved the highest score within their own small group won a prize such as a game-branded water bottle, t-shirt, or hat. This competitive structure was consistent with the definition of direct competition by Ciampa (2014) in which participants must compete against other students to achieve success. This competitive structure was also consistent with Brown, Cron, and Slocum's (1998) definition of structural competition in which an intentionally created situation motivates participants to compete for mutually exclusive rewards.

The competitive structure of the game was designed and delivered according to Stanne, Johnson, and Johnson's (1999) four conditions of appropriate competition as outlined thoroughly in Chapter II. First, it was made known that prizes were available to those who achieved the highest score within each small group, but the prizes were not so extravagant as to produce a heavy emphasis on winning. Second, to a feasible extent, the researcher attempted to match up participants with similar experience levels and abilities

in playing video games. Third, the rules of the competition were kept as simple and clear as possible, with all participants getting an equal amount of playing time, and the winners being determined by simply looking at their current scores at the conclusion of the 40-minute gameplay period. Similar to the ITP condition, a brief discussion concluded the instructional portion of the program just prior to administration of the post-test. And last, the participants were encouraged to track and compare how they were doing relative to the other group members using the main game metric: the player's credit score.

COTP group. In the fourth treatment condition, participants were instructed to play the game cooperatively. According to Slavin's guidelines (1980; 1990), small groups were formed consisting of three or four participants per group. As opposed to collaborative learning which merely requires participation, cooperative learning structure requires a specific goal (Panitz, 1999). The goal of the members of each small group was to achieve an in-game level of success, which is specifically to get each group member to the "master level," i.e., achieving an in-game credit score of 720 or higher. According to guidelines of Li and Lam (2013) for structured team learning, each member of the group had his or her own tablet and was accountable for achieving the master level of success in order for the entire group to be considered successful. Group members were allowed to communicate and to actively help each other by sharing pointers and hints. According to Slavin (1990), a small reward and recognition is an appropriate small-group goal. Small game-branded items were used as prizes for those groups whose members were able to cooperate and collectively achieve the "master level" of success. Such prizes served a similar function as badges which are commonly means of recognition of achievement when using gamification in learning (Kalz, Börner, Ternier, & Specht, 2015; Tran,

Schenke, & Hickey, 2014). These prizes included game-branded water bottles, t-shirts, hats, and other similar items. The number of prizes available was similar to the other group. In other words, no matter how many groups achieved success, there were enough prizes for each group to receive one; therefore, the small groups did not have to compete against each other for a scarce resource/reward.

The cooperative structure of the game was designed and delivered according to the five guidelines of appropriate cooperation outlined by both Johnson et al. (1998) and Johnson and Johnson (1999), and described thoroughly in Chapter II. These guidelines were met through the following procedures. First, it was made clear at the beginning of the activity that success and winning a prize required that all members of the small group achieve a credit score of 720 or higher. Second, as described previously, each student was required to contribute and be successful for the small group to collectively achieve success. Third, group members were encouraged to communicate face-to-face with each other as they played and to explain any tricks or hints for success, thus encouraging promotive interaction between group members. Fourth, group members were encouraged to exhibit their own personal skills such as leadership, decision-making, communication, conflict management, etc., in the process of achieving group success. And last, group members were able to constantly monitor their collective progress through an in-game metric which reported the main character's credit score. As with the other conditions, the 40-minute gameplay period concluded with a brief discussion of the game experience and content, and concluded with a 15 minute period to complete the post-test (See Appendix P). See Table 4 for a summary of the treatments.

Table 4

Independent Variable: Treatment Groups

Treatment Groups	Description
TRA	Participants learned credit score content through a traditional lecture with slides.
ITP	Participants played a digital learning game designed to teach about credit scores.
CMTP	Participants played a digital learning game in small groups, where each member of the group competed for the highest game score (credit score).
COTP	Participants played a digital learning game in small groups where each member of the group had to achieve a minimum score in order for the group to succeed.

Data Collection

Data collection for this study took approximately two months and occurred in the winter of 2018. As described in the next chapter, 12 classes were taught over a 5-week period so that the minimum number of instruments for each condition could be collected. A classic paper and pencil written post-test was used to collect responses from participants. The post-test was administered approximately 15 minutes before the end of the hour, and included measures of knowledge, attitude, and engagement. While in-game performance may have affected participants' overall experiences, it was not a direct factor of analysis in this study.

Data Analysis

One independent variable and three dependent variables were used in this study to answer three research questions. The independent variable consisted of a credit score

lesson taught in four different ways: traditional lecture control (TRA), individual transformational play (ITP), competitive transformational play (CMTP), and cooperative transformational play (COTP). The dependent variables were performance, attitude, and engagement.

The research questions were answered from the results of Analysis of Variance (ANOVA) and nonparametric alternatives to ANOVA conducted in SPSS for each of the dependent measures. ANOVA is the statistical test that is appropriate when analyzing between group variance for evidence of differences from the population. This helped identify the importance of the dependent variables and the strength of the association between the dependent variables. As with a typical ANOVA test, if the main multivariate test was found to be significant, the next step is to examine the univariate *F* tests for each dependent variable to understand the effect of each one, and its contribution to the significance of the overall effect. The following assumptions were checked: normal distribution, linearity, homogeneity of variances, homogeneity of regression slopes.

Summary

Within this chapter can be found a description of the proposed population, sampling techniques, procedures, data collection, data analysis methods, and instrumentation for carrying out the present study. The results of this study can be found in Chapter IV.

CHAPTER IV

Results

The purpose of this quantitative study was to examine the differences between the independent variable conditions, which included four different methods of implementing an adult educational program on credit scores. Specifically, a review of literature indicated a need to delineate the educational impacts of playing transformational play-based games individually, competitively or cooperatively (Barab, Dodge, et al., 2010; Nebel, Beege, Schneider, & Rey, 2016; Roy & Ferguson, 2016). This chapter reports the results of the data collected to answer three research questions directly related to this gap in the literature. Data were collected in the winter of 2018 as part of a regular outreach program with a land-grant university in the intermountain west.

The three research questions that directed this study were:

RQ_1: Is there a significant difference in performance, as measured by a researcher-created knowledge posttest, among adult participants in the four treatment conditions: Traditional learning control group (TRA), individual transformational play-based group (ITP), competitive transformational play-based learning (CMTP), and cooperative transformational play-based (COTP) learning?

RQ_2: Is there a significant difference in learner engagement, as measured by an engagement posttest developed by Csikszentmihalyi and Csikszentmihalyi (1992), among adult participants in the four experimental conditions: traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group?

RQ_3: Is there a significant difference in learner attitude, as measured by an adapted attitude posttest developed by Hwang and Chang (2011), among adult

participants in the four experimental conditions: traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group?

Description of Sample

According to the power analysis reported previously, this study had a goal of collecting at least 40 completed assessments per condition. Based on this goal, a predetermined process of random assignment was used to determine which condition was presented to each respective group.

Participants were allowed to decline participation in the study with no adverse consequences. Twelve classes were taught, with a total of 248 participants. About 73% of these participants returned a completed post-test for a total of 180 usable post-test samples, exceeding the minimum requirements of 160 usable samples found in the power analysis discussed in Chapter III. The other 27% either declined to fill out the post-test, checked the opt-out box, or returned incomplete or otherwise unusable post-test data. Table 5 shows the associated numbers of classes, participants, and completed assessments per condition. Attrition rates between conditions ranged from 32% for the ITP condition to 24% for the TRA condition. These slight differences in attrition between conditions are not expected to significantly influence the outcome of the study but are discussed further in Chapter V.

Table 5

Attrition by Class During Data Collection Process

Condition	Participants	Returned Post-test	Opted Out	Incomplete Post-test	Completed Post-test	Running total per condition
ITP	10	6	0	0	6	6
CMTP	14	14	1	1	12	12
COTP	24	22	1	2	19	19
TRA	9	8	0	0	8	8
ITP	8	8	1	0	7	13
TRA	12	12	0	0	12	20
CMTP	30	24	2	4	18	30
ITP	22	20	2	3	15	28
COTP	40	36	3	6	27	46
TRA	45	38	4	4	30	50
ITP	20	17	2	2	13	41
CMTP	14	13	0	0	13	43

As Table 5 indicates, the ITP condition required four classes to accrue the total number of usable sample post-tests, while the CMTP and TRA conditions required three, and the COTP condition only required two. Due to the inherent heterogeneity of the groups themselves, the variance in numbers of classes is not expected to significantly influence the outcome of this study. Nevertheless, this is discussed further in Chapter V.

Some programs were held for the general public and marketed through established extension channels such as email lists, social media, and traditional media, including radio, television and newspaper press-releases. In the end, each class was demographically unique, which may make it more difficult to separate the true educational effects of the four conditions from the nature of the participants themselves. However, as previously described, random assignment was used in an effort to mitigate these effects. This potential weakness of this study is discussed further in the next chapter.

In total, 12 classes were taught in different regions of a single state in the intermountain west as part of an outreach and extension program that targeted adult participants. Programs were held in a variety of settings including university extension offices, community centers, churches, and hotel conference rooms. All groups were, in some way, associated with traditional outreach and extension target audiences including but not limited to farmers, low-income families, and Hispanic groups. It is worth noting that about 4 of the participants in the CMTP condition and 2 participants in the ITP condition required translation to Spanish in order to fully participate in the program. Fortunately, qualified translators were available to assist in program and post-test participation. Though this language barrier was found in a small portion of the overall sample, it is nevertheless a source of potential bias that must be factored into the interpretation of the results. Table 6 shows the demographics for each group. The average participant tended to be Caucasian, female, and between the ages of 31-50. There are variations in the means of the demographic variables between groups which will need to be factored in to the interpretation of results.

Table 6

Final Sample Participant Demographics by Group

	TRA (*n*=50)	ITP (*n*=41)	CMTP (*n*=43)	COTP (*n*=46)	Total (*n*=180)
Female	42%	66%	72%	48%	56%
Male	58%	34%	28%	52%	44%
18-30	30%	37%	35%	28%	32%
31-50	24%	41%	49%	35%	37%
51-65	40%	15%	12%	26%	24%
66 & older	6%	7%	5%	11%	7%
African-American	2%	5%	0%	0%	2%
Asian	0%	0%	2%	2%	1%
Caucasian	88%	78%	63%	72%	76%
Hispanic	0%	7%	35%	6%	12%
Native-American	0%	0%	0%	6%	2%
Other	10%	10%	0%	13%	8%

Descriptive statistics for performance data. The descriptive statistics for the performance instrument are presented by group in Table 7. The performance instrument was meant to measure the degree to which participants could respond to knowledge, understanding, and application questions related to the content presented as part of the experience in the assigned conditions. There were 19 multiple-choice items on the performance instrument, with one point being awarded for each correct response. Using this final sample data, the performance instrument was found to have adequate reliability (α = .721). The results of this reliability test can be found in Appendix Q. The aggregate mean for all groups was 17.4 (out of 19); the CMTP group had the lowest mean (16.58) while the TRA group had the highest mean (18.02).

Table 7

Descriptive Statistics for Performance Data by Group

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
TRA	50	18.0200	1.13371	.16033	13.00	19.00
ITP	41	17.7073	1.22971	.19205	14.00	19.00
CMTP	43	16.5814	2.77945	.42386	8.00	19.00
COTP	46	17.2174	2.48474	.36635	7.00	19.00
Total	180	17.4000	2.08640	.15551	7.00	19.00

Descriptive statistics for engagement scale. The descriptive statistics for the groups on the engagement scale are presented in Table 8. The engagement scale was meant to measure engagement from the perspective of flow experience (Csikszentmihalyi,1997; Shernoff, Csikszentmihalyi, Schneider, & Shernoff, 2014). The scale is composed of 12 questions related to various aspects of engagement and is measured on an 8-point Likert-scale, with five questions using reverse coding. A composite score was calculated for each participant based on their responses. A higher overall score represents a good experience, and a low overall score represents a bad experience. Using this sample data, the engagement instrument was found to have good reliability (α = .848). The results of this reliability test can be found in Appendix R. The aggregate mean score for all groups was 77.76 (out of 96 possible); the ITP group had the highest engagement mean (80.23), while the COTP group at the lowest engagement mean (74.26).

Table 8

Descriptive Statistics for Engagement Data by Group

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
TRA	50	78.6200	12.77097	1.80609	47.00	96.00
ITP	41	80.2317	11.79306	1.84177	52.50	96.00
CMTP	43	78.1395	13.00290	1.98292	42.00	96.00
COTP	46	74.2609	12.99177	1.91553	42.50	96.00
Total	180	77).7583	12.75209	.95048	42.00	96.00

Descriptive statistics for attitude scale. The descriptive statistics for the groups on the attitude scale are presented in Table 9. The attitude scale was meant to measure the perceived value of various aspects of the lesson (Hwang & Chang, 2011). The scale is composed of seven questions on a four-point Likert-scale. A composite score was calculated for each participant based on their responses. A higher score represents a good overall attitude, and a low score represents a poor overall attitude toward the educational experience. Using this sample data, the attitude instrument was found to have good reliability (α = .877). The results of this reliability test can be found in Appendix S. The aggregate mean for all groups was 26.85 (out of 28); the CMTP group had the highest attitude mean score (27.43), while the other three groups had means that were very similar.

Table 9

Descriptive Statistics for Attitude Data by Group

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
TRA	50	26.6800	2.15179	.30431	18.00	28.00
ITP	41	26.6341	3.49110	.54522	7.00	28.00
CMTP	43	27.4302	1.16793	.17811	23.00	28.00
COTP	46	26.6957	1.87225	.27605	21.00	28.00
Total	180	26.8528	2.30175	.17156	7.00	28.00

Research Question One

The null hypothesis for this research question was that there is no significant difference in performance, as measured by a researcher-created knowledge post-test among adult participants in the four treatment conditions: traditional learning control group (TRA), individual transformational play-based group (ITP), competitive transformational play-based learning (CMTP), cooperative transformational play-based learning (COTP).

A one-way analysis of variance (ANOVA) was the preferred method for testing this null hypothesis. When using an ANOVA, it is important to check several assumptions to ensure that the data can be properly analyzed and interpreted by this statistical tool. The study design helped address several key assumptions including independence of observation and randomness (through random assignment). Other key assumptions needed to be checked through statistical tests. These assumptions included identifying outliers, checking for homogeneity of variances, and checking for normally distributed data.

Outliers. As can be as can be seen in Appendix U, nine cases were found that could be considered outliers. According to several sources (Dixon, 1980; Duan 1997; Wilcox, 2010), a process of transforming such outliers through Winsorization is appropriate so long as fewer than approximately 5% of the total cases are being transformed. As the results found in Appendix U indicate, the new Winsorized data effectively transformed the outliers, thus satisfying this assumption.

Homogeneity of variances. Table 10 shows the results of a Levene's Test, ($F(3, 176) = 6.77$) which produced a result of $p = .000$. Therefore, the data fail to meet the

assumption of homogeneity. The next step was to implement a test called the *Welch's ANOVA* test, which does not assume equal variances. As the results in Table 11 indicate, the *Welch ANOVA* produced a value of $F(3, 176) = 6.77$, $p = .010$, signifying that there is indeed a significant difference in at least one of the four groups on the performance scores. This difference had an effect size of $\eta^2 = 0.038$, which is considered a small effect size. However, this test does not tell us which groups are actually different from each other. A Games-Howell post-hoc test was then run to determine which differences were significant. Results in Table 12 indicate that the only significant difference on the performance measure was found between the TRA and CMTP groups ($p < .05$). This means that the those in the traditional lecture (control group) ($M = 18.02$, $SD = 1.13$) had a significantly higher score than the competitive transformational play group ($M = 16.58$, $SD = 2.78$), with a medium effect size of $d = .68$. This is counter to what the literature had suggested. However, confidence in these results still depends on whether the assumption of normality of data is met.

Table 10

Levene's Test of Homogeneity

Levene Statistic	df1	df2	Sig.
6.772	3	176	.000

Table 11

Welch Test

	Statistic[a]	df1	df2	Sig.
Welch	4.014	3	93.718	.010

a. Asymptotically F distributed.

Table 12

Games-Howell Post-hoc Test

(I) Category	(J) Category	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
TRA	ITP	.33268	.24267	.521	-.3042	.9696
	CMTP	1.01674*	.30746	.008	.2064	1.8271
	COTP	.54000	.27894	.222	-.1926	1.2726
ITP	TRA	-.33268	.24267	.521	-.9696	.3042
	CMTP	.68406	.33077	.173	-.1850	1.5531
	COTP	.20732	.30443	.904	-.5908	1.0055
CMTP	TRA	-1.01674*	.30746	.008	-1.8271	-.2064
	ITP	-.68406	.33077	.173	-1.5531	.1850
	COTP	-.47674	.35822	.546	-1.4156	.4621
COTP	TRA	-.54000	.27894	.222	-1.2726	.1926
	ITP	-.20732	.30443	.904	-1.0055	.5908
	CMTP	.47674	.35822	.546	-.4621	1.4156

*. The mean difference is significant at the 0.05 level.

Normally distributed data. ANOVA is considered to be quite robust to violations of normality; however as can be seen in Appendix T, the Shapiro-Wilk statistic indicates significance (p = .000). Along with the histogram visual, skewness, and kurtosis statistics, it is clear that the data are not normally distributed. Several data transformations were tested but did not produce meaningful change in the normality of the data. While in some cases it is appropriate to accept an ANOVA test without the normality assumption being met, this could introduce significant potential limitations to the meaning of the ANOVA results.

The other possibility is to investigate the use of a non-parametric alternative to ANOVA called the Kruskal-Wallis test. Before the Kruskal-Wallis test can be used, however, a nonparametric test for homogeneity of variance must be run. This is done by

conducting an ANOVA on the absolute difference between case ranks and score means. The results of this test are in Table 13, which shows that $F(3, 176) = 2.335$, $p = .076$. Since $p > .05$, this is interpreted to mean that the data meet the assumption of sufficient homogeneity of variance to conduct the Kruskal-Wallis test.

Table 13

Nonparametric Test of Homogeneity of Variance

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	15544.608	3	5181.536	2.335	.076
Within Groups	390556.620	176	2219.072		
Total	406101.227	179			

Having met the assumption of homogeneity, a Kruskal-Wallis test was run on the performance data. Table 14 shows that $\chi^2(3) = 8.27$, $p = .041$, and is therefore significant. This means that there is a statistical difference between at least two of the four conditions. Eta squared (η^2) was calculated as .046, meaning 4.6% of the variability in group scores can be attributed to the learning conditions themselves. This is considered to be a small effect size (Murphy & Myors, 2004). An additional post-hoc test was needed to determine which groups differ from the others. The post hoc test for Kruskal-Wallis simply requires a separate Kruskal-Wallis test be run on every possible pair of conditions. With four separate conditions, this required six separate tests to be run. Table 15 shows the only pair of conditions that was found to be significant. The difference in scores between the TRA group and CMTP group had a value of $\chi^2(1) = 8.09$, $p = .004$. The eta squared (η^2) was found to be .088, which is considered a medium effect size.

Table 14

Kruskal-Wallis Test

Test Statistics[a,b]

	Total_score
Chi-Square	8.267
df	3
Asymp. Sig.	.041

a. Kruskal Wallis Test

b. Grouping Variable: Category

Table 15

Kruskal-Wallis Post-hoc Test

Test Statistics[a,b]

	Total_score
Chi-Square	8.091
df	1
Asymp. Sig.	.004

a. Kruskal Wallis Test

b. Grouping Variable: Category

Research question one summary. Research question one asked if there were any significant differences in scores on a performance post-test between participants who learned about the personal finance topic of credit scores in one of four different conditions. Since the data had outliers and violated the assumptions of homogeneity of variance and normality, a typical one-way ANOVA was not appropriate for determining statistical significance between conditions. A Welch-ANOVA was used as an alternative because it is robust to violations of homogeneity of variances. Using this statistical tool, and a Games-Howell post-hoc test, a statistically significant difference was found between the TRA group and the CMTP group with a medium practical effect size. However, the results of the Welch-ANOVA should be interpreted with caution since the

assumption of normality was not met. Due to the violation of normally distributed data, a Kruskal-Wallis test was used as a non-parametric alternative to the one-way ANOVA. This test found significance, and further post-hoc testing also revealed a significant difference between the TRA and CMTP conditions with a medium practical effect size. Given the findings, the null hypothesis was rejected because a statistically significant difference was found between the TRA and CMTP conditions on two separate statistical tests. Though statistical significance was found, it is counter to the findings of previous research: the TRA or traditional lecture (control group) actually showed significantly higher performance post-test scores (Admiraal, et al., 2011; Hainey, et al., 2011; Lim and Reeves, 2010; Peng and Crouse, 2013; Peng and Hsieh, 2012; Plass, et al., 2013; Staiano, Abraham, and Calvert, 2012). Interpretation and limitations of this finding will be discussed further in Chapter V.

Research Question Two

The null hypothesis for this research question was that there is not a significant difference in learner engagement, as measured by an engagement posttest developed by Csikszentmihalyi and Csikszentmihalyi (1992), among adult participants in the four experimental conditions: traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group.

A one-way analysis of variance (ANOVA) was the preferred method for testing this null hypothesis. When using an ANOVA, it is important to check several assumptions to ensure that the data can be properly analyzed and interpreted by this statistical tool. The study design helped address several key assumptions like

independence of observation and randomness (through random assignment). Other key assumptions needed to be checked through statistical tests. These assumptions include identifying outliers, checking for homogeneity of variances, and checking for normally distributed data.

Outliers. As can be seen in Appendix V, only two cases were found that could be considered outliers, and they do not deviate greatly from the values of the next case values that are within the normal range. Therefore, Winsorization of these outliers would not be beneficial for the purposes of this analysis.

Homogeneity of variances. Table 16 shows the results of a Levene's Test, $F(3, 176) = .44$, which produced a non-significant result of $p = .728$. Therefore, the data meet the assumptions of homogeneity for parametric tests.

Table 16

Levene's Test of Homogeneity

Levene Statistic	df1	df2	Sig.
.435	3	176	.728

Normally distributed data. ANOVA is robust to violations of normality; however, as can be seen in Appendix W, the Shapiro-Wilk statistic indicates significance (p = .000). Along with the histogram visual and skewness statistics, it is clear that the data are not normally distributed. Using a reflected square root data transformation (for negative skew) resulted in a nonsignificant p value for the Kolmogorov-Smirnov test of normality ($p = .20$). However, the Shapiro-Wilk test for normality was still significant ($p = .003$) (See Appendix W). While in some cases it is appropriate to accept an ANOVA test without the normality assumption being met, this could introduce significant potential limitations to the meaning of the ANOVA results.

The other possibility is to investigate the use the Kruskal-Wallis test as a non-parametric alternative to an ANOVA. Before the Kruskal-Wallis test can be used, however, a nonparametric test for homogeneity of variance must be run. This is done by conducting an ANOVA on the absolute difference between case ranks and score means. The results of this test are in Table 17, which shows that $F(3, 176) = .286$, $p = .836$. Since $p > .05$, this is interpreted to mean that the data meet the assumption of sufficient homogeneity of variance to conduct the Kruskal-Wallis test.

