# TRIGGERING STUDENT INTEREST IN CLASSROOM SUBJECTS THROUGH THE USE OF BOARD GAMES

By
ERIK A. DEWEY

Bachelor of Science in Business Administration
University of Tulsa
Tulsa, Oklahoma
1992

Masters of Business Administration
Southern Nazarene University
Bethany, Oklahoma
2003

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TRIGGERING STUDENT INTEREST IN CLASSROOM

SUBJECTS THROUGH THE USE OF BOARD GAMES

Dissertation Approved:

Dr. Michael Yough

Dissertation Advisor

Dr. Jane Vogler

Committee Chair

Dr. James May

Expert Member

Dr. Penny Thompson

Outside Member

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Abstract:

The purpose of this paper is to study whether playing a subject-related game in class increases a student's interest in the class subject, their perception of the learning climate, and their engagement in the classroom. The lens through which this research was focused was based on Hidi and Renninger's Four-Phase Interest Model that discusses how initial environmental triggers can lead to internal interest and motivation in a topic. The primary question was could game play in the classroom be that trigger and lead to greater interest in U.S. History. Secondarily, would the game play have any effect on increased classroom engagement and a more positive perception of the learning climate? The students involved all filled out an instrument to measure their pre-intervention levels in the four phases of interest model, classroom engagement, and perceptions of learning climate. From there, the students were split into an intervention group that played the game multiple times in the classroom and a control group that continued with class as normal. At the end of the intervention, the students filled out the instrument again. The results were analyzed using MANCOVA and ANCOVA, along with correlations between the various subscales in the instrument.

The MANCOVA and ANCOVA revealed no significant difference between the control and intervention groups on any of the phases of interest, perception of learning climate, and classroom engagement. The correlations between the subscales in the instrument did show significant correlations between them for almost all of the items, showing relationships between most of the phases of interest, perceptions of learning climate, and classroom engagement. Observation of the intervention and interviews with the teachers involved did show positive responses and evidence of learning through game play. These findings show that more research is needed to help determine the best way to incorporate games into the classroom to impact student's interest and success in the classroom.

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# CHAPTER I – INTRODUCTION

Increased motivation of the student is one of the argued benefits of gameplay in the classroom, but in order to better understand it, it is important to determine what underlying motivational theory is most applicable to this type of learning in the classroom. Studies have established that a student with interest in the subject matter being taught will be more motivated to succeed in the class (Hao, Yunhuo, & Zhou, 2018; Subrahmanyam & Renukarya, 2015; Sørebø & Hæhre, 2012; Hess & Gunter, 2013). The challenge becomes not only how do we trigger that interest in the student, but also how to understand the effects of that triggered interest in the student, even if that interest does not directly result in higher scores in the class.

One method that has been incorporated into some studies is the inclusion of games, typically video games, into the classroom to generate interest and allow application of concepts. While video games can be a good choice for inclusion in the classroom because they can help simulate concepts and generate excitement in students who are looking for something different in the classroom (Annetta, Murray, Laird, Bohr, & Park, 2006; Echeverri & Sadler, 2011; Gareau & Guo, 2009; Gate & Kalczynski, 2016), there are some significant drawbacks to their use. First, they require classroom infrastructure and technology be available. Computers, displays, internet connections, student access, and technical support, all must be in place in order for the game to work. Also, many games allow only one set of inputs at a time, meaning only one student can

take their turn at any point in time. Even multi-player games have limited inputs, typically four or less, only allowing small groups to play at the same time. The other students are required to either wait or plan their strategy until it is their opportunity to engage with the game. Board and card games give the benefit of engaging groups of students at the same time, keeping all players involved in the game as it goes on. Even if the players are waiting for their turn to occur, they must still pay attention to what other players are doing in order to make the best choice during their turn. Also, there is little to no infrastructure needed to play board and card games, just the game itself and an area to set up. Lastly, board and card games can be economical compared to other teacher assets and enough games for an entire class can often be purchased cheaply (under $60, while the cost for a single video game console is over $200.)