Table 17

Nonparametric Test of Homogeneity of Variance

ANOVA

abs_diff

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	607.411	3	202.470	.286	.836
Within Groups	124724.855	176	708.664		
Total	125332.267	179			

Having met the assumption of homogeneity, a Kruskal-Wallis test was run on the engagement scale data. Table 18 shows that $\chi^2(3) = 5.15$, $p = .161$, and is therefore not significant. These results indicate that the null hypothesis cannot be rejected, and no significant difference between the participants' engagement scores was found between conditions.

Table 18

Kruskal Wallis Test

Test Statistics[a,b]

	Composite_Score
Chi-Square	5.145
df	3
Asymp. Sig.	.161

a. Kruskal Wallis Test

b. Grouping Variable: Category

Research question two summary. Research question two asked if there were any significant differences in composite scores on an engagement scale between participants who learned about the personal finance topic of credit scores in one of four different conditions. The data had two outliers, but they were not extreme enough to justify Winsorization of data. The data met the assumption of homogeneity of variance but violated the assumption of normality. A Kruskal-Wallis test was used as a non-parametric alternative to the one-way ANOVA. This test did not find significant differences between any of the four groups on the composite engagement scores. No further post-hoc tests were necessary. Given the findings, the null hypothesis could not be rejected, and the inference is that the condition, or type of credit score education that the participants received, did not make a meaningful difference in participants' overall level of engagement. Further interpretation and limitations of this finding will be discussed in Chapter V.

Research Question Three

The null hypothesis for this research question was that there is no significant difference in learner attitude, as measured by an adapted attitude posttest developed by Hwang and Chang (2011), among adult participants in the four experimental conditions:

traditional lecture control group, individual transformational play group, competitive transformational play group, and cooperative transformational play group.

A one-way analysis of variance (ANOVA) was the preferred method for testing this null hypothesis if ANOVA assumptions could be met. The study design helped address several key assumptions like independence of observation and randomness (through random assignment). Other key assumptions needed to be checked through statistical tests. These assumptions include identifying outliers, checking for homogeneity of variances, and checking for normally distributed data.

Outliers. As can be seen in Appendix Y, ten cases were found that were extreme outliers. Again, according to Dixon (1980), Duan (1997) and Wilcox (2010), a process of transforming such outliers through Winsorization is appropriate so long as less than approximately five percent of the total cases are being transformed. However, even with the transformation of these extreme outliers, about nine cases remained non-transformed that may be considered less extreme outliers. Appendix Y shows the data after Winsorization.

Homogeneity of variances. Table 19 shows the results of a Levene's Test, $F(3, 176) = .82$, which produced a non-significant result of $p = .483$. Therefore, the data meet the assumptions of homogeneity for parametric tests.

Table 19

Levene's Test of Homogeneity

Levene Statistic	df1	df2	Sig.
.822	3	176	.483

Normally distributed data. ANOVA is considered to be quite robust to violations of normality; however as can be seen in Appendix X, the Shapiro-Wilk statistic

indicates significance (p = .000). As shown by the histogram visual and skewness and kurtosis statistics, the data are not normally distributed. Several data transformations were attempted but did not help in improving the normality of the data. While in some cases it is appropriate to accept an ANOVA test without the normality assumption being met, this could introduce significant potential limitations to the meaning of the ANOVA results.

The other possibility is to use the Kruskal-Wallis test as a non-parametric alternative to the ANOVA. Before the Kruskal-Wallis test can be used, however, a nonparametric test for homogeneity of variance must be run. This is done by conducting an ANOVA on the absolute difference between case ranks and score means. The results of this test are in Table 20, which shows that $F(3, 176) = 3.027$, $p = .031$. Since $p < .05$, this is interpreted to mean that the data do not meet the assumption of sufficient homogeneity of variance to reliably conduct the Kruskal-Wallis test.

Table 20

Nonparametric Test of Homogeneity of Variance

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	2581.929	3	860.643	3.027	.031
Within Groups	50034.053	176	284.284		
Total	52615.981	179			

Since the data do not completely meet all the assumptions for any one of the proposed tests for analysis of variance, a classic one-way ANOVA was run, but is interpreted with caution since it is more likely to report a false positive (Type I error). Table 21 indicates that $F(3, 176) = 1.299$, $p = .276$. Because $p > .05$, in spite of a bias toward a false positive, the null hypothesis could not be rejected. This means that there

appears to be no significant difference between participants' composite attitude scores between conditions.

Table 21

ANOVA of Conditions on Attitude

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4.644	3	1.548	1.299	.276
Within Groups	209.793	176	1.192		
Total	214.438	179			

Research question three summary. Research question three asked if there were any significant differences in composite scores on an attitude scale between participants who learned about the personal finance topic of credit scores in four different ways, or conditions. The data reduced the effects of ten extreme outliers through a process called Winsorization. However other, non-extreme outliers remained. For a parametric ANOVA test, the data met the assumption of homogeneity of variance but not for normality. For the nonparametric Kruskal-Wallis, test the data did not meet the assumption of homogeneity of variance. Since ANOVA is robust to violations of normality, a classic one-way ANOVA was used to examine the attitude scores between conditions with the acceptance of an increased risk of a Type I error, or false positive. In spite of a bias toward finding significance, the results were not significant, meaning that the null hypothesis could not be rejected. No further post-hoc tests were necessary. The inference is that the condition, or type of credit score education that the participants received, did not make a meaningful difference in participants' overall attitude. Further interpretation and limitations of this finding will be discussed in Chapter V.

Summary of Results

The purpose of this study was to determine if the type of credit score education participants received might have an influence on educational variables of performance, engagement, and attitude. An analysis of the data indicate that the type of education received did not significantly impact participants' engagement or attitude. A significant difference was found in the performance variable, however only the traditional lecture (TRA, control) group and the competitive transformational play (CMTP) group were significantly different. Counter to suggestions from the literature, this difference showed that the traditional lecture group performed significantly better on the performance post-test that the competitive transformational play group. Limitations and implications of this study's findings are presented in the next chapter.

Chapter V

Conclusions

The purpose of this study was to explore the differences in performance, engagement, and attitude among adult participants who learned about the personal finance topic of credit scores taught using one of four different conditions. Those in the three experimental groups played a tablet-based video game called *Night of the Living Debt,* which was designed using the ADDIE model and was informed by a framework of transformational play. These groups played the game either individually, competitively in small groups, or cooperatively in small groups. The last group served as a control and received a traditional slideshow with lecture on identical content.

Discussion of Results

This study attempted to address several gaps found in the literature. First, prior research seemed to indicate that implementing cooperation and competition can be useful for learning outcomes, particularly in learning through gameplay. However, few research studies have adequately defined competition and cooperation in educational settings. From the literature, thorough and distinct definitions of appropriate competition (Ciampa, 2014; Brown et al., 1998, Stanne et al., 1999) and cooperation (Johnson et al., 1998; Johnson, 1990; Kapp, 2012; Panitz, 1999; Slavin, 1980) in education were derived and used for the purposes of this study. This definition served as the framework for building the competitive and cooperative experimental conditions that are spelled out in detail in Appendix O. These class procedures were successfully implemented in the study to create conditions that are clearly defined and replicable.

The literature suggested other gaps that were addressed in the implementation of this study. Prior research suggested more exploration on the educational outcomes of noncommercial (Badatala, 2016; Peng & Hsieh, 2012), nonviolent (Pessiglione, 2013; McGloin et al., 2016), and non-motor-based (Plass et al., 2013; Waddell & Peng, 2014) games. It also encouraged exploration of additional domains, like personal finance (Richards, Williams, Smith & Thyer, 2105). A lack of effective experimental methods and use of controls groups was pervasive in prior literature (Roy & Ferguson, 2016; Schmierbach et al., 2012). Small sample sizes and lack of adequate playtime were also issues in prior literature (Goršič et al., 2017; Ewoldsen et al., 2012). Many of the games used in the literature might also be considered rudimentary (Echeverría et al., 2011; Martín-SanJosé et al., 2014). The present research sought to help close these gaps to some degree through a dynamic, noncommercial, nonviolent, educational game to teach a lesson in the domain of personal finance, using experimental methods with adequate sample size, playtime, and heterogeneity among participants. And while there were many potential dependent variables related to education, the literature seemed to indicate that knowledge gain (performance), engagement, and attitude would collectively create a strong composite variable to represent educational outcomes (Brom et al., 2016; Cagiltay et al., 2015; Hummel et al., 2011; Lim & Reeves, 2010; Schmierbach et al., 2012; Sung, & Hwang, 2013). Accordingly, scores of participants' performance, engagement, and attitudes were used in this study as representations of overall learning.

The classes were taught and data analyzed according to the procedures described in previous chapters. The findings of these analyses indicated that, contrary to some previous research findings (Chen & Chiu, 2016; Hainey, et. al, 2011; Jong, et. al, 2013;

Sung & Hwang, 2013), statistically significant differences between groups did not exist for the dependent variables of engagement or attitude. However, for the performance variable, a statistically significant difference was found, though not in the direction that might be expected according to several previous studies (Admiraal, et al., 2011; Hainey, et al., 2011; Lim and Reeves, 2010; Peng and Crouse, 2013; Peng and Hsieh, 2012; Plass, et al., 2013; Staiano, Abraham, and Calvert, 2012). The traditional lecture (control) group had significantly higher scores on the performance post-test than did the competitive play group. Though a fair amount of prior literature supports competition in educational video games, there are also studies that examined competitive gameplay which produced mixed and ambiguous results (Bernstein et al., 2015; DeLeeuw & Mayer, 2011; Chen, 2014a; Chen, 2014b, DiMenichi & Tricomi, 2015; Nebel, Schneider, & Rey, 2016). In many of the studies with mixed results, it was clear that one or more of Stanne et al.'s (1999) four conditions for appropriate competition were violated (Bernstein et al., 2015; DeLeeuw & Mayer, 2011), thus leading to potentially false negatives due to poorly structured and weakly implemented forms of competition. Therefore, it was expected that the present study, with a clearly and thoroughly defined framework for implementing competition, would find results in favor of learning in the context of competitive game-play. But again, the results indicated otherwise.

In some cases, having no significant or counterintuitive findings can be just as telling as a study that finds expected differences. From some perspectives, the lack of significant differences between educational approaches can be a positive thing because it indicates that a variety of educational methods can be effective, not just one. This provides a typical educator with an array of potential educational options instead of being

pigeonholed into only one. Nevertheless, in this case, it may mean that that something unanticipated or misunderstood has influenced the outcome of the study. The next section explores some factors to consider, including the study's limitations and possible interpretations of the findings.

Interpretations

There are a number of possible interpretations of the results found in this study. First, it's possible that a combination of limitations such as attrition, differences in participant demographics like gender and ethnicity, language barriers, novelty/disruption effects, or measurement shortcomings, combined to effectively cancel out the significance in the results that might correlate with findings from prior literature. The researcher speculates that these limitations had some influence but are not the sole explanation for the findings.

Another possible influence on the outcome was the expertise and experience of the researcher. Through years of teaching about credit scores, the researcher has become somewhat of a content expert in this area. This may have unduly influenced the results in favor of the control group. For example, the researcher noted, while delivering the four conditions in various randomly assigned groups, that those in the traditional control group took advantage of the opportunity to engage the researcher with questions and answers. Of course, this caused slight deviations in the prepared material for the slideshow; but given the researcher's 11 years of experience teaching hundreds of outreach and extension courses, he was able to effectively navigate the questions while staying on topic with the prepared material. At the same time, the participants in the three experimental conditions were usually very focused on the game itself and did not take the

opportunity to ask the researcher nearly as many questions, either about the content itself or the game. They preferred learning by doing. The implication is that if the classes had all been taught by a non-expert or novice instructor, the differences between groups may have been more pronounced and possibly more in favor of the gaming conditions.

While this possibility might partially explain a significant result favoring the traditional lecture control group over the competitive play group, this explanation may also partially explain the non-significance among the groups on the measures of performance, engagement, and attitude. In other words, being able to freely interact with a content expert and experienced lecturer on a topic of interest might prove to be very informative, engaging, and promote good attitudes; but this also means that, with one noted exception, the gameplay groups were able to keep pace on all three measures with what might be considered a top-line approach (Manero, Torrente, Serrano, Martínez-Ortiz, & Fernández-Manjón, 2015).

Another interpretation to consider is that, just as some of the prior literature has indicated, learning through competitive game-play is complex and not well understood. One of the assumptions of the present study is that, by clearly and thoroughly defining appropriate framework for gameplay, results would likewise be clear and unambiguous. However, this was not the case; though one might assume that the results mean that competitive gameplay is simply not effective, another interpretation might be that factors not clearly identified by the present study may have influenced the outcome. This may include factors such as learner preferences (Goršič, Cikajlo, and Novak, 2017; Novak, Nagle, Keller, and Riener, 2014), gender dynamics (DiMenichi and Tricomi, 2015), age, ethnicity, or something else entirely.

Last, it should be noted that the lack of significant differences between educational conditions on most of the measures in this study may be interpreted by some educators as a positive outcome since it supports choice among educational methods based on context or preference. In short, this study has confirmed that when choosing to use educational video games, a variety of methods of implementation are equally valid. If an educator has an aversion or preference regarding any of the social structures outlined in this study, that educator may safely proceed according to those aversions or preferences without sacrificing educational outcomes, at least on the dependent measures considered in this study.

Implications for Instructional Design and Education

Using the findings in the study educators who wish to teach an effective lesson on credit scores to adults could potentially teach that lesson in any of these four conditions without significantly sacrificing educational outcomes. According to the results, educators may need to be cautious when choosing to teach this or other lessons using competitive gameplay methods. Due to the apparent complexity of competitive game-play, additional considerations about audience demographics, preferences, and possibly other factors should be made when specifically measuring performance. Educators can also expect that using the instructional design theory of transformational play to inform educational strategies will likely not decrease learning outcomes.

Instructional designers who wish to design or build additional instructional materials similar to those described in this study can do so with relative confidence in both traditional and game-play methods. Adding the social element of cooperation to gameplay is also a relatively safe instructional design strategy. However, adding the

social element of competition to educational gameplay materials cannot be done at this time without introducing some potential risk of negative influence in learning outcomes, at least on performance.

The specific framework that informed the design of the game was transformational play. This is a relatively under-researched instructional framework for educational video games based on a broader theory of the same name. The basic elements of the theory promote learning through first-person navigation, using contextually legitimate content for the player to advance in the game, and providing an immersive narrative to drive the game mechanics. This framework informed the design of the game used in this research study, and a fourth potential element of social interaction through competition or cooperation was investigated. The results of this study suggest that use of the three main elements of transformational play pose little threat of decreases in learning outcomes. However, adding a fourth element of competition vs. cooperation may introduce some threat of decreases in learning outcomes, specifically in using competitive social gameplay mechanics. The implications for instructional designers is that transformational play is a valid framework for informing educational video game design. While games designed with the framework may not necessarily be superior to other traditional methods of education, they provide a suitable alternative to traditional instructional methods. But, according to the results of this study, using transformational-play based games in a competitive context is not necessarily recommended.

Recommendations for Future Research

Like most studies, a variety of potential limitations are present in this study. Steps were taken to reduce as many of these limitations as possible. For example, random

assignment of classes to condition was used to ensure independence of observations and chance distribution of group characteristics. However random selection was not feasible in this study which causes a potential for selection bias. Some of the groups that participated in the study were part of a publicly advertised community class, while other groups participated as part of their membership in an existing community group. This may have had undue influence on the final results such as the difference found between the control group and the competitive play group. For example, a quick assessment of Table 6 found in Chapter IV shows that participant demographics between groups varied by gender, age, and ethnicity. It is possible that inherent differences on such descriptive variables or other non-measured differences between groups had some level of influence on the outcomes. For example, four members of the competitive group needed translation assistance to participate in the program. It is certainly possible that this limited these participants' abilities to successfully play the game or complete the post-test which could have partially contributed to the outcome of this study. It is recommended that future researchers investigate the same or similar variables with similar materials but with more homogenous populations or by controlling for group differences through a pre-test.

The overall number of classes was different ranging from only two for the cooperative play group to four for the individual play group. It is possible that this made a difference in the overall heterogeneity of participant characteristics found within and between groups. Future research could consider using sample classes of relatively similar size and participant demographics.

The instruments used in this study showed some level of reliability and validity from a combination of research and pilot tests. However, the engagement and attitude

instruments were chosen by the researcher and may have ultimately delivered different results than other instruments that could have been used to measure these dependent variables. Additionally, the performance instrument was developed by the researcher for this specific study, and while the last iteration of the instrument was found to be reliable and possessed face validity, further iterations and validity testing of the instrument with this game are needed. Future research should replicate this study using different instruments to measure the same dependent variables to ensure reliability and validity.

As Table 6 indicates in chapter III, a majority of participants in each group were aged 30 or older and fell outside the target age parameters the designers had in mind while designing the game. It is possible that these adult audiences already possessed some of this content knowledge due to previous learning or life experience. It is also possible that adult audiences do not respond as well to computer-based learning games as youth participants. Certainly, future studies need to examine the same or similar conditions among young adults and youth audiences.

The population of this sample was limited to traditional adult audiences of a land-grant university outreach and extension program. Therefore, these results cannot be generalized beyond that population. Even within this population, results cannot necessarily be uniformly generalized since a disproportionate number of classes were taught in the region nearest the researcher due to convenience. Future research should replicate this study using other populations of adult audiences with different selection criteria.

Night of the Living Debt served as an example game that used a general ADDIE instructional design model, and which was informed by the theory of transformational

play. Other games should be developed using both similar and different instructional design model and theory combinations. It is also recommended that further investigation of the transformational play framework be undertaken to understand the subtle differences this approach will make on games of different genres, contexts, and domains. Of course, *Night of the Living Debt* itself still needs further assessment. Another recommendation includes using different instructors and longer or repeated game sessions. Other variables related to education may also be valuable to assess. Motivation, for example, was represented in this study by assessing learner engagement. However, learning motivation is a complex variable and could be represented by other factors such as effort, self-efficacy, anxiety, or goals. Therefore, a suggestion for further research is to examine these additional aspects of motivation in relation to competitive and cooperative learning in educational video games, and to consider other variables that may help represent overall learning outcomes.

Future research should follow the strict definitions of competitive and cooperative learning outlined in the present study. Merely calling a social interaction "competitive" or "cooperative" does not inherently make it effective, or replicable in other research. Fortunately, the research for standardizing the use of cooperation and competition in educational settings already exists and is relatively easy to replicate.

Conclusions

The purpose of this study was to identify the influence of the social elements of cooperation and competition on learner performance, engagement, and attitude in the context of an experiential financial literacy video game which was designed using the theory of transformational play. The results indicated that the social elements of

cooperation and competition did not have a significant effect on the dependent variables when compared to playing the game individually or by learning the same content through a traditional lecture and slideshow. The one exception was that the participants in the traditional lecture group scored significantly higher on performance than the participants in the competitive play group.

There are several possible explanations for this significant finding, as well as for the findings of no significance between the other groups. The most plausible explanation involves a combination of factors. First, there was notable heterogeneity in the group demographics which were partially mitigated through random assignment of groups, but group composition was ultimately outside the control of the experiment. For example, among those in the competitive group were about a few individuals who needed the course and assessment translated into Spanish from English. Such a language barrier, or other similar preexisting differences, may have contributed to lower performance scores for that group. Also, the instructor could be considered a content expert in the topic being covered and is also an experienced educator, which may have led to a relatively equal outcome for all learning experiences regardless of social method used. And finally, it may be the case that using competition in educational gameplay is simply too complex to assess with these three separate dependent measures. An important benefit to this study is that the lack of significance between conditions on all measures but one affords educators some confidence in choosing among these different instructional methods without sacrificing educational outcomes.

This study is important because it helped define standards for future research on competitive and cooperative learning. For example, much of the previous literature

indicated that any type of cooperative and competitive educational conditions might do, possibly leading to ill-defined conditions and inaccurate interpretations of the results. Perhaps it is precisely because the present study defined competitive and cooperative education so thoroughly that differences were not so pronounced or significant. Much of the previous research also supposed that cooperative and competitive educational contexts are inherently superior to alternative approaches; however, the findings of the present study indicate that success using these methods is conditional on things like participant characteristics, participant preferences, and lecturer dynamics. The research reported here also illuminated that, while the full value of educational video games has yet to be determined, further research should examine similar conditions with more homogenous samples, and perhaps verified through the use of a pre-test. Future research should also examine social game-play conditions apart from a traditional lecture control group, since this method is already accepted as effective for learning. And an individual play condition could also be excluded so that the differences between the social-learning conditions of cooperative and competitive play might be easier to delineate.

Further research is needed on the theory of transformational play, on learning personal finance topics through educational video games, and on social elements of competition and cooperation in learning. However, this study has suggested parameters and appropriate standards of such future research.

References

Adams, E. (2014). *Fundamentals of game design*. San Francisco: Pearson Education.

Admiraal, W., Huizenga, J., Akkerman, S., & Ten Dam, G. (2011). The concept of flow in collaborative game-based learning. *Computers in Human Behavior*, *27*(3), 1185-1194.

Afari, E., Aldridge, J. M., Fraser, B. J., & Khine, M. S. (2013). Students' perceptions of the learning environment and attitudes in game-based mathematics classrooms. *Learning Environments Research, 16*(1), 131-150.

Anderson, G., & Hilton, S. (2015). Increase team cohesion by playing cooperative video games. *CrossTalk, 33*.

Anderson, L. W., Krathwohl, D. R., Airasian, P., Cruikshank, K., Mayer, R., Pintrich, P., Raths, J., & Wittrock, M. (2001). A taxonomy for learning, teaching and assessing: A revision of Bloom's taxonomy. *New York. Longman Publishing.*

Attle, S., & Baker, B. (2007). Cooperative learning in a competitive environment: Classroom applications. *International Journal of Teaching and Learning in Higher Education, 19*(1), 77-83.

Badatala, A., Leddo, J., Islam, A., Patel, K., & Surapaneni, P. (2016). The effects of playing cooperative and competitive video games on teamwork and team performance. *International Journal of Humanities and Social Science Research, 2*(12), 24-28.

Baek, Y., & Touati, A. (2017). Exploring how individual traits influence enjoyment in a mobile learning game. *Computers in Human Behavior, 69*, 347-357. doi:10.1016/j.chb.2016.12.053

Bailey, C. (2016). Free the sheep: Improvised song and performance in and around a Minecraft community. *Literacy, 50*(2), 62-71. doi:10.1111/lit.12076

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

Barab, S. A., & Duffy, T. (2000). From practice fields to communities of practice. In D. Jonassen & S. Land (Eds.), *Theoretical Foundations of Learning Environments,* (pp. 29-65). New York, NY: Routledge.

Barab, S. A., Gresalfi, M. S., & Ingram-Goble, A. (2010). Transformational play: Using games to position person, content, and context. *Educational Researcher, 39*(7), 525-536.

Barab, S., Pettyjohn, P., Gresalfi, M., Volk, C., & Solomou, M. (2012). Game-based curriculum and transformational play: Designing to meaningfully positioning person, content, and context. *Computers & Education, 58*(1), 518-533.