What remains unknown is what impact these games have on a student's interest in a topic and what impact these games have on learning environment and student engagement.

**Student Interest**

Hidi and Renninger (2006) proposed a Four-Phase model of interest, where Triggered Situational Interest can become Well-Developed Individual Interest, transitioning from extrinsic motivation to intrinsic motivation. Triggered Situational Interest can be initialized by the environment, and if the student's interest can be maintained from that initial triggering, it can lead to the student more fully engaging with the subject and being motivated to continue learning (Hidi & Renninger, 2006).

Table 1

*Summary of the Four-Phase model*[1]

| Order | Phase | Description |
|---|---|---|
| 1. | Triggered Situational Interest | Short-term change in cognitive and affective processing. |
| 2. | Maintained Situational Interest | Engage with the triggering incident for an extended period of time. |
| 3. | Emerging Individual Interest | An internal state of interest in the subject and an association with positive feelings, stored knowledge, and stored value. |
| 4. | Well-Developed Individual Interest | An enduring affinity for the subject and continued engagement over long periods of time. |

[1] Note – Based on work by Hidi and Renninger (2006).

Student's internal interest in a topic is a constant concern for teachers at all levels (Adams & Willis, 2015; Chak, 2007; Engel, 2013; Hidi & Jarackiewicz, 2000). Curiosity about a subject is a powerful motivator for a student, often sending he or she in a learning direction instigated all on their own (Hao, Yunhuo & Zhou, 2018). Being able to measure a teacher or program's effect on curiosity, however, can be a difficult task. Interest has been used as a construct to help measure this phenomenon (Schmitt, 2008). In scholarly works, the concept of interest as related to curiosity and motivation has been broken into two classifications; situational and individual (Hidi & Renninger, 2006; Knogler, Harackiewicz, Gegenfurtner, & Lewalter, 2015; Roberts, 2015; Clapper, 2014). Situational interest is "focused attention and the affective reaction that is triggered in the

moment by environmental stimuli, which may or may not last over time" (Hidi & Renninger, 2006, p. 113) and individual interest is "a person's relatively enduring predisposition to reengage particular content over time as well as to the immediate psychological state when this predisposition has been activated" (Hidi & Renninger, 2006, p. 113). Situational interest gains the student's attention and encourages reengaging with that content. Ideally, this reengagement will become a more enduring interest and shift from situational to individual.

**Student Motivation**

Linking a student's motivation to their learning outcomes through game play requires looking at aspects of game play that interact well with the motivational theory. Ryan and Deci's (2017) Self-Determination Theory (SDT) focuses on how a person's personality develops through social context. By their nature games are a social construct, you play them with others and your choices are based partially on their actions, so Self-Determination Theory fits well in this context.

In SDT every person has three innate psychological needs: autonomy (the need to be in control of one's own life), competence (the ability to control outcomes), and relatedness (the need to interact and be connected to others) (Ryan & Deci, 2017). As these needs are filled, a person is said to have better well-being and health (Ryan & Deci, 2017).

In order to fill these three needs, a person needs to be driven towards activities that reinforce these needs as well as lead to greater control over them (Ryan & Deci, 2017). They describe the motivation to fulfill these needs in two categories, intrinsic and extrinsic (Ryan & Deci, 2017). Intrinsic motivation is a natural internal drive, often

received from social context and support such as feedback or comradery (Ryan & Deci, 2017). Extrinsic motivation comes from external sources and often guides the person towards a goal (Ryan & Deci, 2000).

In education, one of the goals of this theory is to help guide instructors to design experiences for students to fulfill these psychological needs through extrinsic structures that, ideally, will enhance the student's own intrinsic behaviors (Hess & Gunter, 2013). Teachers can design areas like curriculum, assignments, projects, and discussions to help trigger extrinsic motivation towards learning and through that move closer to intrinsic motivation (Hess & Gunter, 2013).

The learning environment, or learning climate, can also play a role in supporting or thwarting students' psychological needs (Gillen, Wright, & Spink, 2011). As a student's autonomy is supported by the learning climate, the student will tend to find their intrinsic motivation maintained or enhanced (Black & Deci, 2000). In addition, as the student becomes more connected to the classroom and the subject, they experience a higher level of classroom engagement (Gareau & Guo, 2009). Activities and characteristics of a student with high classroom engagement include higher participation in class activities, asking probing questions, showing interest in the material presented, and putting effort in class assignments (Dennie, Acharya, Greer, & Bryant, 2019).

**Board/Card Games**

Studies have shown high intrinsic motivation with students and video games (Gee, 2003). This motivation causes the students to seek out greater information on the game in order to help them to win, and when faced with a challenge, continue their attempts (Gee, 2003). New strategies need to be determined, research needs to be done,

and connections with others who play the same game are forged. This process mirrors the four stages of interest occurring while a student is playing a new video game. First the student learns the controls and what the game expects of them (Triggered Situational Interest). From there the student discovers the challenges that the game world presents. Faced with these challenges the student either abandons the game entirely or seeks out greater skill (Maintained Situational Interest). This greater skill can come from practice, research, or communication. When the challenge has been defeated, they move on to another one, typically a greater one (Emerging Individual Interest). The cycle continues as they play the game, shifting easily into the fourth phase of interest. By the time they have completed the game, the player has gained a significant amount of information about the game and the world the game presents.

Capturing that same interest for a particular school subject could lead to students initiating learning on their own in addition to what happens in the classroom. In order to help activate this enthusiasm, educators need to find a way to start at phase one and trigger the situational interest. Looking at students of all ages, the inclusion of a game of some kind into the normal classroom could lead to excitement and interest, even if it is simply from moving away from the standard class practice.

In Manero's work (2015), the author cites that multiple studies have shown video games added to a class can increase interest in the class's subject, improve learning performance, and provide a more interesting learning environment, but this only allows school districts that can afford the technology and infrastructure to utilize this option. There are few studies that look at the impact of non-electronic games in the classroom. Even in relatively wealthy school districts, the logistics of having multiple computer

stations with licensed software and internet connections can cause difficulty in creating situational interest if the opportunity to play these educational games only happens on occasion. With non-electronic games, multiple students can interact with the game at the same time, there is social reinforcement with the interest and knowledge gain, there are no technological barriers, and the cost is a relatively low single-time cost. An entire classroom could have enough games that every student is engaged at the same time for under $200.

**Research Questions**

The purpose of this study is to see what impact playing a card game in a U.S. History class has on the students in that class. Specifically, I want to examine the changes in the students as they play games in class in regards to their Situational Interest in the class, their Individual Interest in the class, their perception of the learning climate, and their engagement with the class room.

The research questions this study will focus on are:

(a) Do students who play a U.S. History-related game in the classroom have higher Situational Interest in U.S. History than students who do not?

(b) Do students who play a U.S. History-related game in the classroom have higher Individual Interest in U.S. History versus students who do not?

(c) Do students who play a U.S. History-related game in the classroom have a higher level of classroom engagement than students who do not?

(d) Do students who play a U.S. History-related game in the classroom have a higher measure of perceived positive learning climate than students who do not?

## Significance of the Study

While other studies have researched the impact of video games in the classroom (Afari et al., 2012; Gates & Kalczynski, 2016; Stieler-Hunt & Jones, 2015; Subrahmanyam & Renukarya, 2015; Sorebo & Haehre 2012), the researchers tend to look for improvement in test scores or grades. Likewise, the focus on video games requires the classroom and the teacher to have access to the infrastructure for the game and the skills to run the game for the class. By using board and card games in the classroom there are no infrastructure requirements, only the game itself, and the games come with instructions on how to use them so no special training is required for the teacher.

By examining the impact that playing games in the classroom has on the student's Situational Interest, this study helps to apply some practical application of the Four-Phase model in helping to spark interest and ultimately motivation in the class subject. Likewise, no study has looked at measuring the impact on the other three categories of interest (Maintained Situational Interest, Emerging Individual Interest, Well-Developed Individual Interest) that playing board and card games in the classroom may have.