Barab, S., Scott, B., Siyahhan, S., Goldstone, R., Ingram-Goble, A., Zuiker, S., & Warren, S. (2009). Transformational play as a curricular scaffold: Using videogames to support science education. *Journal of Science Education & Technology, 18*(4), 305-320.

Beale, I. L., Kato, P. M., Marin-Bowling, V. M., Guthrie, N., & Cole, S. W. (2007). Improvement in cancer-related knowledge following use of a psychoeducational video game for adolescents and young adults with cancer. *Journal of Adolescent Health*, *41*(3), 263-270.

Beckem, J. M., & Watkins, M. (2012). Bringing life to learning: Immersive experiential learning simulations for online and blended courses. *Journal of Asynchronous Learning Networks*, *16*(5), 61-70.

Becker, K. (2011). The magic bullet: A tool for assessing and evaluating learning potential in games. *International Journal of Game-Based Learning (IJGBL)*, *1*(1), 19-31.

Bekebrede, G., Warmelink, H. J. G., & Mayer, I. S. (2011). Reviewing the need for gaming in education to accommodate the Net generation. *Computers & Education, 57*(2), 1521-1529.

Bellotti, F., Kapralos, B., Lee, K., Moreno-Ger, P., & Berta, R. (2013). Assessment in and of serious games: An overview. *Advances in Human-Computer Interaction, 2013*, 1.

Bernstein, E., Gibbone, A., & Rukavina, P. (2015). Task design and skill level perceptions of middle school students toward competition in dance-related active gaming. *Physical Educator*, *72*(5), 99-122.

Bigelow, R. (1975). The role of competition and cooperation in human evolution. In M. A. Nettleship & D. Givens (Eds.) *War: Its causes and correlates*, (pp. 235-261). Paris: Mouton Publishers.

Bracht, G. H., & Glass, G. V. (1968). The external validity of experiments. *American Educational Research Journal*, *5*(4), 437-474.

Bressler, D., & Bodzin, A. (2013). A mixed methods assessment of students' flow experiences during a mobile augmented reality science game. *Journal of Computer Assisted Learning, 29*(6), 505-517. doi:10.1111/jcal.12008

Breuer, J. S., & Bente, G. (2010). Why so serious? On the relation of serious games and learning. *Eludamos. Journal for Computer Game Culture*, *4*(1), 7-24.

Brockmyer, J. H., Fox, C. M., Curtiss, K. A., McBroom, E., Burkhart, K. M., & Pidruzny, J. N. (2009). The development of the Game Engagement Questionnaire: A measure of engagement in video game-playing. *Journal of Experimental Social Psychology, 45*(4), 624-634.

Brom, C., Šisler, V., Slussareff, M., Selmbacherová, T., & Hlávka, Z. (2016). You like it, you learn it: Affectivity and learning in competitive social role play gaming. *International Journal of Computer-Supported Collaborative Learning, 11*(3), 313-348.

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

Brown, S. R. (2006). *Religious orientation and flow* (Thesis). Eastern Michigan University, Ypsilanti, Michigan.

Brown, S. P., Cron, W. L., & Slocum Jr, J. W. (1998). Effects of trait competitiveness and perceived intraorganizational competition on salesperson goal setting and performance. *The Journal of Marketing 62*(4), 88-98.

Bruner, J. (1960). *The process of education*. Cambridge, MA: Harvard University Press.

Burton, B. G., & Martin, B. N. (2010). Learning in 3D virtual environments: Collaboration and knowledge spirals. *Journal of Educational Computing Research, 43*(2), 259-273.

Burch, G. F., Batchelor, J. H., Heller, N. A., Shaw, J., Kendall, W., & Turner, B. (2014). Experiential learning-What do we know? A meta-analysis of 40 years of research. *Developments in Business Simulation and Experiential Learning, 41,* 279-283.

Cagiltay, N. E., Ozcelik, E., & Ozcelik, N. S. (2015). The effect of competition on learning in games. *Computers & Education, 87*, 35-41.

Campbell, J. K. (1965). *The children's crusader: Colonel Francis W. Parker* (Doctoral dissertation). Teachers College, Columbia University.

Campbell, D. T., & Stanley, J. C. (1963). Experimental designs for research on teaching. *Handbook of research on teaching*, 171-246.

Carlson, K. (2014). Financial Forest: A Smart Phone App (Doctoral dissertation). University of Central Florida Orlando, Florida.

Chanel, G., Kivikangas, J. M., & Ravaja, N. (2012). Physiological compliance for social gaming analysis: Cooperative versus competitive play. *Interacting with Computers, 24*(4), 306-316.

Chen, Z. H. (2014). Exploring students' behaviors in a competition-driven educational game. *Computers in Human Behavior, 35*, 68-74.

Chen, Z. H. (2014). Learning preferences and motivation of different ability students for social-competition or self-competition. *Educational Technology & Society, 17*(1), 283-293.

Chen, Z. H., & Chen, S. Y. (2013). A surrogate competition approach to enhancing game-based learning. *ACM Transactions on Computer-Human Interaction (TOCHI), 20*(6), 35.

Chen, C. H., & Chiu, C. H. (2016). Employing intergroup competition in multitouch design-based learning to foster student engagement, learning achievement, and creativity. *Computers & Education, 103*, 99-113.

Chen, Z. H., Chou, C. Y., Biswas, G., & Chan, T. W. (2012). Substitutive competition: Virtual pets as competitive buffers to alleviate possible negative influence on pupils. *British Journal of Educational Technology*, *43*(2), 247-258.

Cheng, Y. C., & Ku, H. Y. (2009). An investigation of the effects of reciprocal peer tutoring. *Computers in Human Behavior, 25*, 40–49.

Chevlen, E. M. (1998). Discovering the Talmud. *First Things: A Monthly Journal of Religion & Public Life,* (85), 40-44.

Chittaro, L., & Buttussi, F. (2015). Assessing knowledge retention of an immersive serious game vs. a traditional education method in aviation safety. *IEEE Transactions on Visualization and Computer Graphics*, *21*(4), 529-538.

Chou, C. Y., Lu, S. P., & Chen, Z. H. (2013). Evenly matched competitive strategies: dynamic difficulty adaptation in a game-based learning system. *Research & Practice in Technology Enhanced Learning, 8*(2).

Ciampa, K. (2014). Learning in a mobile age: an investigation of student motivation. *Journal of Computer Assisted Learning, 30*(1), 82-96.

Cohen, J. (1988). *Statistical power analysis for the behavioral sciences* (2nd ed.). Hilsdale. NJ: Lawrence Earlbaum Associates.

Cohen, J. (1992). A power primer. *Psychological Bulletin*, *112*(1), 155.

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

Csikszentmihalyi, M. (1997). *The masterminds series. Finding flow: The psychology of engagement with everyday life.* New York, NY, US: Basic Books.

Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (Eds.). (1992). *Optimal experience: Psychological studies of flow in consciousness*. Cambridge University press.

Cubberley, E. P. (1934). *Public education in the United States* (Rev. ed). Boston: Houghton Mifflin.

Csikszentmihalyi, M., Rathunde, K., & Whalen, S. (1997). *Talented teenagers: The roots of success and failure.* Cambridge University Press.

D'Arcy, C. & D'Arcy, J. (2012). Weekly experiential exercise. *The Empty Chair, 1*, 11. Retrieved from: http://www.theemptychair.com/issue1.pdf

Dawley, L., & Dede, C. (2014). Situated learning in virtual worlds and immersive simulations. In J. M. Spector, M. D. Merrill, J. Elen, M. J. Bishop (Eds.), *Handbook of research on educational communications and technology* (4th ed.) (pp. 723-734). New York, NY: Springer.

deCos, L. (2015). *Opportunity for banks to utilize gamification as a tool to promote financial education to children* (Thesis). Turku University of Applied Sciences.

De Simone, J. J. (2014). The possible prosocial and antisocial effects of playing video games frequently. *Journal of Communications Research, 6*(2), 79-94.

Delle Fave, A., & Massimini, F. (1988). Modernization and the changing contexts of flow in work and leisure. In Csikszentmihalyi, M. & Csikszentmihalyi, I.S. (eds.), *Optimal experience: Psychological studies of flow in consciousness* (pp. 288-306). Cambridge University Press.

DeLeeuw, K. E., & Mayer, R. E. (2011). Cognitive consequences of making computer-based learning activities more game-like. *Computers in Human Behavior*, *27*(5).

Deutsch, M. (1949). An experimental study of the effects of co-operation and competition upon group process. *Human Relations*, *2*(3), 199-231.

Deutsch, M. (1962). Cooperation and trust: Some theoretical notes. *Nebraska symposium on motivation*, 275-320. Lincoln: Nebraska University Press.

Dewey, J. (1928). Progressive education and the science of education. In R. D. Archambault (ed.), *John Dewey on education*. New York: The Modern Library.

Dewey, J. (1938). *Experience and education.* New York, NY: Collier MacMillan.

DiMenichi, B. C., & Tricomi, E. (2015). The power of competition: Effects of social motivation on attention, sustained physical effort, and learning. *Frontiers in Psychology*, *6*, 1282.

Dixon, W. J. (1980). Efficient analysis of experimental observations. *Annual review of pharmacology and toxicology*, *20*(1), 441-462.

Duan, B. (1997). The robustness of trimming and Winsorization when the population distribution is skewed (Unpublished doctoral dissertation). Tulane University.

Echeverría, A., Améstica, M., Gil, F., Nussbaum, M., Barrios, E., & Leclerc, S. (2012). Exploring different technological platforms for supporting co-located collaborative games in the classroom. *Computers in Human Behavior, 28*(4), 1170-1177.

Echeverría, A., García-Campo, C., Nussbaum, M., Gil, F., Villalta, M., Améstica, M., & Echeverría, S. (2011). A framework for the design and integration of collaborative

classroom games. *Computers & Education, 57*(1), 1127-1136. doi:10.1016/j.compedu.2010.12.010

Engerman, J. A., MacAllan, M., & Carr-Chellman, A. A. (2018). Games for boys: a qualitative study of experiences with commercial off the shelf gaming. *Educational Technology Research and Development, (66)*2, 313-339.

Ewoldsen, D. R., Eno, C. A., Okdie, B. M., Velez, J. A., Guadagno, R. E., & DeCoster, J. (2012). Effect of playing violent video games cooperatively or competitively on subsequent cooperative behavior. *Cyberpsychology, Behavior, and Social Networking, 15*(5), 277-280.

Ferguson, W., Bareiss, R., Birnbaum, L., & Osgood, R. (1992). ASK systems: An approach to the realization of story-based teachers. *Journal of the Learning Sciences, 2*(1), 95.

Freeman, R. D. (1969). Adam Smith, education and laissez-faire. *History of Political Economy*, *1*(1), 173-186.

Fu, F. L., Su, R. C., & Yu, S. C. (2009). EGameFlow: A scale to measure learners' enjoyment of e-learning games. *Computers & Education*, *52*(1), 101-112.

Gadanidis, G., & Hoogland, C. (2003). The aesthetic in mathematics as story. *Canadian Journal of Science, Mathematics & Technology Education, 3*(4), 487-498.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy.* New York, NY: St. Martin's Press.

Gee, J. P. (2012) The old and the new in the new digital literacies. *The Educational Forum, 76*(4), 418-420.

Gee, J. P. (2014). *Unified Discourse Analysis: Language, Reality, Virtual Worlds and Video Games.* London: Routledge.

Gee, J. P. (2015). Accountable talk and learning in popular culture: The game/affinity paradigm. In L. B. Resnick, C. S. Asterhan, & S. N. Clarke (Eds.), *Socializing Intelligence through Academic Talk and Dialogue* (pp. 197-204). Washington, DC: AERA.

González-González, C., & Blanco-Izquierdo, F. (2012). Designing social videogames for educational uses. *Computers & Education, 58*(1), 250-262. doi:10.1016/j.compedu.2011.08.014

González-González, C., Toledo-Delgado, P., Collazos-Ordoñez, C., & González-Sánchez, J. L. (2014). Design and analysis of collaborative interactions in social educational videogames. *Computers in Human Behavior, 31*, 602-611. doi:10.1016/j.chb.2013.06.039

Goršič, M., Cikajlo, I., & Novak, D. (2017). Competitive and cooperative arm rehabilitation games played by a patient and unimpaired person: Effects on motivation and exercise intensity. *Journal of Neuroengineering and Rehabilitation*, *14*(1), 23.

Granic, I., Lobel, A., & Engels, R. E. (2014). The benefits of playing video games. *American Psychologist, 69*(1), 66-78. doi:10.1037/a0034857

Greitemeyer, T. (2013). Playing violent video games increases intergroup bias. *Personality and Social Psychology Bulletin, 40*, 70-78.

Greitemeyer, T., & Cox, C. (2013). There's no 'I' in team: Effects of cooperative video games on cooperative behavior. *European Journal of Social Psychology, 43*(3), 224-228.

Greitemeyer, T., Traut-Mattausch, E., & Osswald, S. (2012). How to ameliorate negative effects of violent video games on cooperation: Play it cooperatively in a team. *Computers in Human Behavior, 28*(4), 1465-1470.

Hainey, T., Connolly, T., Stansfield, M., & Boyle, E. (2011). The differences in motivations of online game players and offline game players: A combined analysis of three studies at higher education level. *Computers & Education, 57*(4), 2197-2211. doi:10.1016/j.compedu.2011.06.001

Hummel, H. G., Van Houcke, J., Nadolski, R. J., Van der Hiele, T., Kurvers, H., & Löhr, A. (2011). Scripted collaboration in serious gaming for complex learning: Effects of multiple perspectives when acquiring water management skills. *British Journal of Educational Technology, 42*(6), 1029-1041.

Hwang, G. J., & Chang, H. F. (2011). A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students. *Computers & Education*, *56*(4), 1023-1031.

Iqbal, A., Kankaanranta, M., & Neittaanmäki, P. (2010). Engaging learners through virtual worlds. *Procedia-Social and Behavioral Sciences, 2*(2), 3198-3205.

Jackson, S. A., & Marsh, H. W. (1996). Development and validation of a scale to measure optimal experience: The Flow State Scale. *Journal of Sport and Exercise Psychology, 18*, 17-35.

Jennett, C., Cox, A. L., Cairns, P., Dhoparee, S., Epps, A., Tijs, T., & Walton, A. (2008). Measuring and defining the experience of immersion in games. *International Journal of Human-Computer Studies, 66*(9), 641-661.

Jin, Y., & Li, J. (2017). When newbies and veterans play together: The effect of video game content, context and experience on cooperation. *Computers in Human Behavior, 68*, 556-563. doi:10.1016/j.chb.2016.11.059

Johnson, D., & Johnson, R. (1985). Motivational processes in cooperative, competitive, and individualistic learning situations. *Research on Motivation in Education*, *2*, 249-286.

Johnson, D. W., & Johnson, R. T. (1999). Making cooperative learning work. *Theory into Practice, 38*(2), 67.

Johnson, D. W., Johnson, R. T., & Holubec, E. J. (1994). *The nuts & bolts of cooperative learning.* Edina, MN: Interaction Book Company.

Johnson, D. W., Johnson, R. T., & Smith, K. A. (1998). Cooperative learning returns to college what evidence is there that it works? *Change: The Magazine of Higher Learning*, *30*(4), 26-35.

Jones, D. A., & Chang, M. (2014). Pecunia-a life simulation game for finance education. *Research & Practice in Technology Enhanced Learning, 9*(1), 7-39.

Jong, B. S., Lai, C. H., Hsia, Y. T., Lin, T. W., & Lu, C. Y. (2013). Using game-based cooperative learning to improve learning motivation: A study of online game use in an operating systems course. *IEEE Transactions on Education*, *56*(2), 183-190.

Kalz, M., Börner, D., Ternier, S., & Specht, M. (2015). Mindergie: A pervasive learning game for pro-environmental behaviour at the workplace. Wong, L. H., Milrad,

M., & Specht, M. (Eds.). (2015). *Seamless learning in the age of mobile connectivity* (pp. 397-417). Singapore: Springer.

Kapp, K. M. (2012). *The gamification of learning and instruction: game-based methods and strategies for training and education*. San Fransisco, CA: John Wiley & Sons.

Kato, P. M., Cole, S. W., Bradlyn, A. S., & Pollock, B. H. (2008). A video game improves behavioral outcomes in adolescents and young adults with cancer: A randomized trial. *Pediatrics*, *122*(2), e305-e317.

Ke, F., & Grabowski, B. (2007). Gameplaying for maths learning: Cooperative or not? *British Journal of Educational Technology, 38*(2), 249-259.

Keatinge, M. W. (1921). *The great didactic of John Amos Comenius: Translated into English and edited with biographical, historical and critical introductions*. London: Adam and Charles Black.

Keith, C. (2010). *Agile game development with Scrum*. Upper Saddle River, NJ: Pearson Education.

King, C. W. (1888). Epitaph of M. Verrius Flaccus. *Proceedings of the American Philosophical Society, 25*(127), 55-59.

King, S. N., Davis, L., Lehman, J. J., & Ruddy, B. H. (2012). A model for treating voice disorders in school-age children within a video gaming environment. *Journal of Voice*, *26*(5), 656-663.

Kirkley, J., Kirkley, S., & Heneghan, J. (2007). Building bridges between serious game design and instructional design. *The design and use of simulation computer games in education*, *2*, 74.

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development.* Englewood Cliffs, NJ: Prentice Hall.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development (2nd edition)*. Upper Saddle River, NJ: Pearson Education.

Kolb, A., & Kolb, D. A. (2009). Experiential learning theory: A dynamic, holistic approach to management learning, education and development. In S. J. Armstrong, & C. V. Fukami (Eds.), *The Sage Handbook of Management Learning, Education and Development* (pp. 42-68). Thousand Oaks, CA: Sage Publications.

Kose, U., Koc, D., & Yucesoy, S. (2013). Design and development of a sample "computer programming" course tool via story-based e-learning approach. *Educational Sciences: Theory & Practice, 13*(2), 1235-1250.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, England: Cambridge University Press.

Le Bouc, R., & Pessiglione, M. (2013). Imaging social motivation: Distinct brain mechanisms drive effort production during collaboration versus competition. *Journal of Neuroscience, 33*(40), 15894-15902.

Lenhart, A., Smith, A., Anderson, M., Duggan, M., Perrin, A. (2015, August). *Teens, technology and friendships*. Pew Research Center. Retrieved from http://www.pewinternet.org/2015/08/06/teens-technology-and-friendships/

Lenhart, A., Kahne, J., Middaugh, E., Macgill, A., Evans, C., Vitak, J. (2008, September). *Teens, video games and civics.* Pew Research Center. Retrieved from http://www.pewinternet.org/2008/09/16/teens-video-games-and-civics/

Lewin, K. (1935). *A dynamic theory of personality: Selected papers* (D. K. Adams & K. E. Zener, Trans.). New York: McGraw.

Lewis, L. H., & Williams, C. J. (1994). Experiential learning: Past and present. *New Directions for Adult and Continuing Education, 1994*(62), 5-16.

Laing, S., Apperley, M., & Masoodian, M. (2017). Investigating the effects of client imagery on the ideation process of graphic design. *Design Studies*, *53*, 78-98.

Liang, J., Wu, S., & Tsai, C. (2011). Nurses' internet: Self-efficacy and attitudes toward web-based continuing learning. *Nurse Education Today, 31*(8), 768-773.

Li, M.P., & Lam, B.H. (2005). *Cooperative learning.* Hong Kong: Hong Kong Institute of Education.

Lim, S., & Reeves, B. (2010). Computer agents versus avatars: Responses to interactive game characters controlled by a computer or other player. *International Journal of Human-Computer Studies, 68*(1/2), 57-68. doi:10.1016/j.ijhcs.2009.09.008

Lin, Y. T., & Lin, Y. C. (2016). Effects of mental process integrated nursing training using mobile device on students' cognitive load, learning attitudes, acceptance, and achievements. *Computers in Human Behavior*, *55*, 1213-1221.

Lin, Y. T., Wen, M. L., Jou, M., & Wu, D. W. (2014). A cloud-based learning environment for developing student reflection abilities. *Computers in Human Behavior*, *32*, 244-252.

Lisk, T. C., Kaplancali, U. T., & Riggio, R. E. (2012). Leadership in multiplayer online gaming environments. *Simulation & Gaming*, *43*(1), 133-149.

Liu, C., Franklin, T., Shelor, R., Ozercan, S., Reuter, J., Ye, E., & Moriarty, S. (2011). A learning game for youth financial literacy education in the teen grid of second life

three-dimensional virtual environment. *American Journal of Business Education, 4*(7), 1-18.

Loparev, A., Lasecki, W. S., Murray, K. I., & Bigham, J. P. (2014). Introducing shared character control to existing video games. Paper presented at *Foundations of Digital Games*. Fort Lauderdale, Florida.

Lundblad, T., Malmberg, C., Areskoug, M., & Jönsson, P. (2012). Simulating real-life problems in secondary science class. *Human IT, 12*(2), 1-41.

Mandell, L. (2006). Financial literacy: If it's so important, why isn't it improving? *Networks Financial Institute Policy Brief 2006-PB-08*. Retrieved from http://www.networksfinancialinstitute.org/Lists/Publication%20Library/Attachments/30/2006-PB-08_Mandell.pdf

Manero, B., Torrente, J., Serrano, Á., Martínez-Ortiz, I., & Fernández-Manjón, B. (2015). Can educational video games increase high school students' interest in theatre? *Computers & Education*, *87*, 182-191.

Martín-SanJosé, J. F., Juan, M., Torres, E., & Vicent, M. J. (2014). Playful interaction for learning collaboratively and individually. *Journal of Ambient Intelligence and Smart Environments, 6*(3), 295-311.

Masson, M. E., Bub, D. N., & Lalonde, C. E. (2011). Videogame training and naïve reasoning about object motion. *Applied Cognitive Psychology*, *25*(1), 166-173.

Mayer, P. (1978). *Flow in adolescence and its relation to the school experience* (Doctoral dissertation). University of Chicago.

Maynard, N. W., Mehta, P., Parker, J., & Steinberg, J. (2012). Can games build financial capability? Financial entertainment: A research overview. *Santa Monica, CA:*

RAND Corporation Working Paper WR-963-SSA. Available from http://www. rand. org/pubs/working_papers/WR963. html (last accessed December 28, 2016).

McGloin, R., Hull, K. S., & Christensen, J. L. (2016). The social implications of casual online gaming: Examining the effects of competitive setting and performance outcome on player perceptions. *Computers in Human Behavior, 59*, 173-181. doi:10.1016/j.chb.2016.02.022

Mitchell, A., & Savill-Smith, C. (2004). *The use of computer and video games for learning: A review of the literature.* London, England: LSDA.

Morrison, G. R., Ross, S. M., Kemp, J. E., & Kalman, H. (2010). *Designing effective instruction*. Hoboken, New Jersey: John Wiley & Sons.

Murayama, K., & Elliot, A. J. (2012). The competition–performance relation: A meta-analytic review and test of the opposing processes model of competition and performance. *Psychological Bulletin, 138*(6), 1035.

Murphy, K.R. & Myors, B. (2004) Statistical power analysis. A simple and general model for traditional and modern hypothesis tests (2nd ed.). Mahwah, New Jersey: Lawrence Erlbaum Associates.

Nebel, S., Beege, M., Schneider, S., & Rey, G. D. (2016). The higher the score, the higher the learning outcome? Heterogeneous impacts of leaderboards and choice within educational videogames. *Computers in Human Behavior*, *65*, 391-401.

Nebel, S., Schneider, S., & Rey, G. D. (2016). From duels to classroom competition: Social competition and learning in educational videogames within different group sizes. *Computers in Human Behavior*, *55*, 384-398.

Noah, J. A., Ono, Y., Shimada, S., Tachibana, A., & Bronner, S. (2015). Changes in sympathetic tone during cooperative game play. *Social Behavior and Personality: An International Journal*, *43*(7), 1123-1134.

Nosal, E. M. (2013). *It figures in their future: Assessing the impact of EverFi, a virtual environment, on learning high school personal finance* (Doctoral dissertation). George Mason University.

Novak, D., Nagle, A., Keller, U., & Riener, R. (2014). Increasing motivation in robot-aided arm rehabilitation with competitive and cooperative gameplay. *Journal of Neuroengineering & Rehabilitation (JNER), 11*(1), 1. doi:10.1186/1743-0003-11-64

Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.

Pachori, S. S. (1983). Dr. Andrew Bell and Coleridge's lectures on education. *The Journal of General Education, 35*(1), 26-37.

Palomo-Duarte, M., Dodero, J. M., & García-Domínguez, A. (2014). Betting system for formative code review in educational competitions. *Expert Systems with Applications*, *41*(5), 2222-2230.

Padrós, A., Romero, M., & Usart, M. (2012). Measuring the knowledge convergence process in the collaborative game MetaVals. *Procedia Computer Science, 15*, 193-202.

Panitz, T. (1999). Collaborative versus cooperative learning: Comparing the two definitions helps understand the nature of interactive learning. *Cooperative Learning and College Teaching, 8*(2), 1-13.

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education*, *52*(1), 1-12.

Peng, T., Bartholomae, S., Fox, J., & Cravener, G. (2007). The impact of personal finance education delivered in high school and college courses. *Journal of Family and Economic Issues, 28*(2), 265-284.

Peng, W., & Crouse, J. (2013). Playing in parallel: The effects of multiplayer modes in active video game on motivation and physical exertion. *Cyberpsychology, Behavior & Social Networking, 16*(6), 423-427. doi:10.1089/cyber.2012.0384

Peng, W., & Hsieh, G. (2012). The influence of competition, cooperation, and player relationship in a motor performance centered computer game. *Computers in Human Behavior*, *28*(6), 2100-2106.

Peppler, K., Danish, J. A., & Phelps, D. (2013). Collaborative gaming: Teaching children about complex systems and collective behavior. *Simulation & Gaming, 44*(5), 683-705. doi:10.1177/1046878113501462

Piaget, J. (1972). Development and learning. In C. S. Lavatelly, & F. Stendler (Eds.), *Reading in child behavior and development.* New York, NY: Hartcourt, Brace, Janovich Publishers.

Plass, J. L., Homer, B. D., Case, J., O'Keefe, P. A., Hayward, E. O., Stein, M., & Pedin, K. (2013). The Impact of individual, competitive, and collaborative mathematics game play on learning, performance, and motivation. *Journal of Educational Psychology, 105*(4), 1050-1066. doi:10.1037/a0032688

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

Price, S., Rogers, Y., Scaife, M., Stanton, D., & Neale, H. (2003). Using 'tangibles' to promote novel forms of playful learning. *Interacting with Computers, 15*(2), 169-185.

Rand, D. G., & Nowak, M. A. (2013). Human cooperation. *Trends in Cognitive Sciences*, *17*(8), 413-425.

Ratan, R., & Sah, Y. J. (2015). Leveling up on stereotype threat: The role of avatar customization and avatar embodiment. *Computers in Human Behavior*, *50*, 367-374.

Ravenscroft, A., Matheson, M. P. (2002). Developing and evaluating dialogue games for collaborative e-learning. *Journal of Computer Assisted Learning, 18*(1), 93–101.

Reeves, B., & Read, J. L. (2013). *Total engagement: How games and virtual worlds are changing the way people work and businesses compete.* Boston, Massachusetts: Harvard Business Press.

Rheinberg, F., Vollmeyer, R., & Engeser, S. (2003). Die erfassung des flow-erlebens [The assessment of flow]. In J. Stiensmeier-Pelster & F. Rheinberg (Eds.), *Diagnostik von motivation und selbstkonzept [Diagnosis of motivation and self-concept]* (pp. 261–279). Göttingen, Germany: Hogrefe.

Richards, K., Williams, J. M., Smith, T. E., & Thyer, B. A. (2015). Financial video games: A financial literacy tool for social workers. *International Journal of Social Work, 2*(1), 22.

Rong, H. O. U. (2013). Proverbs Reveal Culture Diversity. *Cross-Cultural Communication, 9*(2), 31-35.

Roy, A., & Ferguson, C. J. (2016). Competitively versus cooperatively? An analysis of the effect of game play on levels of stress. *Computers in Human Behavior, 56*, 14-20.

Sánchez, J., & Olivares, R. (2011). Problem solving and collaboration using mobile serious games. *Computers & Education, 57*(3), 1943-1952.

Schank, R., & Berman, T. (2006). Living stories: Designing story-based educational experiences. *Narrative Inquiry, 16*(1), 220-228.

Schmierbach, M., Xu, Q., Oeldorf-Hirsch, A., & Dardis, F. E. (2012). Electronic friend or virtual foe: Exploring the role of competitive and cooperative multiplayer video game modes in fostering enjoyment. *Media Psychology, 15*(3), 356-371. doi:10.1080/15213269.2012.702603

Shaffer, D. W., & Gee, J. P. (2012). The right kind of gate: Computer games and the future of assessment. Technology-based assessments for 21st century skills. In M. C. Mayrath, J. Clarke-Midura, D. H. Robinson, & G. Schraw (Eds.), *Technology-based assessments for 21st century skills: Theoretical and practical implications from modern research* (pp. 211-228). Charlotte, NC: Information Age Publishing.

Shernoff, D. J., Csikszentmihalyi, M., Schneider, B., & Shernoff, E. S. (2014). Student engagement in high school classrooms from the perspective of flow theory. In *Applications of Flow in Human Development and Education* (pp. 475-494). Springer Netherlands.

Short, D. (2016). The tragedy of the commons. *Teaching Science: The Journal of the Australian Science Teachers Association, 62*(1), 24.

Shute, V. J., & Ke, F. (2012). Games, learning, and assessment. In D. Ifenthaler, D. Eseryel, & X. Ge (Eds.), *Assessment in Game-Based Learning* (pp. 43-58). New York, NY: Springer.

Sims, V. K., & Mayer, R. E. (2002). Domain specificity of spatial expertise: The case of video game players. *Applied cognitive psychology*, *16*(1), 97-115.

Slavin, R. E. (1980). Cooperative learning. *Review of Educational Research*, *50*(2), 315-342.

Slavin, R. E. (1990). Research on cooperative learning: Consensus and controversy. *Educational Leadership*, *47*(4), 52-54.

Smith, S., & Chan, S. (2017). Collaborative and competitive video games for teaching computing in higher education. *Journal of Science Education & Technology, 26*(4), 438. doi:10.1007/s10956-017-9690-4

Snow, E. L., Allen, L. K., Jacovina, M. E., & McNamara, D. S. (2015). Does agency matter?: Exploring the impact of controlled behaviors within a game-based environment. *Computers & Education, 82*, 378-392.

Squire, K. (2011). *Video games and learning: Teaching and participatory culture in the digital age. Technology, Education--Connections (the TEC Series).* New York, NY: Teachers College Press.

Staiano, A. E., Abraham, A. A., & Calvert, S. L. (2012). Competitive versus cooperative exergame play for African American adolescents' executive function skills: Short-

term effects in a long-term training intervention. *Developmental Psychology, 48*(2), 337-342. doi:10.1037/a0026938

Stanne, M. B., Johnson, D. W., & Johnson, R. T. (1999). Does competition enhance or inhibit motor performance: A meta-analysis. *Psychological Bulletin*, *125*(1), 133.

Sung, H. Y., & Hwang, G. J. (2013). A collaborative game-based learning approach to improving students' learning performance in science courses. *Computers & Education, 63*, 43-51.

Susi, T., Johannesson, M., & Backlund, P. (2007). Serious Games: An Overview. *Technical Report HS-IKI-TR-07-001.*

Ter Vrugte, J., de Jong, T., Vandercruysse, S., Wouters, P., van Oostendorp, H., & Elen, J. (2015). How competition and heterogeneous collaboration interact in prevocational game-based mathematics education. *Computers & Education, 89*, 42-52.

Tran, C., Schenke, K., & Hickey, D. T. (2014). Design principles for motivating learning with digital badges: Consideration of contextual factors of recognition and assessment. *Learning and Becoming in Practice Principles for Motivating Learning with Digital Badge (ICLS proceedings)*, *2*, 1027.

Trespalacios, J., Chamberlin, B., & Gallagher, R. (2011). Collaboration, engagement & fun: How youth preferences in video gaming can inform 21st century education. *Techtrends: Linking Research & Practice to Improve Learning, 55*(6), 49-54. doi:10.1007/s11528-011-0541-5

Vandercruysse, S., Vandewaetere, M., Cornillie, F., & Clarebout, G. (2013). Competition and students' perceptions in a game-based language learning environment.

Educational Technology Research & Development, 61(6), 927-950. doi:10.1007/s11423-013-9314-5

Vang, M. H., & Fox, J. (2014). Race in virtual environments: Competitive versus cooperative games with black or white avatars. *Cyberpsychology, Behavior and Social Networking, 17*(4), 235-240. doi:10.1089/cyber.2013.0289

Velez, J. A., Greitemeyer, T., Whitaker, J. L., Ewoldsen, D. R., & Bushman, B. J. (2016). Violent video games and reciprocity: The attenuating effects of cooperative game play on subsequent aggression. *Communication Research*, *43*(4), 447-467.

Verhoeff, T. (1997). The role of competitions in education. *Proceedings of Future World International Conference: Educating for the 21st Century*. Cape Town, South Africa.

Vollmeyer, R., & Rheinberg, F. (2006). Motivational effects on self-regulated learning with different tasks. *Educational Psychology Review, 18*(3), 239-253.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press. Original work published 1933.

Waddell, J. C., & Peng, W. (2014). Does it matter with whom you slay? The effects of competition, cooperation and relationship type among video game players. *Computers in Human Behavior, 38*, 331-338.

Watson, W. R. (2007). *Formative research on an instructional design theory for educational video games* (Doctoral dissertation). Indiana University.

Way, W. L., & Wong, N. (2010). Harnessing the power of technology to enhance financial literacy education and personal financial well-being: A review of the

literature, proposed model, and action agenda. *Center for Financial Security WP*, *10*, 6.

Wiggins, G., & McTighe, J. (2005). Understanding by design (Expanded 2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

Whitton, N. J. (2007). *An investigation into the potential of collaborative computer game-based learning in higher education* (Doctoral dissertation). Edinburgh, Napier University).

Whitman, N. A. (1988). Peer teaching: To teach is to learn twice. *Report no. 4. Washington, D.C.: Association for the Study of Higher Education.*

Whitmire, A. J. (1991). Correlation of optimal experience and counselor development. *Research Report: ERIC Document Reproduction Service No: ED375337.*

Wilcox, R. R. (2010). *Fundamentals of Modern Statistical Methods*. New York, NY: Springer

Williams, R. B., & Clippinger, C. A. (2002). Aggression, competition and computer games: computer and human opponents. *Computers in Human Behavior, 18*(5), 495-506.

Xu, L., & Zia, B. (2012). Financial literacy around the world: An overview of the evidence with practical suggestions for the way forward. *World Bank Policy Research Working Paper,* (6107).

Yao, Z., & Yu, R. (2016). The spreading of social energy: How exposure to positive and negative social news affects behavior. *PloS ONE, 11*(6), 1-12. doi:10.1371/journal.pone.0156062

Ying-Shao, H. (2006). 'Lesson Rainbow': The use of multiple representations in an internet-based, discipline-integrated science lesson. *British Journal of Educational Technology, 37*(4), 539-557.

Yu, F. Y., Han, C., & Chan, T. W. (2008). Experimental comparisons of face-to-face and anonymous real-time team competition in a networked gaming learning environment. *CyberPsychology & Behavior, 11*(4), 511-514.

Yueh-Min, H., Yi-Wen, L., Shu-Hsien, H., & Hsin-Chin, C. (2014). A jigsaw-based cooperative learning approach to improve learning outcomes for mobile situated learning. *Journal of Educational Technology & Society, 17*(1), 128-140.

Zhang, M., Xu, M., Han, L., Liu, Y., Lv, P., & He, G. (2012). Virtual Network Marathon with immersion, scientificalness, competitiveness, adaptability and learning. *Computers & Graphics, 36*(3), 185-192. doi:10.1016/j.cag.2012.01.006

Zhi-Hong, C. (2014). Learning preferences and motivation of different ability students for social-competition or self-competition. *Journal of Educational Technology & Society, 17*(1), 283-293.

APPENDIX A

Discussion of the Instructional Design of the Game *Night of the Living Debt*

Night of the Living Debt (*NLD*) is the culmination of years of collaboration, research, experience, theory, and application. The following description discusses these details in terms of the ADDIE phases of instructional design used for educational program creation.

Analysis. As part of the Northwest Youth Financial Education (NYFE) initiative, priority topics for youth program development were identified through a thorough needs assessment, which included population surveys, advisory board feedback, and research. Among the priority topics was helping teens prepare to build and maintain strong credit scores. Use of digital learning platform was also identified as a preferable delivery mechanism for this content based on research. Additional research identified the theory of Transformational Play as a useful tool in aiding digital learning game design, which was used in conjunction with an adapted ADDIE model. The project was given approximately two years for design and development and another two years for implementation and evaluation.

Design. The leaders of the NYFE initiative, (including the researcher) considered several media companies with which to work to develop a digital learning game appropriate credit score program. The New Mexico State Extension Learning Game Lab was selected. During the initial meeting between the project leaders and the Games Lab personnel, three primary learning (performance) objectives were identified. The first was that a credit card can be the most effective way to build credit if used correctly. The second was that subprime loans such as payday loans are harmful for credit even when paid back on time. And the third main objective was that missing payments is the most

harmful thing for one's credit. The basic structure and content of the game was then designed around these primary objectives. Additional secondary objectives were pursued including factors to increase engagement of users through the use of the elements of transformational play, namely useful content, dynamic narrative context, and first-person control. We wanted users to leave with a good attitude as a result of their experience and want to recommend the game to their friends. The resulting primary and secondary objectives of performance, engagement and attitude are reflected in the dependent variables of the present study.

Through subsequent visits and asynchronous communications, the game theme, appearance and aesthetics were worked out. Finally, game mechanics were roughly storyboarded along with preliminary artwork. Throughout this process the project leaders ensured that the principles of transformational play were present. These include the basic premise as explained by Barab et al., 2012)

> It is a theory about the need to establish curricular experiences that position non-experts as change agents who, through their successful application of conceptual tools, can have experiences involving actually changing contexts at the same time they come to see themselves as people who successfully use academic experiences. (p. 532).

Development. Development of the games artwork, media elements, and programmed game mechanics were primarily completed by the Learning Games Lab, according to regular feedback from NYFE leaders. Execution of development was, for the most part, consistent with the design plans. Formative evaluations were collected from teens during the development process to test game prototypes. This data was used to

ensure that learning objectives drove the content and mechanics of the game, and that the game was engaging and of a high quality as perceived by the participants.

Implementation. To date, the game has been downloaded 23,920 times. According to usage statistics, the game has been individually played to completion 2,285 times. Additionally, NYFE leaders and associated educators have delivered the program to hundreds of students in various group settings including high school classrooms, and community game activities.

Evaluation. Preliminary summative evaluations have begun to take place. This program has been offered to 148 youth participants in classrooms. Participant surveys indicated an overall rating of 9/10 for enjoyment and engagement. A brief retrospective survey produced the following results measuring knowledge gain and behavior change related to the game's learning objectives.

Figure 1.

Night of the Living Debt App - Title Screen.

Figure 2.

Night of the Living Debt - Participant Knowledge Gain

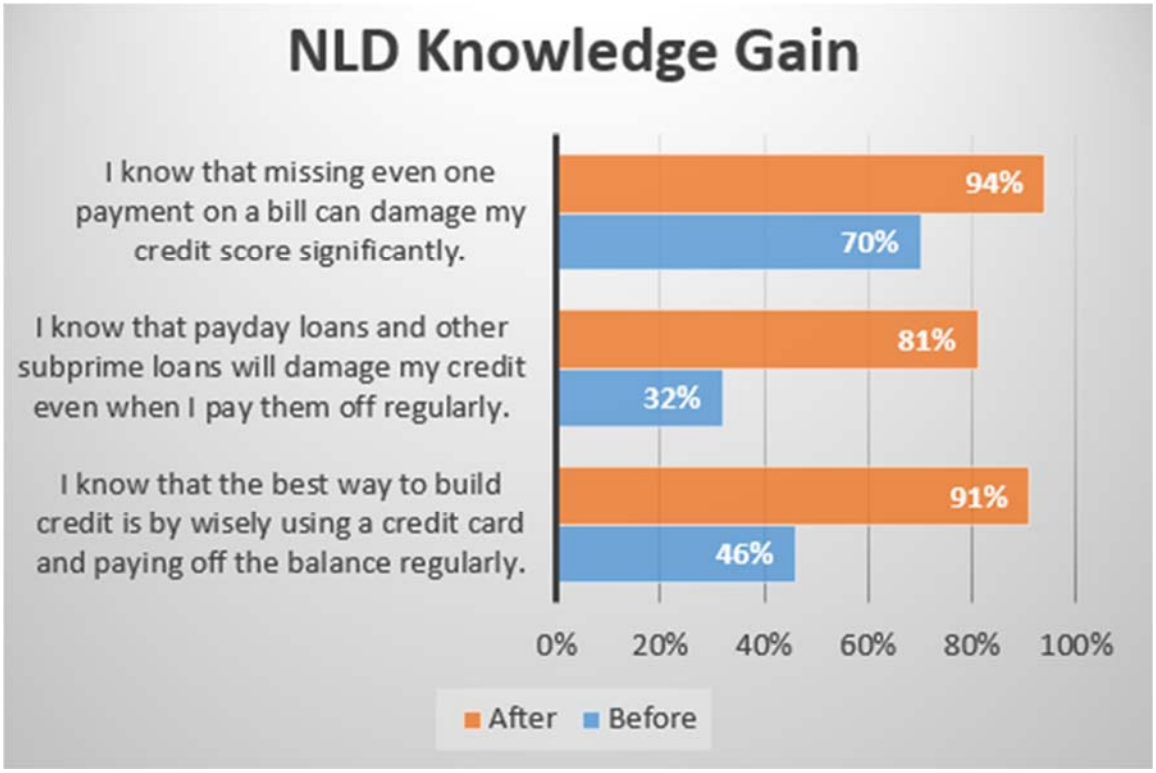
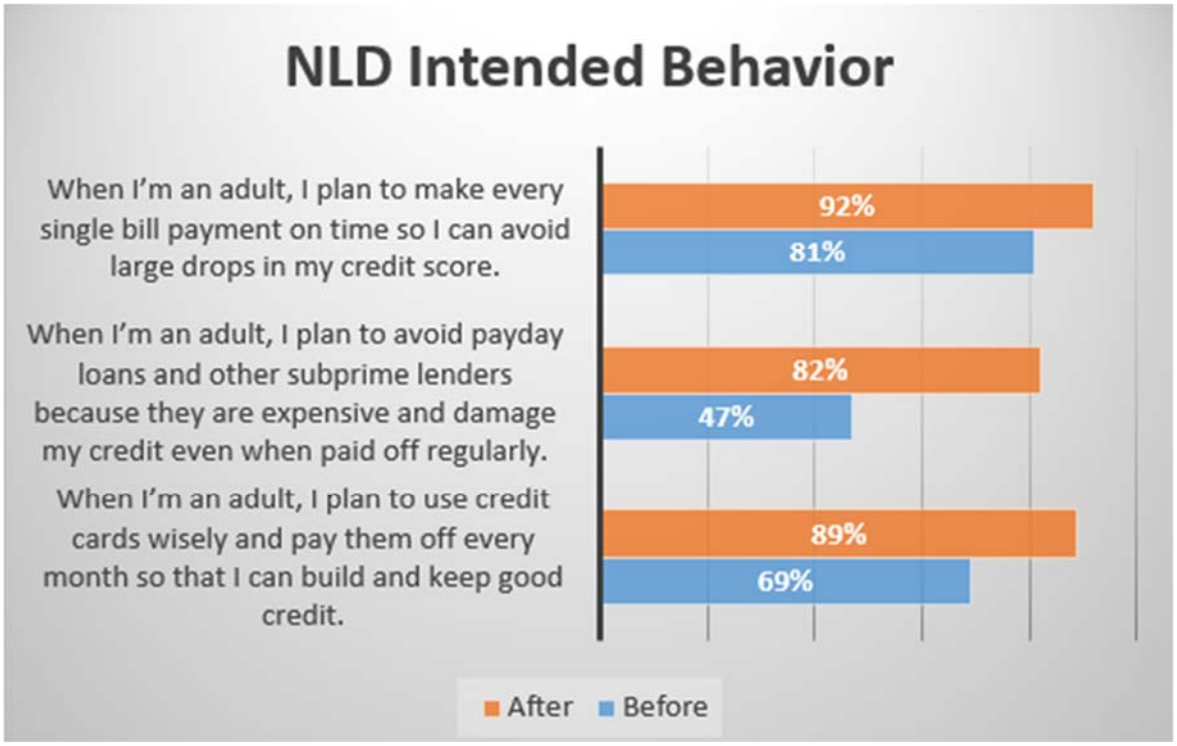


Figure 3.

Night of the Living Debt - Participant Intended Behavior



When asked to comment on the overall experience of participating in the game, responses included:

- **"**I really enjoyed it. I learned a lot. I'm going to spend my money more wisely."
- "I'm glad I was here for this lesson."
- "I thought it was fantastic!"
- "I like it, it is not only fun but also teaches you a lesson."
- "I think this is good, because it teaches us how to save some money so when we are adults, we won't make mistakes to our credit scores."

APPENDIX B

Performance Instrument

Questions about knowledge: (Circle the answer that you think is most correct).

1. Which of the following statements about credit cards is most correct?
    a. Credit cards are expensive and damage credit scores and should always be avoided.
    b. Credit cards are inexpensive and build strong credit scores and should be used frequently.
    c. Credit cards are no better or worse than other types of loans.
    d. Credit cards can be good or bad for a credit score depending how they are used, so they should be used wisely.

2. How many times do you need to use a payday (subprime) loan to have a good credit score?
    a. 10
    b. 5
    c. 3
    d. None

3. What is the worst thing for your credit score?
    a. Missing a payment.
    b. Using only one type of loan.
    c. Having a new loan.
    d. Having a credit card.