There is a gap in the literature regarding the impact of card and board games in generating Situational Interest, Individual Interest, perceptions of learning climate and classroom engagement, and ultimately, if playing a card or board game could increase learning outcomes for students. If true, programs could be designed around games to help incorporate them into the classroom. There have been studies published that show that situational awareness directly influences the extent of learning (Rotgans & Schmidt, 2011, 2014). Finding specific learning outcomes can be difficult to measure and track, so looking at increasing aspects of learning outcomes, like Situational and Individual

Interest, learning climate, and engagement can provide practical applications for the classroom.

The application of a non-electronic game in the classroom likewise deserves scholarly analysis as if the research shows an impact in Situational Interest, it can be a very cost-effective application to add to a classroom. Board and card games require relatively little monetary investment and no infrastructure changes to schools. Given the struggle many communities have funding education, finding teaching methods that show increases in a student's interest or psychological needs towards a school subject at little cost could be easily embraced and incorporated.

Additionally, placing the game into a lecture-driven class like history could help students employ other areas of decision-making and analysis. For instance, if they are looking at a card where a particular invention has a lot of black metal and brass on it, they may look for other inventions with similar aesthetics to help better determine the era it is from, showing how each period has its own style, a concept they may not intrinsically realize they are utilizing.

Lastly, additional analysis of Situational Interest, and by extrapolation Individual Interest, tests the Four-phased Interest Model and the applicability of the theory in a practical classroom. Each additional study continues to build on the community's knowledge and through that, increasing learning outcomes.

**Limitations**

One aspect of games in the classroom is the design of the game itself. While it is possible that students will enjoy a poorly-designed game because it is something different, it will likely not grasp their interest like a well-designed game would. The

concept of what is a good design is outside the scope of this research. To help minimize the impact it will have, the game chosen to play is one that has been a success in the general game-playing marketplace and while it has educational uses, it was designed foremost to entertain.

Second, this research looks at U.S. History classes in the central United States. There may be differences in the outcome if the same research were conducted in other areas of the country, or even the world. Also different classes may benefit differently from games, so the results of a History class may not be generalizable to an English class, for instance.

Lastly, a limitation of this study is that it only looks at students from one high school in a specific area of the country. Ideally, the same study would be performed at schools around the United States, or the world, giving not only stronger analysis, but also the opportunity to see what regional details, if any, make a difference in stimulating a student's interest, engagement, and learning environment.

**Purpose of the Study**

The purpose of this study is to understand the impact playing subject-related board and card games in the classroom can have on students' Situational Interest, over time their Individual Interest, their perception of the learning climate, and their engagement in the subject.

**Definitions of Terms**

*Board and card game* – A non-electronic activity designed primarily for entertainment that requires choices to be made by the participant in order to achieve victory. The participants may be competing against one-another or against the game itself.

*Classroom Engagement* – A student's active involvement in classroom learning activities. It is often conceptualized by having three components: affective, cognitive, and behavioral. (Wang et al., 2014).

*Expectancy-Value Theory* – A motivation theory where the expected value of undergoing the task helps to determine the motivation to engage in the task. There are three main values, attainment, utility, and intrinsic.

*Extrinsic Motivation* – Performing a task because it leads to a desirable outcome (Ryan & Deci, 2000).

*Individual Interest* – Two of the four phases in the Hidi and Renninger's (2006) Four-Phase model of interest, based on Self-Determination Theory. These are the final two phases and are forms of intrinsic motivation. In these phases, the subject is seeking out interaction with the subject on their own volition.

*Intrinsic Motivation* – Performing a task because it is interesting or enjoyable to the individual (Ryan & Deci, 2000).

*Learning Climate* – Learning climate refers to teacher's support of students' autonomy in learning. Based on Self-Determination Theory, high autonomy support should maintain or enhance intrinsic motivation (Black & Deci, 2000).