4. What is the best thing to do if you can't afford a monthly loan payment?
    a. Ignore it and pay double next month.
    b. Ignore it and hope they forget about it.
    c. Pay a little bit this month and then try to make up for it next month.
    d. Call your lender and work out a payment plan so that you avoid missing any payments if possible.

5. The best way to use a credit card to build credit is to:
    a. Use it until you reach the maximum spending limit.
    b. Use just a little bit and pay it off every month.
    c. Always carry a balance by making just a minimum monthly payment.
    d. Don't use it at all.

6. To build a good credit score you should…
    a. Avoid all loans because they get you into trouble.
    b. Have only home and car loans.
    c. Have several payday loans.
    d. Have 2-3 revolving loans, like credit cards.

7. Good credit is not required for which of the following?
    a. Boat loan.
    b. Home loan.
    c. Car loan.
    d. Payday (subprime) loan.

8. Which of the following can be the most effective tool for building good credit, if used correctly?
    a. Credit card
    b. Student loan
    c. Car loan
    d. Payday loan

9. The single most important factor in building good credit is:
    a. Never miss a payment.
    b. Never check your own credit score.
    c. Never get a loan.
    d. Never pay off your full loan balance.

10. Which type of loan is the worst for your credit?
    a. Credit card.
    b. Student loan.
    c. Car loan.
    d. Payday (subprime) loan.

11. When using a credit card, which action is best for building credit?
    a. Always pay the full balance at the end of the month.
    b. Pay as much as possible, but always leave a little balance to carry over to the next month.
    c. Always pay a little bit, but leave most of the balance to carry over to the next month.
    d. Never pay the full balance.

12. Which of the following is a true statement about payday loans?
    a. They are great for building credit.
    b. They are inexpensive.
    c. Good credit is not needed to get one.
    d. They are great options for those with bad credit.

13. After missing 9 payments a typical person's (FICO) credit score will probably be about:
    a. 400-550
    b. 600-725
    c. 750-800
    d. 825-850

14. If you have a bad credit score, you can still get which of the following products at regular price?
    a. A home loan.
    b. A payday (subprime) loan.
    c. A credit card.
    d. An insurance policy.

15. The best way to build credit is to:
    a. Borrow as much money as you can.
    b. Borrow a small amount and pay it off regularly.
    c. Avoid borrowing any money.
    d. Borrow about half of the available amount and carry the balance from month to month.

16. Should millionaires worry about their credit?
    a. No. Because they have enough money they don't need loans.
    b. Yes. Because their credit will still be checked for other things like insurance, and elective medical services.
    c. No. Because millionaires are usually the ones giving other people loans.
    d. Yes. Because they need good credit to manage their investments.

17. Credit and credit scores will NOT impact this (select one):
    a. Job opportunities.
    b. Eligibility for apartment rentals.
    c. Cost of insurance rates.
    d. Eligibility for payday (subprime) loans.

18. What is the maximum possible FICO credit score?
    a. 1050
    b. 300
    c. 550
    d. 850

19. Your friend is using a credit card to build credit. What is the best advice you can give this person?
    a. Keep the balance high and never pay the full balance off.
    b. Keep the balance low and pay off the full balance every month.
    c. Use it only for emergencies and pay the balance off the next day.
    d. Use it only on large purchases and make only minimum payments.

APPENDIX C

Flow Experience – Engagement Instrument

Questions about engagement.
Csikszentmihalyi & Csikszentmihalyi (1992).
Instructions: Check the box that most closely describes your experience during the lesson.

	Strongly Disagree	Disagree	Somewhat disagree	Probably disagree	Probably agree	Somewhat agree	Agree	Strongly Agree
1. I got involved.								
2. I got anxious.								
3. I clearly knew what I was supposed to do.								
4. I got direct clues as to how well I was doing.								
5. I felt I could handle the demands of the situation.								
6. I felt self-conscious.								
7. I got bored.								
8. I had to make an effort to keep my mind on what was happening.								
9. I would have done it even if I didn't have to.								
10. I got distracted.								
11. Time passed quickly.								
12. I enjoyed the experience and/or the use of my skills.								

APPENDIX D

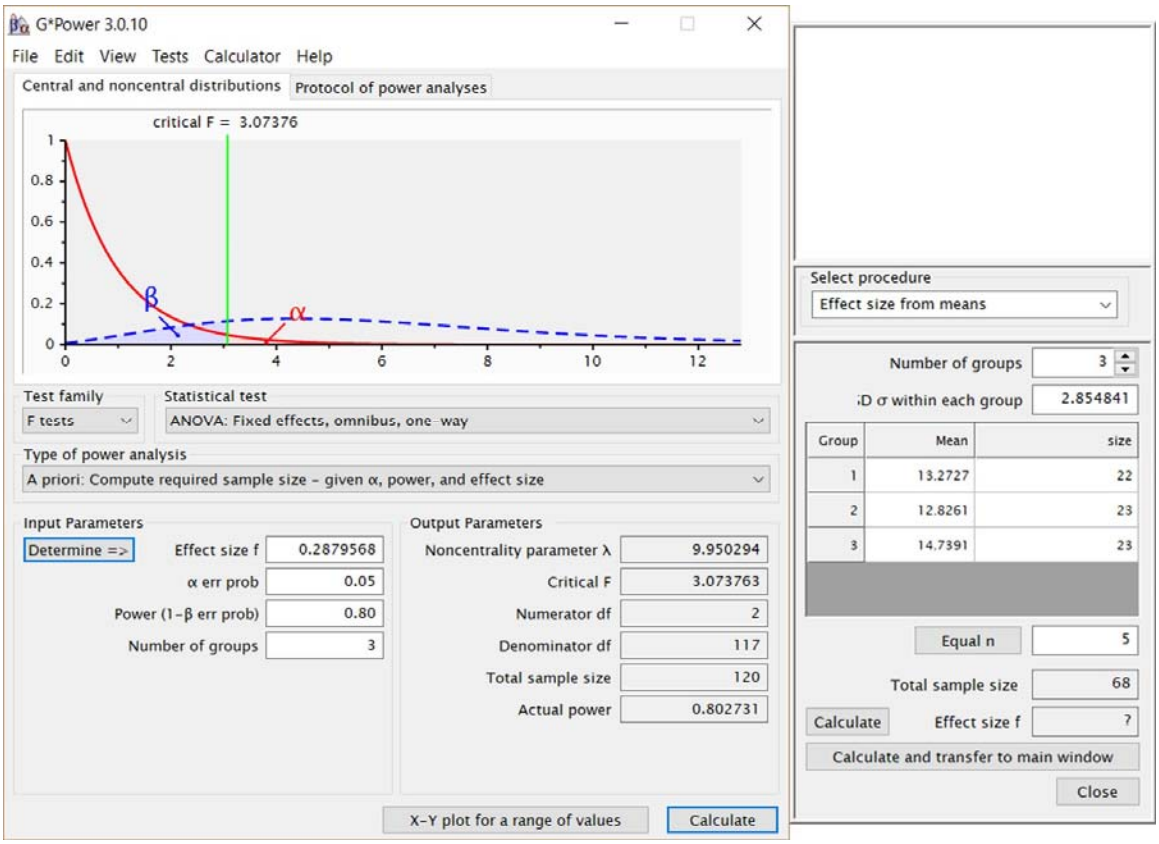
Attitude Instrument

Questions about attitude.
Learning attitudes (Adapted from Hwang & Chang, 2011).
Instructions: Check the box the most closely matches your attitude during the lesson.

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
1. The lesson on credit scores is valuable and worth studying.				
2. It is worth learning those things about building credit scores.				
3. It is worth learning the content about how to build credit scores well.				
4. It is important to learn more about building credit scores, to never miss a loan payment and keep loan balances low.				
5. It is important to know the things that damage and build credit scores.				
6. I will actively search for more information and learn about credit scores.				
7. It is important for everyone to take this credit score lesson.				

APPENDIX E

Power Analysis



APPENDIX F

Pilot I - KR-20 Results of Performance Instrument

Using pilot I data a KR-20 analysis was run on the original performance questionnaire using SPSS statistical software. The Cronbach's alpha with all questions was .662. This level of reliability is considered suitable for some types of exploratory research but a minimum Cronbach's alpha or .70 is desirable for most types of research. As can be seen in the SPSS output below, a Cronbach's alpha of .705 was reached by removing questions six, seven, and twenty. This indicated a need to rework the original questions, and pilot test the performance instrument again.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	92	100.0
	Excluded[a]	0	.0
	Total	92	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.705	17

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	10.9239	8.972	.289	.696
Q2	11.1196	8.260	.397	.681
Q3	11.2065	8.341	.323	.689
Q4	11.0435	8.591	.315	.691
Q5	11.0543	8.689	.261	.696
Q8	11.1087	8.208	.427	.678
Q9	11.0543	8.535	.330	.689
Q10	11.1304	8.290	.378	.683
Q11	11.3261	8.552	.225	.701
Q12	10.9239	9.126	.184	.702
Q13	11.2826	8.601	.211	.703
Q14	11.4674	8.647	.199	.704
Q15	11.2500	7.948	.461	.672
Q16	10.9457	8.711	.402	.687
Q17	11.3478	8.493	.245	.699
Q18	11.1522	8.592	.247	.698
Q19	11.4022	8.573	.218	.702

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
11.8587	9.463	3.07625	17

APPENDIX G

Pilot II - KR-20 Results of Performance Instrument

After several of the questions were rewritten according to the reliability results of pilot test I, a second pilot test was run on the performance instrument. The findings indicated a sufficient alpha level (α=.763) after removal of question 19. SPSS results can be seen below. Therefore, the final performance instrument was deemed to be sufficiently reliable with these 19 questions.

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	37	100.0
	Excluded[a]	0	.0
	Total	37	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.763	.808	19

Item Statistics

	Mean	Std. Deviation	N
Q1	.9730	.16440	37
Q2	.9459	.22924	37
Q3	.9189	.27672	37
Q4	.7568	.43496	37
Q5	.9730	.16440	37
Q6	.8649	.34658	37
Q7	.9459	.22924	37
Q8	.9730	.16440	37
Q9	.9730	.16440	37
Q10	.9730	.16440	37
Q11	.9459	.22924	37
Q12	.8919	.31480	37
Q13	.9730	.16440	37
Q14	.8108	.39706	37
Q15	.8649	.34658	37
Q16	.7568	.43496	37
Q17	.9730	.16440	37
Q18	.8378	.37368	37
Q20	.9730	.16440	37

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	16.3514	5.068	.252	.758
Q2	16.3784	4.575	.666	.732
Q3	16.4054	4.581	.526	.738
Q4	16.5676	4.919	.089	.784
Q5	16.3514	4.790	.645	.741
Q6	16.4595	5.033	.082	.776
Q7	16.3784	5.186	.040	.770
Q8	16.3514	4.790	.645	.741
Q9	16.3514	4.790	.645	.741
Q10	16.3514	5.123	.176	.762
Q11	16.3784	4.853	.372	.751
Q12	16.4324	4.641	.399	.747
Q13	16.3514	5.290	-.048	.771
Q14	16.5135	4.479	.383	.750
Q15	16.4595	4.422	.507	.737
Q16	16.5676	4.252	.468	.741
Q17	16.3514	5.068	.252	.758
Q18	16.4865	4.590	.344	.753
Q20	16.3514	4.790	.645	.741

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
17.3243	5.281	2.29799	19

APPENDIX H

Permission to Use: Flow Experience – Engagement Instrument

From: Mihaly Csikszentmihalyi <Mihaly.Csikszentmihalyi@cgu.edu>
Subject: Re: Permission to use instrument in dissertation
Date: October 19, 2017 at 11:51:25 AM MDT
To: "Erickson, Luke (erickson@uidaho.edu)" <erickson@uidaho.edu>

Dear Luke,
Certainly, go ahead and use the instrument mentioned below. And if there are interesting findings, let me know!
Best,

Mihaly Csikszentmihal
Distinguished Professor
of Psychology and Management
Claremont Graduate University
1227 N. Dartmouth Ave.
Claremont, CA, 91711

From: "Erickson, Luke (erickson@uidaho.edu)" <erickson@uidaho.edu>**Date:** Tuesday, October 17, 2017 at 3:30 PM**To:** Mihaly Csikszentmihalyi <Mihaly.Csikszentmihalyi@cgu.edu>**Subject:** Permission to use instrument in dissertation

Hello Dr. Csikszentmihalyi. I'm writing in hopes that you will grant me permission to use the 12 question "flow experience" questionnaire found on page 195 of your book Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (Eds.). (1992). *Optimal experience: Psychological studies of flow in consciousness*. I would like to use this instrument to measure flow experiences of participants in my dissertation project who will play an educational game using either cooperative and competitive social gameplay elements. Thank you sincerely for considering my request and have a nice day.

Luke Erickson
Ph.D. candidate
Idaho State University, Instructional Design

APPENDIX I

Cronbach's Alpha – Reliability Pilot-Test I of Engagement Instrument

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	24	100.0
	Excluded[a]	0	.0
	Total	24	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.782	10

Item Statistics

	Mean	Std. Deviation	N
Q1	6.2083	2.35869	24
Q3	5.3750	2.14299	24
Q4	5.5000	2.06419	24
Q5	5.6667	2.20013	24
Q7	7.2292	1.25091	24
Q8	6.3333	1.97080	24
Q9	5.3958	2.76224	24
Q10	6.0833	2.44801	24
Q11	6.5625	2.14330	24
Q12	6.3958	2.03758	24

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	54.5417	124.781	.540	.751
Q3	55.3750	132.332	.444	.764
Q4	55.2500	123.413	.679	.735
Q5	55.0833	119.471	.717	.727
Q7	53.5208	148.467	.288	.780
Q8	54.4167	148.514	.133	.798
Q9	55.3542	129.576	.343	.783
Q10	54.6667	154.058	-.021	.825
Q11	54.1875	117.670	.786	.719
Q12	54.3542	119.228	.796	.720

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
60.7500	158.804	12.60176	10

APPENDIX J

Permission to Make Slight Adjustments to Original Scale

From: Mihaly Csikszentmihalyi <Mihaly.Csikszentmihalyi@cgu.edu>
Subject: Re: Permission to use instrument in dissertation
Date: January 26, 2018 at 3:06:45 PM MST
To: "Erickson, Luke (erickson@uidaho.edu)" <erickson@uidaho.edu>

If it might help your study, you should make the revisions you indicated. Let me know if the revised version helped or not . . .

Mihaly Csikszentmihalyi
Distinguished Professor
of Psychology and Management
Claremont Graduate University
1227 N. Dartmouth Ave.
Claremont, CA, 91711

On Jan 26, 2018, at 1:57 PM, Erickson, Luke (erickson@uidaho.edu) <erickson@uidaho.edu> wrote:
Dr. Csikszentmihalyi. Thank you again for granting me permission to use the 12-question 'flow experience" questionnaire found on page 195 of your book Csikszentmihalyi, M., & Csikszentmihalyi, I. S. (Eds.). (1992) in my dissertation research. I was curious if any reliability data exists on this instrument. I have not been able to locate any reliability statistics on this instrument in the research to which I have access. I did run a pilot program with youth participants ages 12-14, and found, that questions 2 and 6 were sometimes confusing to the students, in particular because they are reverse coded. I am proposing that adding a synonym may add some clarity to these two questions. See below:

Original question 2: I got anxious.
Revised question 2: I got anxious/nervous.

Original question 6: I felt self-conscious.
Revised question 6: I felt self-conscious/insecure.

I would like to conduct an additional study and test reliability using the instrument with these two slight revisions, but thought I would ask first if you find this acceptable. If not, I will continue to use the instrument as it was originally published. Thanks for any feedback in this process you are able to provide. All the best.

Sincerely,
Luke Erickson
Ph.D. candidate
Idaho State University, Instructional Design

APPENDIX K

Slightly Amended (Final) Flow Experience – Engagement Instrument

Questions about engagement.
Csikszentmihalyi & Csikszentmihalyi (1992).
Instructions: Check the box that most closely describes your experience during the lesson.

	Strongly Disagree	Disagree	Somewhat disagree	Probably disagree	Probably agree	Somewhat agree	Agree	Strongly Agree
1. I got involved.								
2. I got *nervous*/anxious.								
3. I clearly knew what I was supposed to do.								
4. I got direct clues as to how well I was doing.								
5. I felt I could handle the demands of the situation.								
6. I felt self-conscious/*insecure*.								
7. I got bored.								
8. I had to make an effort to keep my mind on what was happening.								
9. I would have done it even if I didn't have to.								
10. I got distracted.								
11. Time passed quickly.								
12. I enjoyed the experience and/or the use of my skills.								

APPENDIX L

Cronbach's Alpha – Reliability Pilot-Test II of Engagement Instrument

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	37	100.0
	Excluded[a]	0	.0
	Total	37	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.798	12

Item Statistics

	Mean	Std. Deviation	N
Q1	5.2432	1.93513	37
Q2	6.1081	2.07878	37
Q3	5.8108	1.76128	37
Q4	5.9730	1.46224	37
Q5	6.4054	1.38362	37
Q6	6.3514	1.82903	37
Q7	5.7568	1.99172	37
Q8	5.3784	2.03240	37
Q9	5.3108	1.83087	37
Q10	5.5405	1.73757	37
Q11	6.2432	1.49825	37
Q12	6.5405	1.19244	37

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	65.4189	118.813	.333	.795
Q2	64.5541	113.539	.423	.786
Q3	64.8514	120.470	.337	.793
Q4	64.6892	124.810	.295	.795
Q5	64.2568	116.370	.613	.771
Q6	64.3108	119.644	.340	.793
Q7	64.9054	111.317	.507	.777
Q8	65.2838	108.744	.560	.771
Q9	65.3514	115.359	.455	.782
Q10	65.1216	111.464	.603	.768
Q11	64.4189	118.813	.476	.781
Q12	64.1216	123.339	.447	.785

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
70.6622	136.598	11.68751	12

APPENDIX M

Permission to Use Attitude Instrument

From: Gwo-Jen Hwang <gjhwang.academic@gmail.com>
Sent: Wednesday, October 18, 2017 10:02 AM
To: Erickson, Luke (erickson@uidaho.edu)
Subject: RE: Permission to use Attitude Questionnaire

I am happy to permit your modifications on and use of the questionnaire. Please be sure to cite the article in your dissertation and future publications.

Sincerely Yours,
Gwo-Jen

Gwo-Jen Hwang
Chair Professor, Graduate Institute of Digital Learning and Education
Dean, College of Liberal Arts and Social Sciences
National Taiwan University of Science and Technology
43, Sec.4, Keelung Rd., Taipei, 106, Taiwan
E-mail: gjhwang.academic@gmail.com; gjhwang@mail.ntust.edu.tw
Tel.: +886-915-396558, 886-2-27301239; fax: +886-2-2737-6433 http://www.idlslab.net/

From: Erickson, Luke (erickson@uidaho.edu) [mailto:erickson@uidaho.edu]
Sent: Wednesday, October 18, 2017 11:08 PM
To: gjhwang.academic@gmail.com
Subject: Permission to use Attitude Questionnaire

Hello Dr. Hwang, my name is Luke Erickson and I am working on a dissertation for a Ph.D. in Instructional Design at Idaho State University. I am writing to ask for permission to adapt and use the attitude questionnaire from your article: Hwang, G. J., & Chang, H. F. (2011). A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students. *Computers & Education*, *56*(4), 1023-1031. I do not want to change the structure of the questions, but rather the content references. Specifically, here are the original questions compared to the adaptations I would like to make. The content of my educational program is U.S.-based credit scores for personal finances.

Original questions:
Learning attitudes
1. The local culture course is valuable and worth studying.
2. It is worth learning those things about local culture.
3. It is worth learning the local culture course well.
4. It is important to learn more about local culture, including observing and learning those ancient artworks.
5. It is important to know the ancient history and customs related to our home town.
6. I will actively search for more information and learn about local culture.

7. It is important for everyone to take the local culture course.

Adapted Questions
1. The lesson on credit scores is valuable and worth studying.
2. It is worth learning those things about building credit scores.
3. It is worth learning the content about how to build credit scores well.
4. It is important to learn more about building credit scores, including how missing payments, and having high loan balances can affect a score.
5. It is important to know the things that hurt and build credit scores.
6. I will actively search for more information and learn about credit scores.
7. It is important for everyone to take this credit score lesson.

Please let me know if adapting your questionnaire in this way is permissible for use in my Ph.D. dissertation. Thanks and have a nice day.

With respect,
Luke Erickson

APPENDIX N

Informed Consent Script

Dear Participants:

At the conclusion of today's learning activity, I will be passing out a written assessment that will take approximately ten minutes to complete. The purpose of this assessment is to gain insight into the educational impact and your experiences with the program. The assessment will ask questions about your knowledge, engagement, and attitudes as a result of your participation in this program. It is my hope that information from this assessment will contribute to a better understanding of the role that this type of education can play in an individual's overall learning experiences.

Your responses to the assessment will be anonymous. Your name will not be collected or appear anywhere on the assessment and complete privacy will be guaranteed.

Participation is completely voluntary, and you may there will be no adverse consequences by choosing to complete or not complete the assessment. By completing and turning in the written assessment you are providing implied consent to use your anonymous responses in research.

For further information regarding this research please contact Doctoral Candidate - Luke Erickson at (208) 206-9529, email: ericluke@isu.edu, or Dr. Dorothy Sammons at (208) 282-2569, email: sammdott@isu.edu.

If you have any questions about your rights as a research participant you may contact the Idaho State University Institutional Review Board at (208) 282-2179.

Thank you in advance for your participation and support.

APPENDIX O

Class Procedures

Ten Minutes Before Class Begins

Arrive, meet with instructor to go over last-minute questions on procedures.

Class Period Begins

Introduction script. "Today I'll be sharing a personal finance lesson on credit building and credit scores. Who knows what a credit score is? (Allow a few participants to respond). A credit score is a like a score on a class exam, except it's for your finances. It tells other people how responsible you have been with the loans you've had in the past. And why do people want to know if you've handled your past loans responsibly? (Let a few participants respond). Some research has found that what you've done with your loans in the past is a pretty good indicator of your behavior will be like in the future. So, future lenders want to know if you've been honest and responsible with other lenders before they will consider loaning you more money. But it's not just lenders who care about your credit score. Turns out that if you've been irresponsible with past loans, then you're a lot more likely to have problems in other areas of life too. For example, auto, home and life insurance companies will charge you more for insurance products if you have bad credit. Apartment managers are less likely to approve your rental contract because they fear that you will skip out on rent, or not pay bills for any damages that might happen. And, last but not least, employers may deny you a job based on bad credit because they think you won't handle certain responsibilities well like handling the company's cash, or turning in projects on time, and so on. So today we'll talk a little more about why credit is important. How to build good credit, and why you should care.

But before we start the learning activity, I just wanted to let you know that today's class is part of a research project I am completing for my dissertation for a doctoral degree at Idaho State University. As part of this research I have to read the following statement, so that you know that your participation is completely voluntary.

Informed Consent script. See APPENDIX M.

Implement the Randomly Assigned Condition with Scripts

Traditional learning (TL) group. "I will be sharing some slides today to go over this content about credit and credit scores. There will be some time for discussion and questions at the end, but you are welcome to ask questions during the lesson as well. I will also have a few prizes that I will give away at the end of the class period (Describe prizes, water bottles, hats, t-shirts). These prizes will be awarded by randomly drawing your name out of a hat (prizes will be awarded on a ratio of approximately one prize for every four participants to match the ratio of participants to prizes of the other conditions)." Proceed to give lecture according to slides.

Individual transformational play (ITP) group. "The learning activity is based on a game I'll ask you to play on the iPad. This game is called *Night of the Living Debt.* As you might have guessed from the title of the game, it is about some cartoon zombies who have taken over the financial system. In order to be successful in the game, you have to learn to deal with these zombies effectively, just like you have to learn how to deal with credit in real life. There are a lot of ways to play this game, but today I'm going to ask you to play individually. You will each get an iPad, and you will have about 40 minutes to play the game by yourself. You are free to ask me questions, but I will ask you to try not to talk to your neighbor too much while playing. At the end of the 40 minutes

we'll have a short discussion about some of the main points of credit building from the game, and, I will give away a few prizes by randomly drawing names out of a hat (water bottles, hats, and t-shirts; prizes will be awarded on a ratio of approximately one prize for every four participants in the group to match the ratio of the other conditions)."

Competitive transformational play (CMTP) group. "The learning activity I'll share with you today is based on a game you will play on an iPad. This game is called *Night of the Living Debt.* As you might have guessed form the title, the game is about some cartoon zombies who have taken over the financial system. In order to be successful in the game, you have to learn to deal with these zombies effectively, just like you have to learn how to deal with credit in real life. There are a lot of ways to play this game, but today I'm going to give each of you an iPad, and ask you to divide into groups of about 3 or 4 players each and compete with each other to see who can get the highest score in your small group. To form these groups I'm going to start by asking about your experiences with video games. Who in here plays video games more than 5 hours a week? Next who plays 1-4 hours per week? And who plays less than one hour per week? Ok now that the groups are formed, you will have about 40 minutes of game-time (Stanne et al., 1999; guideline 2). You can play the game as many times as you want, but the goal is to achieve the highest score you can by the end of the 40 minutes (Stanne et al., 1999; guideline 3). Those who have the highest score in their own group will win one of these prizes (describe available prizes, water bottles, hats, tshirts) (Stanne et al., 1999; guideline 1). Only one person can win a prize from each group, so it's up to you to try to get the best score in your group. You are free to ask me questions along the way but keep in mind that anything you talk about could be a clue for those you are competing against.

To help you gauge your progress compared to others in your group, I'm going to ask you to share your current scores with each other about every five minutes (Stanne et al., 1999; guideline 4). At the end of the 40 minutes we'll also have a short discussion on some of the main points of credit building to conclude the activity."

Cooperative transformational play (COTP) group. "The learning activity is based on a game I'll ask you to play on an iPad. This game is called *Night of the Living Debt.* As you might have guessed form the title, the game is about cartoon zombies who have taken over the financial system. In order to be successful in the game, you will have to learn to deal with these zombies effectively, just like you have to learn to deal with credit scores in real life. There are a lot of ways to play this game, but today I'm going to give each of you an iPad, and ask you to divide into groups of about 3 or 4 players each and cooperate with the other players in your group so that you all achieve a credit score of 720 or higher. This means that even if you achieve a score of 720 or higher by yourself, you are not successful until each of your teammates also achieves a score of 720 or higher (Johnson, Johnson, & Smith, 1998; guidelines 1 & 2). You will have about 40 minutes of game-time. If you have extra time after your team all achieves a 720 score you can play again to see if you can all achieve an even higher score. Those teams who get all of their members to a score of 720 or higher will win one of these prizes (describe available prizes, water bottles, hats, tshirts). You are encouraged to communicate with others in your group, offer pointers, and provide leadership if you learn something that works in the game (Johnson, Johnson, & Smith, 1998; guidelines 3 & 4). You can see how the rest of your team members are doing at any point by glancing at the credit score meter in the lower right corner of each player's screens (Johnson, Johnson, & Smith,

1998; guideline 5). You are also free to ask me questions about the game, but I won't give you any answers right away so that you have opportunities to figure it out from your own play experience. But know that at the end of the 40 minutes we'll also have a short discussion on some of the main points of credit building to conclude the activity."

Concluding Discussion Points for all Conditions

1. Why are credit and credit scores important?
    a. Future loans (car, house).
    b. Insurance
    c. Apartment
    d. Employment.
2. What type of loan is best for building credit?
    a. In order to use a credit card to build credit you should a) always pay the balance off each month and b) keep the balance low.
3. What type of loan is worst for building credit?
    a. Payday loans are expensive.
    b. Payday loans damage your credit even when used responsibly.
    c. Anyone can get a payday loan even with bad credit.
4. What things make your score drop the most?
    a. It only takes one or two missed payments to drop your score by 100 points
5. How many loans should you have at a time?
    a. Less than 7.
    b. Having more can damage you credit and be tough to keep up with.

APPENDIX P

Participant Post-test

☐ **Check this box only if you DO NOT want to participate in this research, then return the form to the instructor.** By filling out this assessment you are providing implied consent to let your answers be used anonymously for the research project which has been explained at the beginning of this class**. Please do not write you name anywhere on this form.**

Questions about knowledge: (Circle the answer that you think is most correct).

1. Which of the following statements about credit cards is most correct?
    a. Credit cards are expensive and damage credit scores and should always be avoided.
    b. Credit cards are inexpensive and build strong credit scores and should be used frequently.
    c. Credit cards are no better or worse than other types of loans.
    d. Credit cards can be good or bad for a credit score depending how they are used, so they should be used wisely.

2. How many times do you need to use a payday (subprime) loan to have a good credit score?
    a. 10
    b. 5
    c. 3
    d. None

3. What is the worst thing for your credit score?
    a. Missing a payment.
    b. Using only one type of loan.
    c. Having a new loan.
    d. Having a credit card.

4. What is the best thing to do if you can't afford a monthly loan payment?
    a. Ignore it and pay double next month.
    b. Ignore it and hope they forget about it.
    c. Pay a little bit this month and then try to make up for it next month.
    d. Call your lender and work out a payment plan so that you avoid missing any payments if possible.

5. The best way to use a credit card to build credit is to:
    a. Use it until you reach the maximum spending limit.
    b. Use just a little bit and pay it off every month.
    c. Always carry a balance by making just a minimum monthly payment.
    d. Don't use it at all.

6. To build a good credit score you should…
    a. Avoid all loans because they get you into trouble.
    b. Have only home and car loans.
    c. Have several payday loans.
    d. Have 2-3 revolving loans, like credit cards.

7. Good credit is not required for which of the following?
    a. Boat loan.
    b. Home loan.
    c. Car loan.
    d. Payday (subprime) loan.

8. Which of the following can be the most effective tool for building good credit, if used correctly?
    a. Credit card
    b. Student loan
    c. Car loan
    d. Payday loan

9. The single most important factor in building good credit is:
    a. Never miss a payment.
    b. Never check your own credit score.
    c. Never get a loan.
    d. Never pay off your full loan balance.

10. Which type of loan is the worst for your credit?
    a. Credit card.
    b. Student loan.
    c. Car loan.
    d. Payday (subprime) loan.

11. When using a credit card, which action is best for building credit?
    a. Always pay the full balance at the end of the month.
    b. Pay as much as possible, but always leave a little balance to carry over to the next month.
    c. Always pay a little bit, but leave most of the balance to carry over to the next month.
    d. Never pay the full balance.

12. Which of the following is a true statement about payday loans?
    a. They are great for building credit.
    b. They are inexpensive.
    c. Good credit is not needed to get one.
    d. They are great options for those with bad credit.

13. After missing 9 payments a typical person's (FICO) credit score will probably be about:
    a. 400-550
    b. 600-725
    c. 750-800
    d. 825-850

14. If you have a bad credit score, you can still get which of the following products at regular price?
    a. A home loan.
    b. A payday (subprime) loan.
    c. A credit card.
    d. An insurance policy.

15. The best way to build credit is to:
    a. Borrow as much money as you can.
    b. Borrow a small amount and pay it off regularly.
    c. Avoid borrowing any money.
    d. Borrow about half of the available amount and carry the balance from month to month.

16. Should millionaires worry about their credit?
    a. No. Because they have enough money they don't need loans.
    b. Yes. Because their credit will still be checked for other things like insurance, and elective medical services.
    c. No. Because millionaires are usually the ones giving other people loans.
    d. Yes. Because they need good credit to manage their investments.

17. Credit and credit scores will NOT impact this (select one):
    a. Job opportunities.
    b. Eligibility for apartment rentals.
    c. Cost of insurance rates.
    d. Eligibility for payday (subprime) loans.

18. What is the maximum possible FICO credit score?
    a. 1050
    b. 300
    c. 550
    d. 850
19. Your friend is using a credit card to build credit. What is the best advice you can give this person?
    a. Keep the balance high and never pay the full balance off.
    b. Keep the balance low and pay off the full balance every month.
    c. Use it only for emergencies and pay the balance off the next day.
    d. Use it only on large purchases and make only minimum payments.

Questions about engagement. (Instructions: Check the box that most closely describes your experience during the lesson.)

(Select one answer per row)	Strongly Disagree	Disagree	Somewhat disagree	Probably disagree	Probably agree	Somewhat agree	Agree	Strongly Agree
1. I got involved.								
2. I got nervous/anxious.								
3. I clearly knew what I was supposed to do.								
4. I got direct clues as to how well I was doing.								
5. I felt I could handle the demands of the situation.								
6. I felt self-conscious/insecure.								
7. I got bored.								
8. I had to make an effort to keep my mind on what was happening.								
9. I would have done it even if I didn't have to.								
10. I got distracted.								
11. Time passed quickly.								
12. I enjoyed the experience and/or the use of my skills.								

Questions about attitude. (Instructions: Check the box the most closely matches your attitude during the lesson).

	Disagree	Somewhat Disagree	Somewhat Agree	Agree
1. The lesson on credit scores is valuable and worth studying.				
2. It is worth learning those things about building credit scores.				
3. It is worth learning the content about how to build credit scores well.				
4. It is important to learn more about building credit scores, to never miss a loan payment and keep loan balances low.				
5. It is important to know the things that damage and build credit scores.				
6. I will actively search for more information and learn about credit scores.				
7. It is important for everyone to take this credit score lesson.				

Demographic information (Instructions: Please circle the answer that describes you).

Gender: Female Male

Age range: 17 or younger 18-30 31-50 51-65 65 or older

Ethnicity: African-American Asian Caucasian Hispanic Native American

Eskimo/Pacific Islander Other

Location: _____

APPENDIX Q

KR-20 Final Reliability Results of Performance Instrument

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	180	100.0
	Excluded[a]	0	.0
	Total	180	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.721	19

Item Statistics

	Mean	Std. Deviation	N
Q1	.9722	.16479	180
Q2	.9611	.19387	180
Q3	.9889	.10511	180
Q4	.8667	.34088	180
Q5	.9722	.16479	180
Q6	.8667	.34088	180
Q7	.9500	.21855	180
Q8	.9500	.21855	180
Q9	.9944	.07454	180
Q10	.9389	.24020	180
Q11	.8611	.34680	180
Q12	.7611	.42759	180
Q13	.9333	.25014	180
Q14	.8389	.36866	180
Q15	.9278	.25958	180
Q16	.7500	.43422	180
Q17	.9444	.22970	180
Q18	.9389	.24020	180
Q19	.9833	.12838	180

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	16.4278	4.347	-.030	.730
Q2	16.4389	3.957	.465	.700
Q3	16.4111	4.266	.176	.719
Q4	16.5333	3.960	.204	.721
Q5	16.4278	4.235	.134	.721
Q6	16.5333	3.658	.444	.693
Q7	16.4500	3.780	.619	.686
Q8	16.4500	4.148	.176	.719
Q9	16.4056	4.242	.342	.716
Q10	16.4611	3.848	.475	.695
Q11	16.5389	3.635	.452	.692
Q12	16.6389	3.629	.332	.710
Q13	16.4667	3.949	.344	.706
Q14	16.5611	3.678	.381	.701
Q15	16.4722	4.016	.259	.713
Q16	16.6500	3.927	.138	.738
Q17	16.4556	3.948	.386	.703
Q18	16.4611	3.959	.351	.706
Q19	16.4167	4.200	.260	.715

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
17.4000	4.353	2.08640	19

APPENDIX R

Cronbach's Alpha – Final Reliability Results for Engagement Instrument

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	180	100.0
	Excluded[a]	0	.0
	Total	180	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.848	12

Item Statistics

	Mean	Std. Deviation	N
Q1	6.7389	1.39177	180
Q2	6.7111	1.83537	180
Q3	6.0222	1.88409	180
Q4	6.2444	1.67005	180
Q5	6.4250	1.58509	180
Q6	6.5444	1.87998	180
Q7	6.9194	1.47433	180
Q8	6.4750	1.88738	180
Q9	5.7694	2.11431	180
Q10	6.6139	1.64336	180
Q11	6.5972	1.64274	180
Q12	6.6972	1.69414	180

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	71.0194	144.864	.472	.840
Q2	71.0472	142.220	.389	.846
Q3	71.7361	132.848	.604	.830
Q4	71.5139	138.258	.549	.834
Q5	71.3333	136.986	.623	.830
Q6	71.2139	140.874	.408	.845
Q7	70.8389	141.770	.532	.836
Q8	71.2833	136.241	.518	.837
Q9	71.9889	133.271	.510	.838
Q10	71.1444	138.898	.543	.835
Q11	71.1611	140.519	.498	.838
Q12	71.0611	135.577	.613	.830

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
77.7583	162.616	12.75209	12

APPENDIX S

Cronbach's Alpha – Final Reliability Results for Attitude Instrument

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	180	100.0
	Excluded[a]	0	.0
	Total	180	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.877	7

Item Statistics

	Mean	Std. Deviation	N
Q1	3.8889	.37949	180
Q2	3.9167	.33217	180
Q3	3.9139	.33355	180
Q4	3.9222	.32504	180
Q5	3.9389	.30202	180
Q6	3.5500	.66244	180
Q7	3.7222	.55988	180

Item-Total Statistics

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Q1	22.9639	3.978	.777	.847
Q2	22.9361	4.103	.806	.848
Q3	22.9389	4.102	.803	.848
Q4	22.9306	4.108	.823	.847
Q5	22.9139	4.201	.813	.850
Q6	23.3028	3.697	.456	.916
Q7	23.1306	3.616	.643	.868

Scale Statistics

Mean	Variance	Std. Deviation	N of Items
26.8528	5.298	2.30175	7

Descriptives

C_Score

	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
TRA	50	26.6800	2.15179	.30431	18.00	28.00
ITP	41	26.6341	3.49110	.54522	7.00	28.00
CMTP	43	27.4302	1.16793	.17811	23.00	28.00
COTP	46	26.6957	1.87225	.27605	21.00	28.00
Total	180	26.8528	2.30175	.17156	7.00	28.00

APPENDIX T

Performance Outliers

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total_score	180	100.0%	0	0.0%	180	100.0%

Descriptives

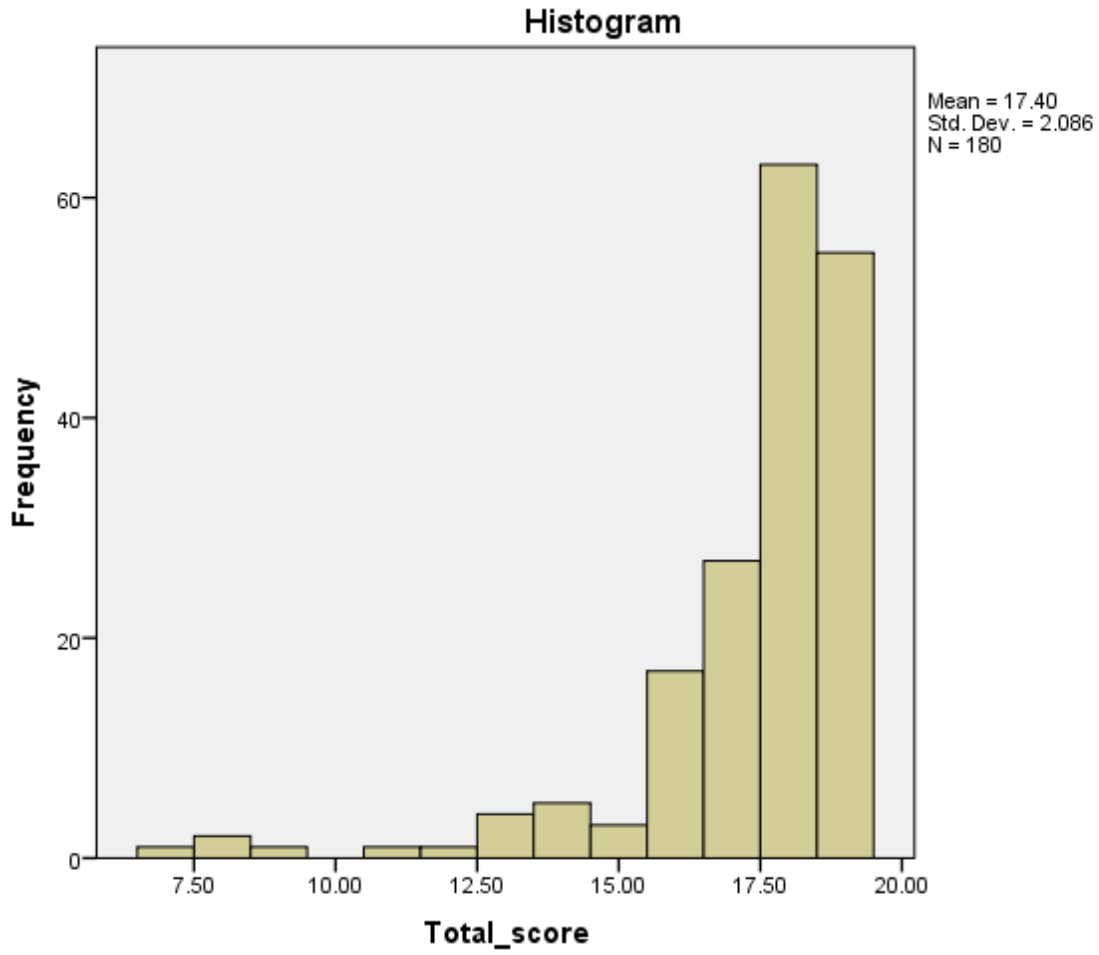
			Statistic	Std. Error
Total_score	Mean		17.4000	.15551
	95% Confidence Interval for Mean	Lower Bound	17.0931	
		Upper Bound	17.7069	
	5% Trimmed Mean		17.6975	
	Median		18.0000	
	Variance		4.353	
	Std. Deviation		2.08640	
	Minimum		7.00	
	Maximum		19.00	
	Range		12.00	
	Interquartile Range		2.00	
	Skewness		-2.604	.181
	Kurtosis		8.388	.360

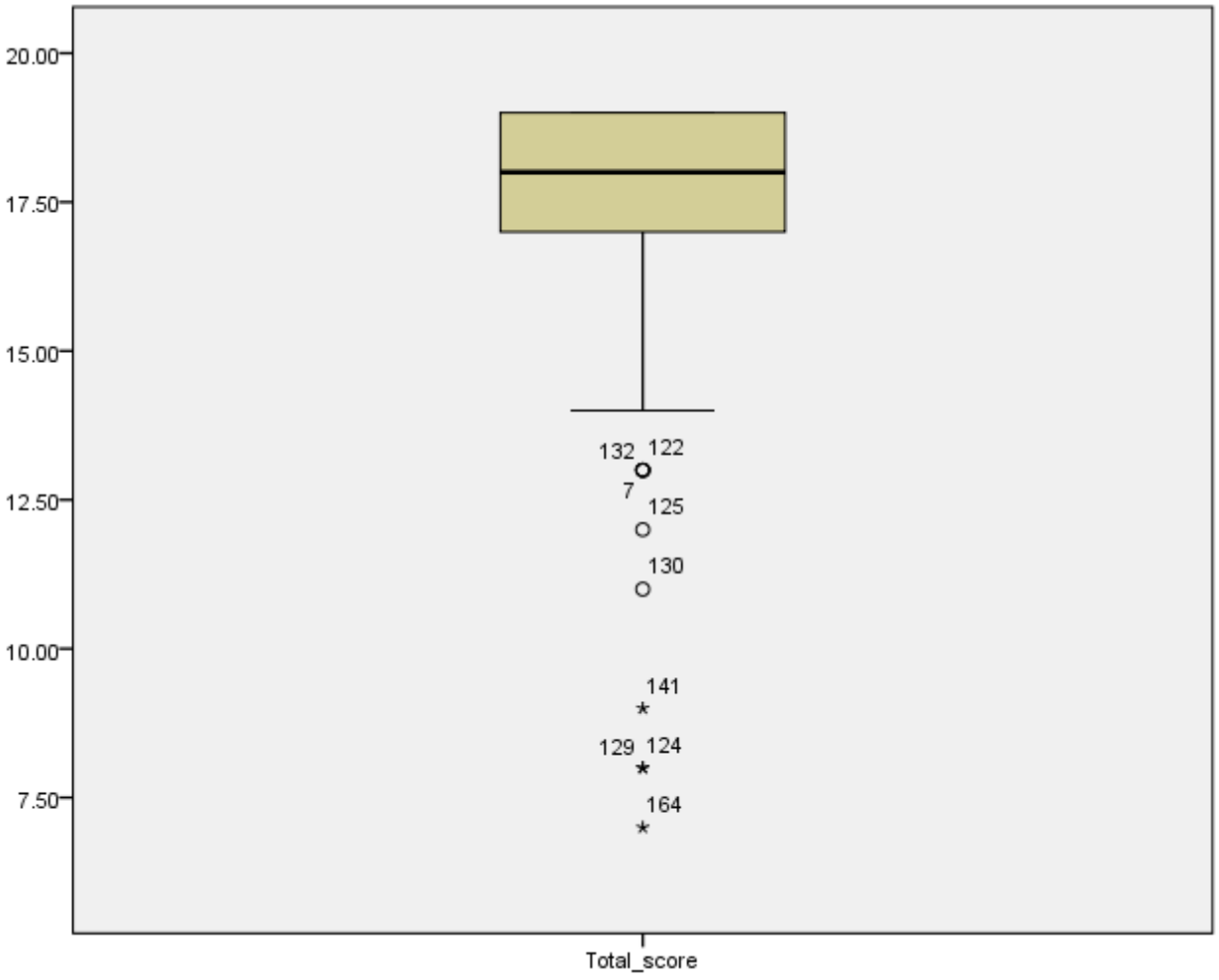
Extreme Values

			Case Number	Value
Total_score	Highest	1	3	19.00
		2	5	19.00
		3	14	19.00
		4	15	19.00
		5	17	19.00[a]
	Lowest	1	164	7.00
		2	129	8.00
		3	124	8.00
		4	141	9.00
		5	130	11.00

a. Only a partial list of cases with the value 19.00 are shown in the table of upper extremes.