*Mastery Goals* – Methods used to increase competence in a skill.

*Self-Determination Theory* – Deci and Ryan's (2017) motivation theory where motivation is broken into extrinsic and intrinsic drive. The state of motivation comes from the satisfaction of three needs: autonomy, competence, and relatedness.

*Situational Interest* – Two of the four phases in the Hidi and Renninger's (2006) Four-Phase model of interest, based on Self-Determination Theory. These are the first two

phases and can be impacted by environment. In these phases, outside factors stimulate a student's initial interaction with the subject.

*Video game* – An electronically driven activity, typically controlled by a computer, that has the participants input actions or choices and see the results on a display screen.

**Summary**

Students' motivation can be tied to their interest in the subject being taught. Both Ryan and Deci's Self-Determination Theory and Hidi and Renninger's Four-Phase Model of Interest are ways to look at methods of motivating students. By bringing board and cards games into the classroom and measuring their impact on a student's learning climate, engagement, and their interest in the topic, educators can hopefully have additional methods to reach out to their students and increase their educational outcomes.

## CHAPTER II – LITERATURE REVIEW

Understanding the process students use to achieve more in class is one of the aims of Educational Psychology ("Educational Psychology promotes teaching and learning," 2019). To reach this goal, understanding what motivates a student and how that can be tied to their success in school is critical. Examining how both Self-Determination Theory and Expectancy-Value Theory look at motivation and how gameplay can tap into those aspects of motivation helps to show where the games themselves can assist. In looking deeper at aspects of motivation, Hidi and Renninger's (2006) Four Phase Model of Interest shows how the environment can affect a student's interest in the subject being taught. From there, it is important to see if games can affect interest and motivation in both the players and the subject of the game. Lastly, it is important to look into what impact games have shown in education so far.

In this chapter, I will provide a brief overview of Expectancy Value Theory to look at the underlying theory behind the concept of interest in this context. From there, we examine the concept of interest in the classroom and the potential impact it can have on student's motivation. Hidi and Renninger's Four-Phase Model of interest development is discussed, providing the theoretical framework for the first section of the intervention. The four-phase model has two general sections, Situational Interest and Individual Interest. With the goal of using games to help create Situational Interest in students, the triggers of Situational Interest are examined as well as how Situational Interest influences Individual interest. Next, the relationship between games and interest is looked at, seeing

how games have interacted with interest and what the potential outcome of their use in classrooms are. Next, mastery goals and interest are discussed as methods for how students will apply their interest in a subject to actually succeeding in the subject.

The next section takes a brief look at Self-Determination Theory, specifically the psychological needs a student has to fulfill to help motivate them to continue and succeed. How games can meet those need satisfactions is investigated as well. This leads to the learning climate itself and how the learning climate can promote or thwart the needs of the student's, especially autonomy, and help enhance their motivation about the subject they are studying.

Next, engagement is examined, specifically classroom engagement and the affect it can have on student's learning outcomes and motivation along with the components that make up the classroom engagement construct. I will describe the differences between school engagement and classroom engagement and take a deeper look at the impact that classroom engagement can have. Lastly, the relationship between engagement and achievement is examined.

In order to investigate the impact games can have on interest, it is important to understand what makes a good game. The concept of game design is examined especially in regards to how good design can capture some of the player's psychological needs. The impact of how the game is designed and what areas the designer needs to consider is discussed and an examination of the potential learning outcomes that can occur through game play.

Lastly, I will discuss the use of games in education. Specifically, I will describe the impact that reflection after game play can have and how game play can affect a

student's skill acquisition. Another positive aspect of game use in education is how applicable it can be across cultures and subjects, which is examined. Finally, the use of games in promoting both problem-based learning in the classroom and teachers attitudes towards the class itself is examined.