Total_score


Histogram
Mean = 17.40
Std. Dev. = 2.086
N = 180
Frequency
60
40
20
0
7.50
10.00
12.50
15.00
17.50
20.00
Total_score


20.00
17.50
15.00
12.50
10.00
7.50
132
122
7
125
130
141
129
124
164
Total_score

APPENDIX U

Performance Data with Winsorized Outliers

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Total_score	180	100.0%	0	0.0%	180	100.0%

Descriptives

			Statistic	Std. Error
Total_score	Mean		17.5833	.10942
	95% Confidence Interval for Mean	Lower Bound	17.3674	
		Upper Bound	17.7992	
	5% Trimmed Mean		17.7037	
	Median		18.0000	
	Variance		2.155	
	Std. Deviation		1.46800	
	Minimum		14.00	
	Maximum		19.00	
	Range		5.00	
	Interquartile Range		2.00	
	Skewness		-1.168	.181
	Kurtosis		.606	.360

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Total_score	.267	180	.000	.816	180	.000

a. Lilliefors Significance Correction

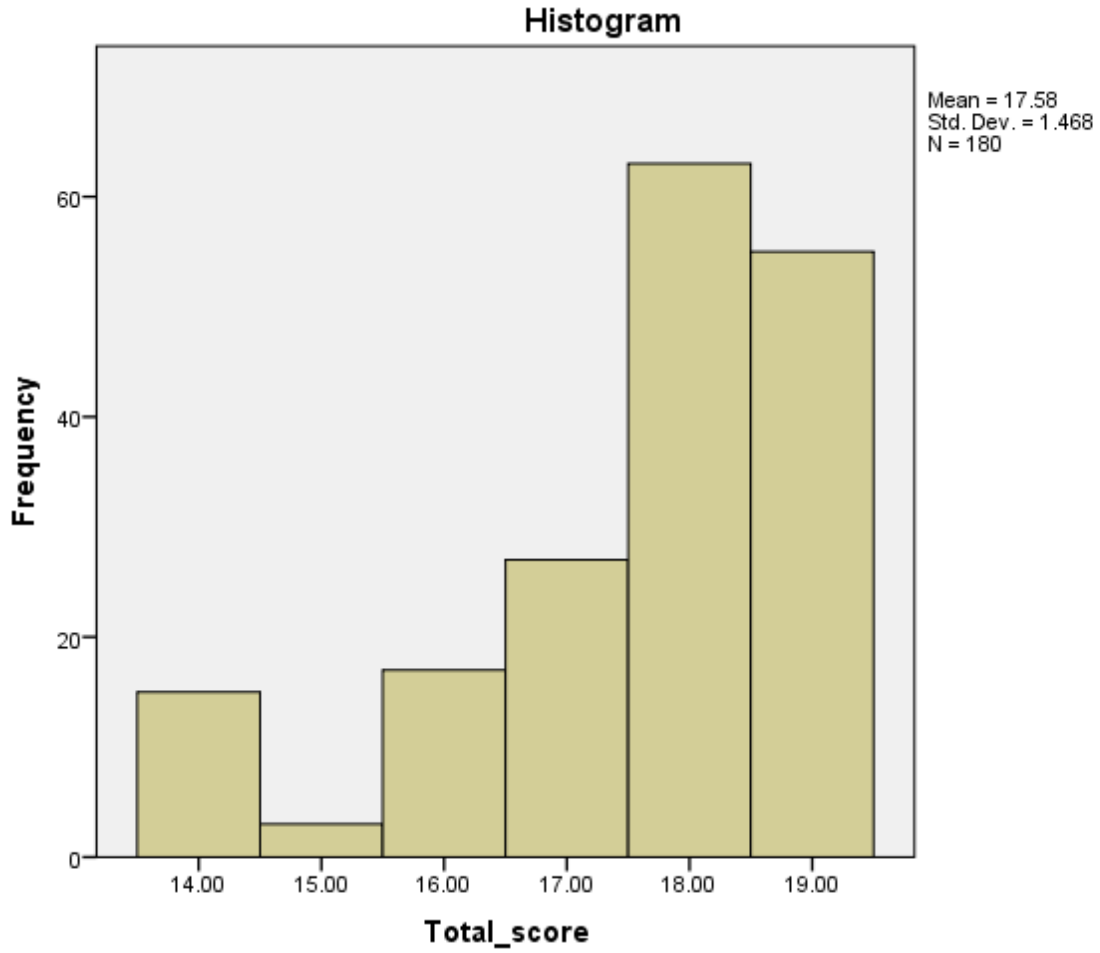
Extreme Values

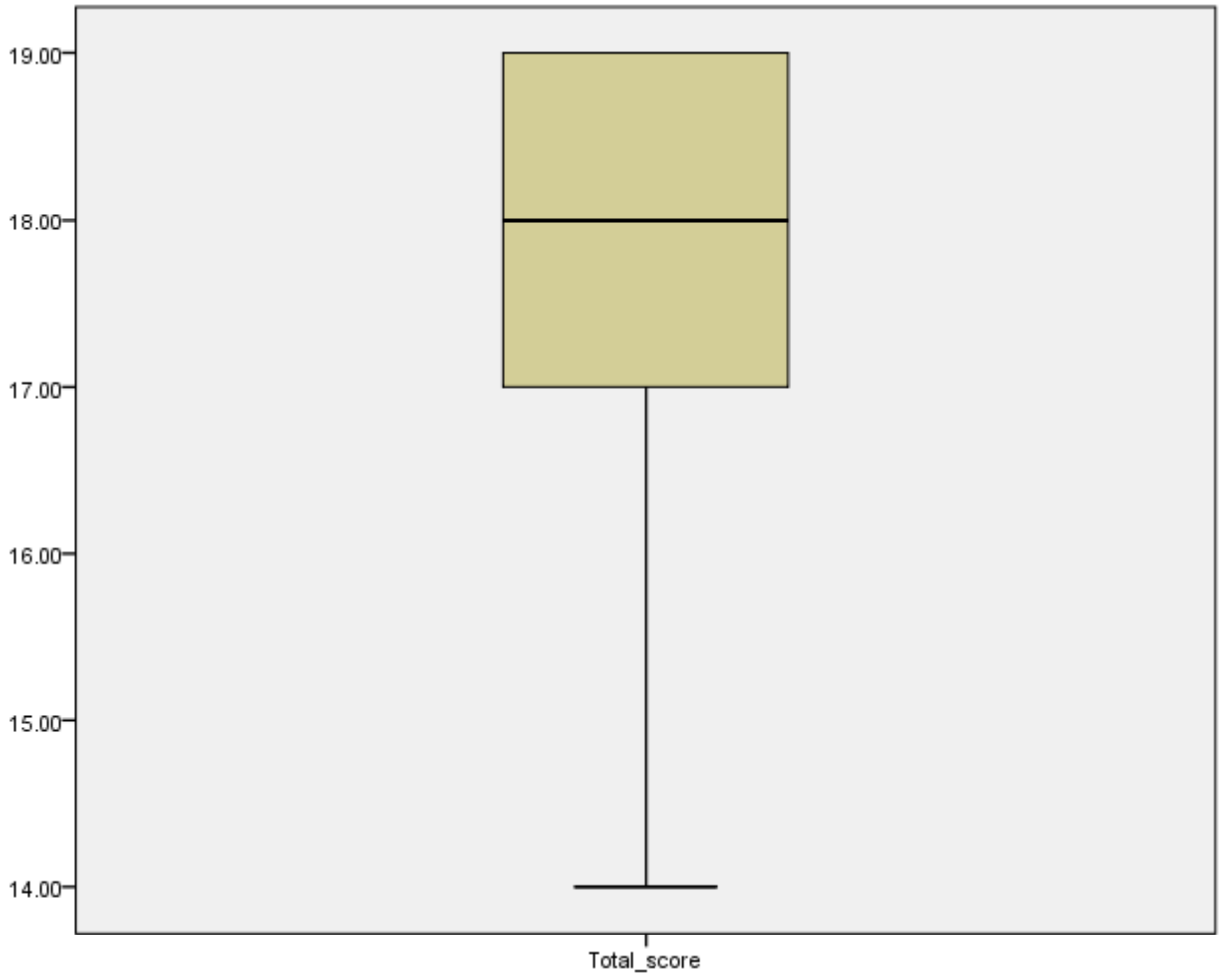
			Case Number	Value
Total_score	Highest	1	3	19.00
		2	5	19.00
		3	14	19.00
		4	15	19.00
		5	17	19.00[a]
	Lowest	1	164	14.00
		2	156	14.00
		3	142	14.00
		4	141	14.00
		5	135	14.00[b]

a. Only a partial list of cases with the value 19.00 are shown in the table of upper extremes.

b. Only a partial list of cases with the value 14.00 are shown in the table of lower extremes.

Total_score


Histogram
Mean = 17.58
Std. Dev. = 1.468
N = 180
Frequency
60
40
20
0
14.00
15.00
16.00
17.00
18.00
19.00
Total_score


19.00
18.00
17.00
16.00
15.00
14.00
Total_score

APPENDIX V

Engagement Outliers

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Composite_Score	180	100.0%	0	0.0%	180	100.0%

Descriptives

			Statistic	Std. Error
Composite_Score	Mean		77.7583	.95048
	95% Confidence Interval for Mean	Lower Bound	75.8827	
		Upper Bound	79.6339	
	5% Trimmed Mean		78.3148	
	Median		79.5000	
	Variance		162.616	
	Std. Deviation		12.75209	
	Minimum		42.00	
	Maximum		96.00	
	Range		54.00	
	Interquartile Range		18.00	
	Skewness		-.542	.181
	Kurtosis		-.380	.360

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Composite_Score	.093	180	.001	.958	180	.000

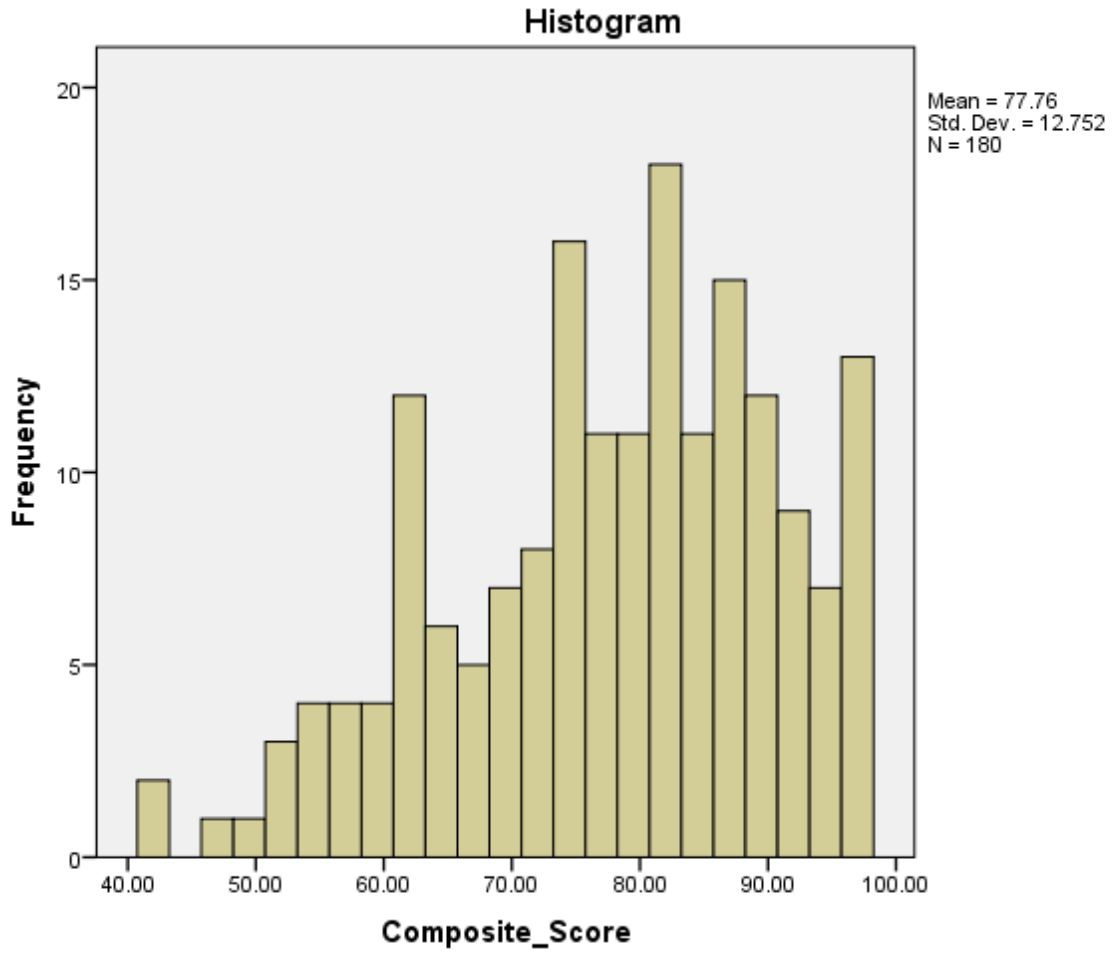
a. Lilliefors Significance Correction

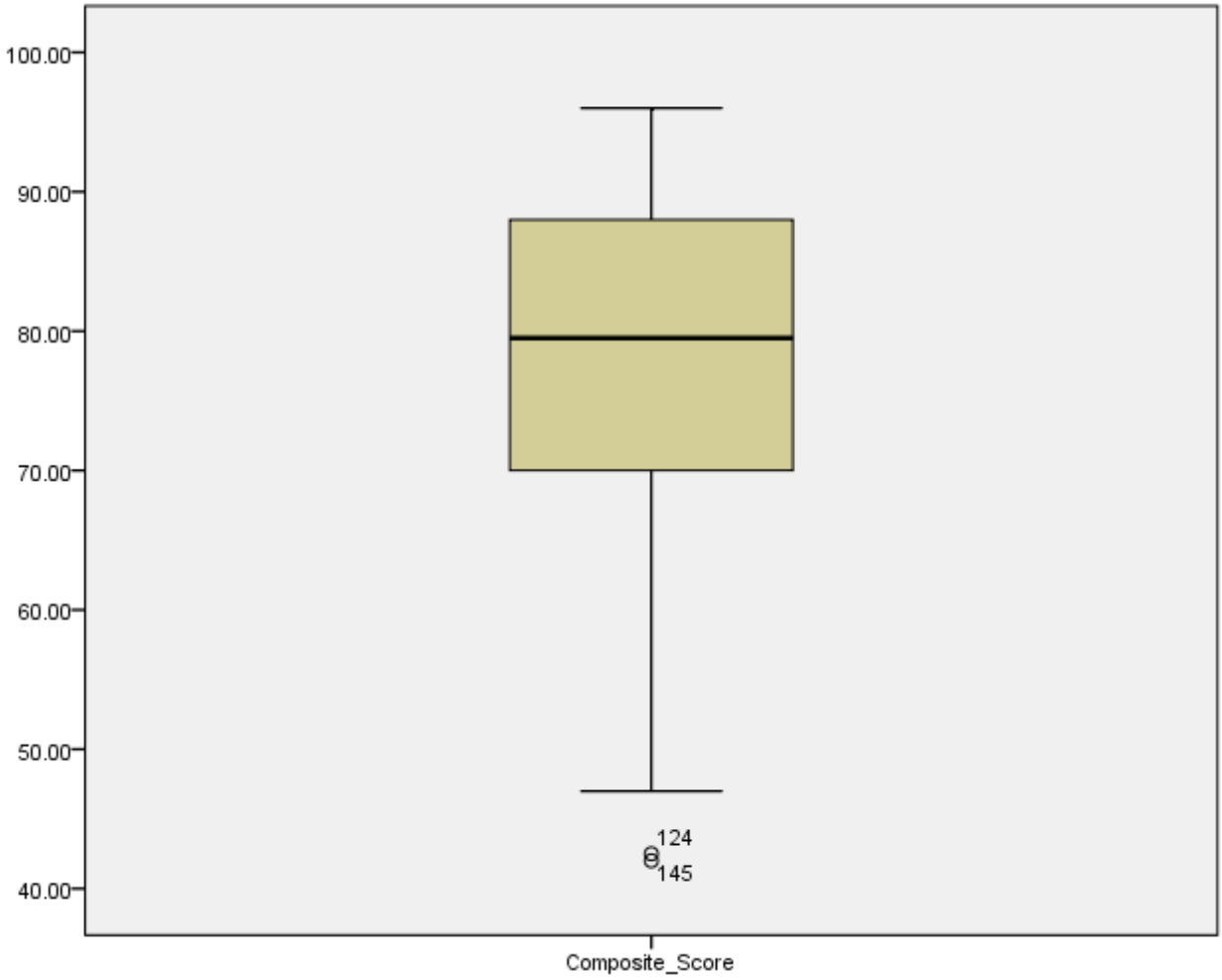
Extreme Values

			Case Number	Value
Composite_Score	Highest	1	3	96.00
		2	10	96.00
		3	39	96.00
		4	47	96.00
		5	49	96.00[a]
	Lowest	1	124	42.00
		2	145	42.50
		3	9	47.00
		4	156	49.50
		5	125	51.00

a. Only a partial list of cases with the value 96.00 are shown in the table of upper extremes.

128




100.00
90.00
80.00
70.00
60.00
50.00
40.00
124
145
Composite_Score

APPENDIX W

Engagement - Test of Normality for Reflected Square-Root Data Transformation

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
CS_sqrt	180	100.0%	0	0.0%	180	100.0%

Descriptives

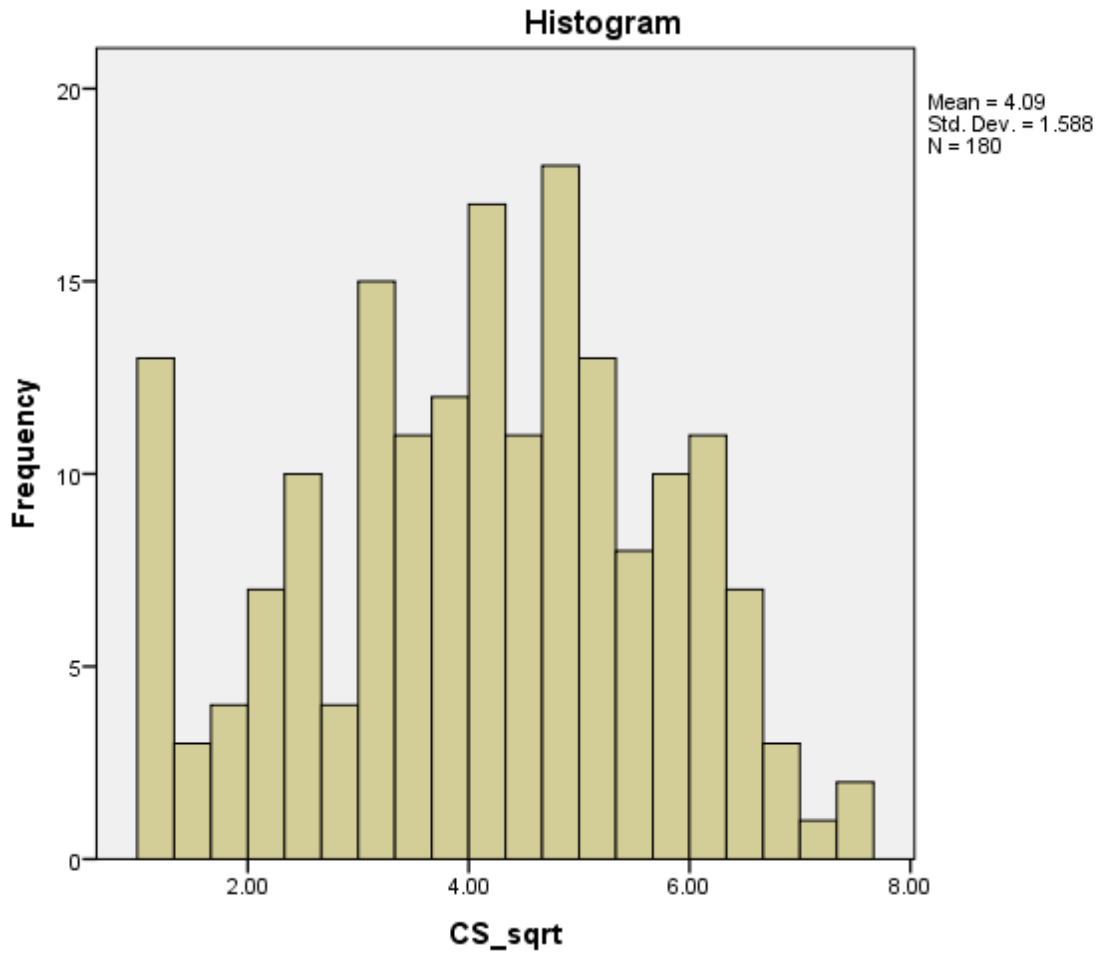
			Statistic	Std. Error
CS_sqrt	Mean		4.0906	.11839
	95% Confidence Interval for Mean	Lower Bound	3.8570	
		Upper Bound	4.3242	
	5% Trimmed Mean		4.1071	
	Median		4.1829	
	Variance		2.523	
	Std. Deviation		1.58831	
	Minimum		1.00	
	Maximum		7.42	
	Range		6.42	
	Interquartile Range		2.20	
	Skewness		-.231	.181
	Kurtosis		-.607	.360

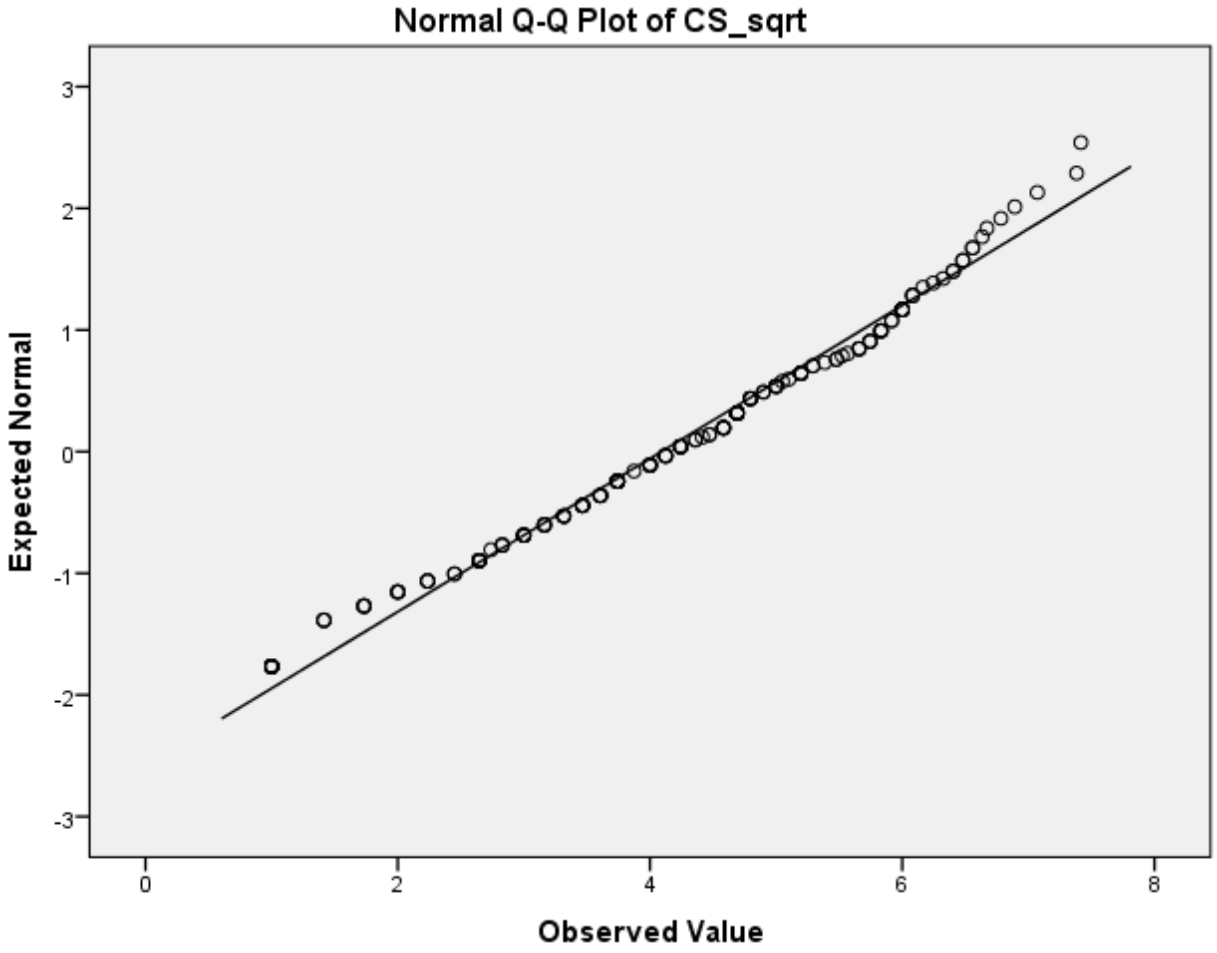
Tests of Normality

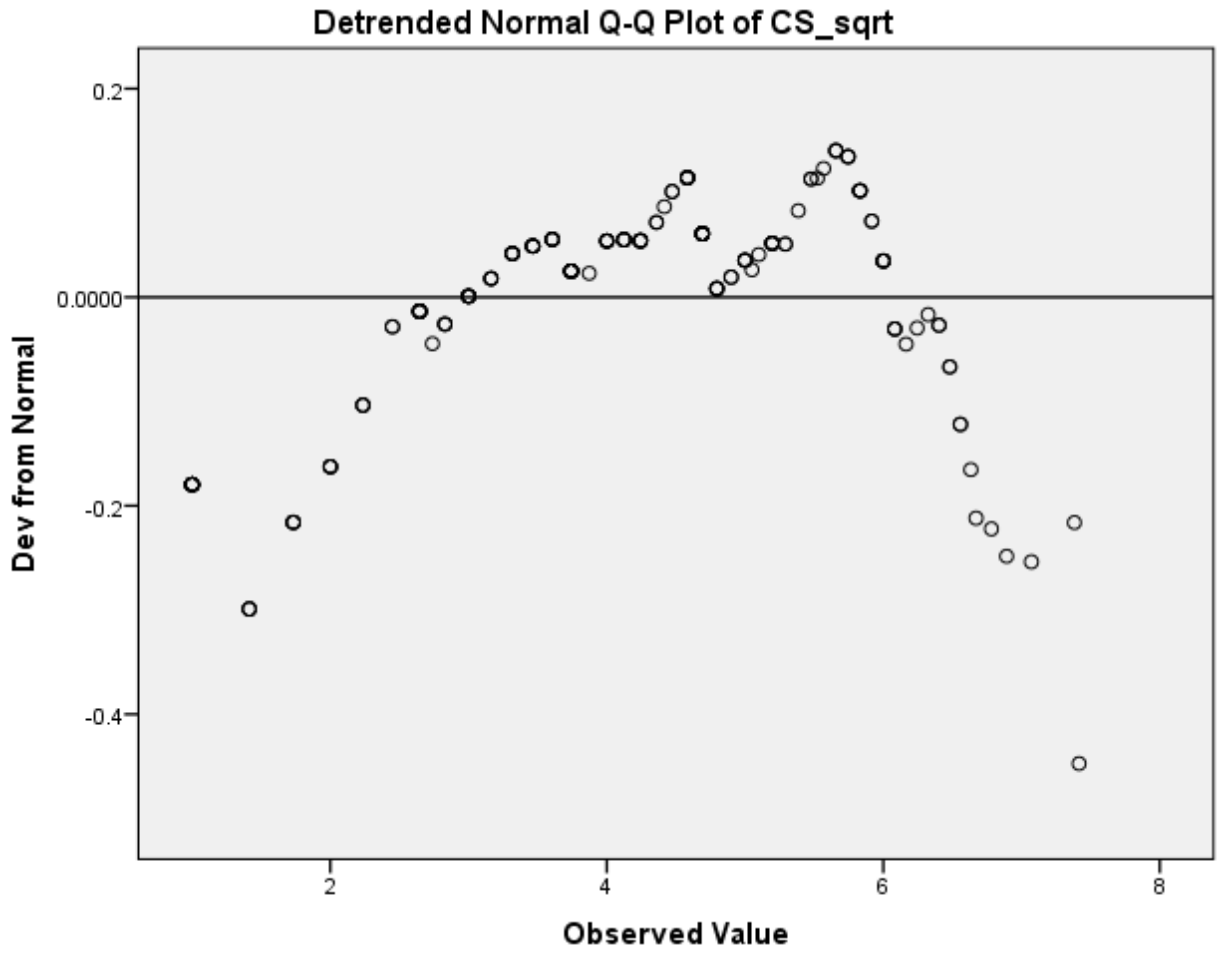
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
CS_sqrt	.061	180	.200*	.976	180	.003

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction


Histogram
Mean = 4.09
Std. Dev. = 1.588
N = 180
Frequency
20
15
10
5
0
2.00
4.00
6.00
8.00
CS_sqrt


Normal Q-Q Plot of CS_sqrt
Expected Normal
3
2
1
0
-1
-2
-3
0
2
4
6
8
Observed Value


Detrended Normal Q-Q Plot of CS_sqrt
Dev from Normal
0.2
0.0000
-0.2
-0.4
2
4
6
8
Observed Value

APPENDIX X

Attitude Outliers

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
C_Score	180	100.0%	0	0.0%	180	100.0%

Descriptives

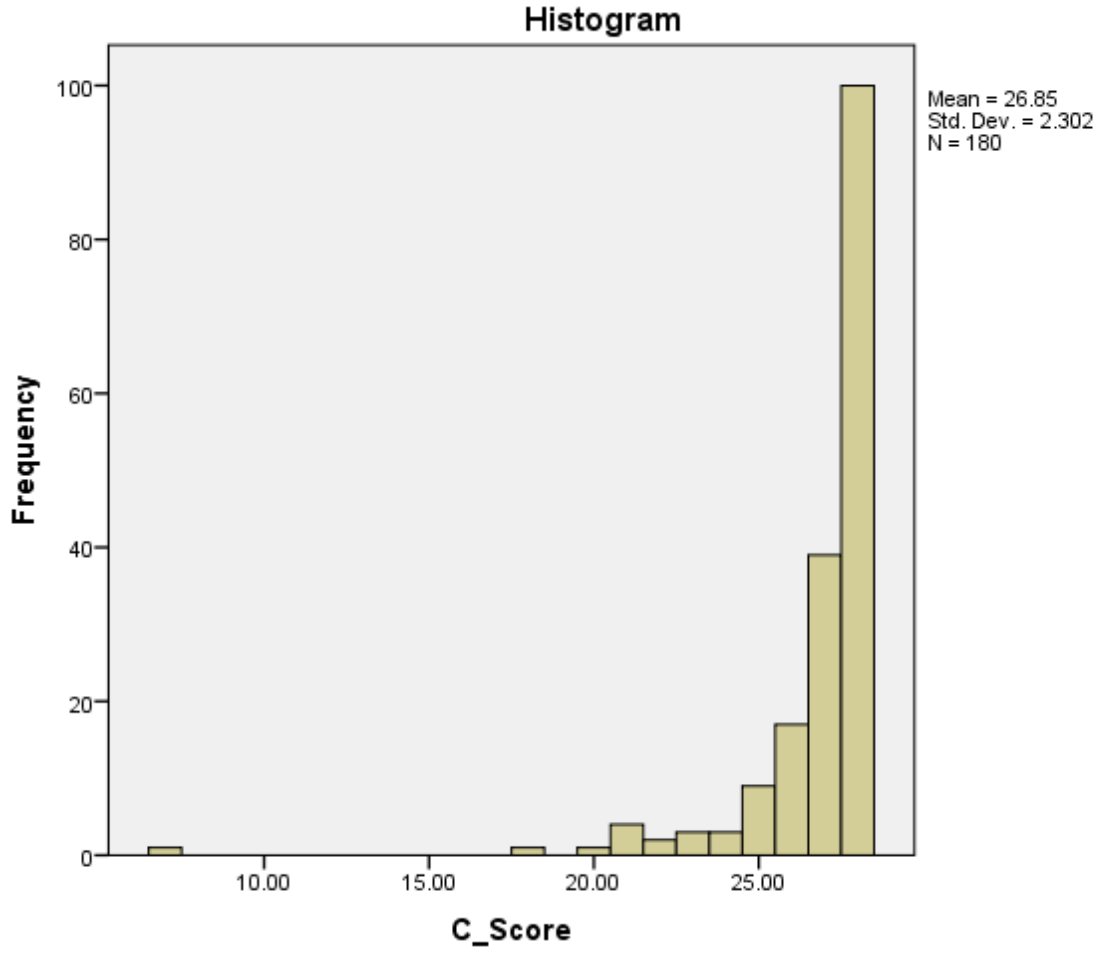
			Statistic	Std. Error
C_Score	Mean		26.8528	.17156
	95% Confidence Interval for Mean	Lower Bound	26.5142	
		Upper Bound	27.1913	
	5% Trimmed Mean		27.2130	
	Median		28.0000	
	Variance		5.298	
	Std. Deviation		2.30175	
	Minimum		7.00	
	Maximum		28.00	
	Range		21.00	
	Interquartile Range		1.00	
	Skewness		-4.646	.181
	Kurtosis		32.069	.360

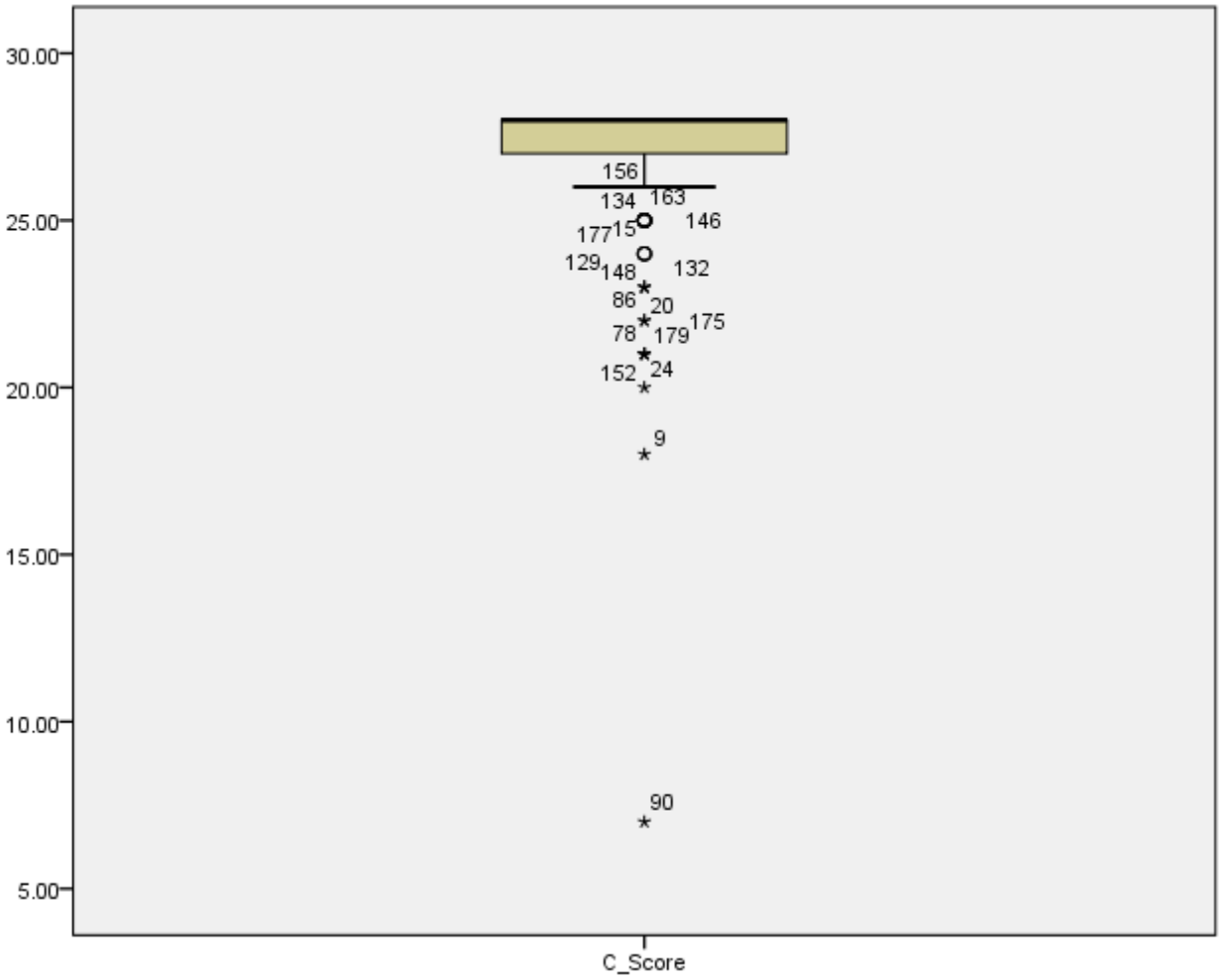
Extreme Values

			Case Number	Value
C_Score	Highest	1	2	28.00
		2	3	28.00
		3	6	28.00
		4	7	28.00
		5	10	28.00[a]
	Lowest	1	90	7.00
		2	9	18.00
		3	24	20.00
		4	179	21.00
		5	152	21.00[b]

a. Only a partial list of cases with the value 28.00 are shown in the table of upper extremes.

b. Only a partial list of cases with the value 21.00 are shown in the table of lower extremes.


Histogram
Mean = 26.85
Std. Dev. = 2.302
N = 180
Frequency
100
80
60
40
20
0
10.00
15.00
20.00
25.00
C_Score


30.00
25.00
20.00
15.00
10.00
5.00
156
134
163
177
15
146
129
148
132
86
20
78
179
175
152
24
9
90
C_Score

APPENDIX Y

Attitude – Ten Extreme Outliers Winsorized

Explore

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
W_Score	180	100.0%	0	0.0%	180	100.0%

Descriptives

			Statistic	Std. Error
W_Score	Mean		27.2083	.08158
	95% Confidence Interval for Mean	Lower Bound	27.0473	
		Upper Bound	27.3693	
	5% Trimmed Mean		27.3302	
	Median		28.0000	
	Variance		1.198	
	Std. Deviation		1.09452	
	Minimum		23.00	
	Maximum		28.00	
	Range		5.00	
	Interquartile Range		1.00	
	Skewness		-1.481	.181
	Kurtosis		2.006	.360

Extreme Values

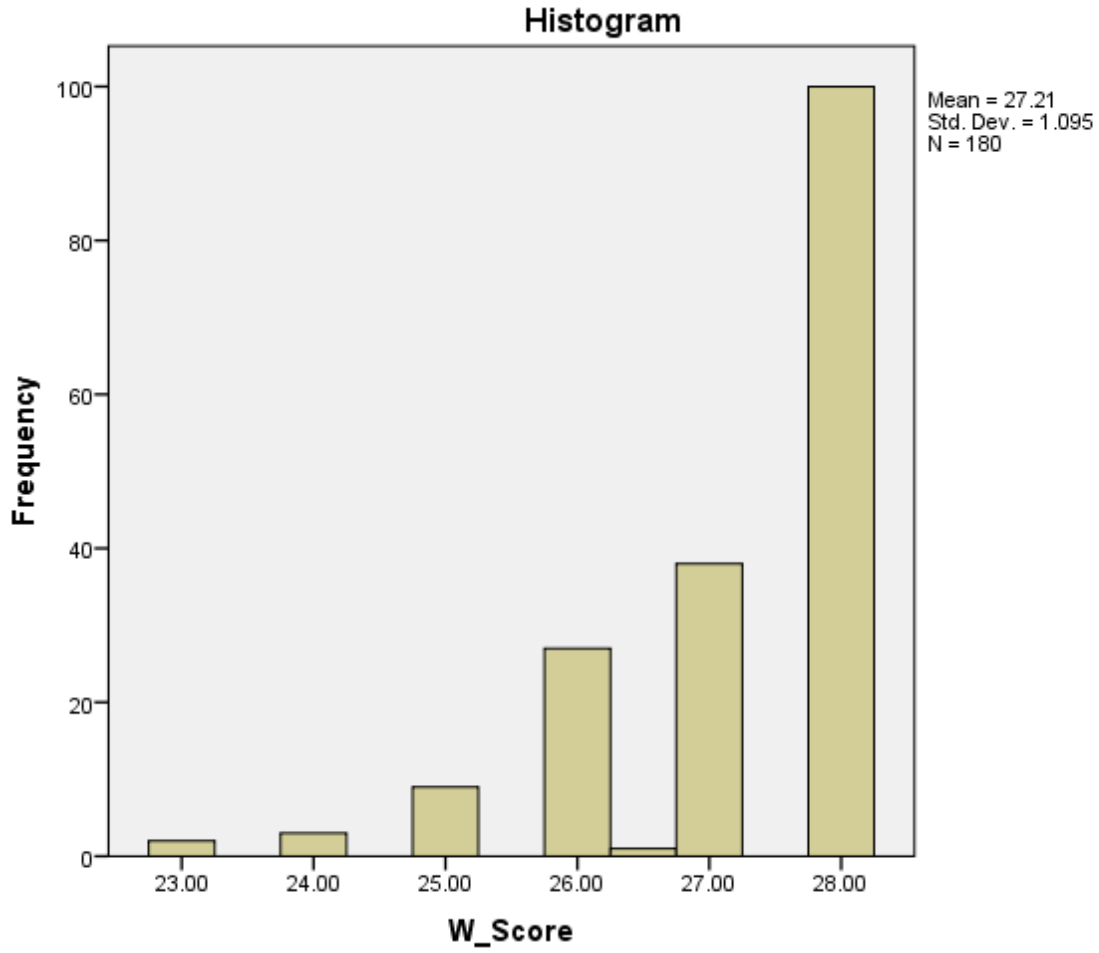
			Case Number	Value
W_Score	Highest	1	2	28.00
		2	3	28.00
		3	6	28.00
		4	7	28.00
		5	10	28.00[a]
	Lowest	1	132	23.00
		2	20	23.00
		3	177	24.00
		4	129	24.00
		5	15	24.00

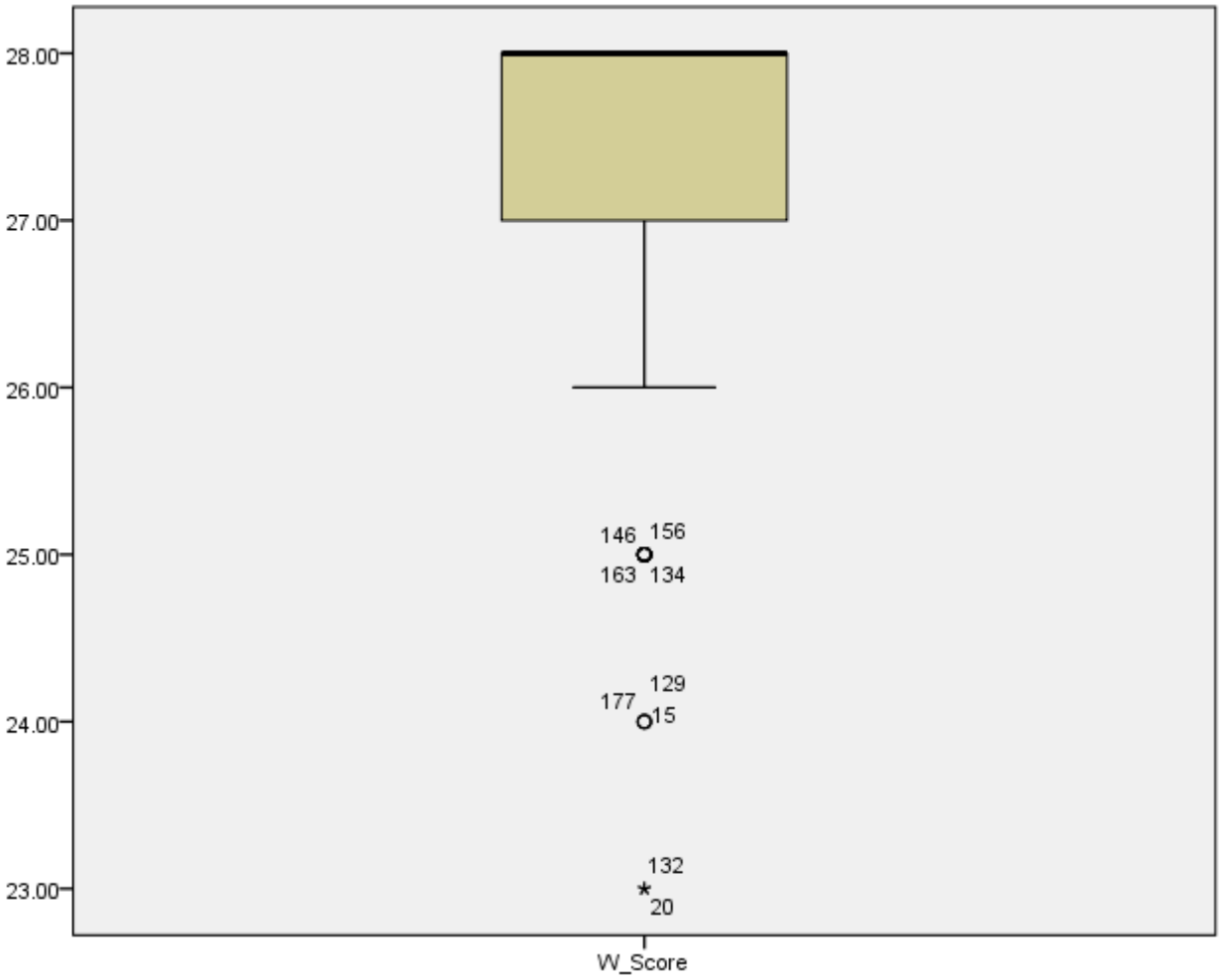
a. Only a partial list of cases with the value 28.00 are shown in the table of upper extremes.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
W_Score	.321	180	.000	.739	180	.000

a. Lilliefors Significance Correction




28.00
27.00
26.00
25.00
24.00
23.00
146
156
163
134
129
177
15
132
20
W_Score