**Expectancy Value Theory**

In Expectancy Value Theory (EVT), there is a direct connection between the value a subject places on an activity and the decisions they make regarding that activity (Atkinson, 1964; Eccles & Wigfield, 2002). The greater the value the subject places on the activity then the more motivated they will be to perform that activity (Atkinson, 1964; Eccles & Wigfield, 2002). Consequently, if the perceived value of the activity is low, then the motivation towards it will likewise be low (Atkinson, 1964; Eccles & Wigfield, 2002). As an example, giving a reward for completing a task, say earning a candy bar for completing homework, is only motivating if the reward itself is considered desirable in regards to the effort expended to earn it. If the reward is not valued enough, the student is not hungry or does not like that particular kind of candy, then it will have little positive, and possibly some negative, impact on the subject's motivation to complete the task (Atkinson, 1964).

In EVT, the value of a particular task is composed of three components: attainment value, utility value, and intrinsic value (Eccles, 1983). Attainment value refers to how important it is for the individual to do well on the task to be performed (Eccles, 1983). For example, if a person self-identifies as smart the attainment value for something that a smart person would do, such as take a higher level math course, is high. Utility value is how useful the task is to the accomplishment of some future goal (Eccles,

1983). An example of utility value is taking a required course for a degree, such as calculus, even though the student's career plan has little to no use for calculus. It is the utility of the class, required to earn the degree being sought, that gives it value. Lastly, intrinsic value is the short-term enjoyment that an individual gets from performing the activity (Eccles, 1983). A classic example of this is video games. The individual often plays them for the pleasure they receive in playing the game.

In addition to the values found in EVT, there are also costs. So while a particular task may have a certain level of value (attainment, utility, and/or intrinsic) to the individual, this value is offset by the potential costs of engaging in the activity (Eccles, 1983). These costs can be categorized in three ways: effort, loss of valued alternatives, and psychological cost of failure (Eccles, 1983). Effort is simply the amount of effort, physical, mental, and emotional, that is perceived to be required to succeed in the task (Eccles, 1983). As this effort costs increases, the value of the task should decrease (Eccles, 1983). Loss of valued alternatives describes how desirable the alternative to what the individual could be doing instead of the specific task is (Eccles, 1983). By partaking in the current task, the individual will not be able to partake in another desirable tasks and the repercussions of not participating can be a greater cost (Eccles, 1983). An example is the student struggle of wanting to go to a movie with friends or study for an upcoming test. The student would rather go out with friends, but if he or she fails the test, he or she could be grounded and lose the ability to go out with friends in the future. Psychological cost of failure refers to the repercussions of failure in the task (Eccles, 1983). While the values of a task focus on the benefits of success, this cost focuses on the potential impact for failure (Eccles, 1983). An example of this is a student taking an easier course in order

to avoid getting a lower grade in a more challenging course with repercussions to their GPA.

In deciding whether or not to attempt a task presented, the individual weighs the potential value against the potential cost (Eccles, 1983). At a certain point, the task either no longer becomes worth the cost based on the expected effort to perform and the individual does not do the task (or performs with minimal effort if the task cannot be avoided) or the costs to perform are lower than the expected value and the individual moves forward with the task (Eccles, 1983).

In addition, the belief on how well a student will do, their expectancy, also has a significant impact on their motivation (Eccles & Wigfield, 2002). The student automatically measures these expectations and applies this to the value of the predicted outcome to help determine how much effort, if any, to put into the task presented (Eccles & Wigfield, 2002). These predicted outcomes likewise help the student understand the impacts of failure in the task and also anticipate the amount of effort they will put forth (Caruana et al., 2016).

Galla (2018) used Expectancy-Value theory to understand student's academic self-control. They found that value beliefs had a stronger impact than success expectancies in their self-control and that the intrinsic value (the student's perceptions of enjoyment) was a stronger incremental predictor than utility value (the long-term usefulness of the knowledge gained). When looking at incorporating games into the classroom, the intrinsic value of the gameplay (and the enjoyment that gameplay provides) could serve as a strong motivator to do well in the activity and by association motivate the student to process the information learned.

**Interest**

It is important to understand practical applications of theory to the classroom. Bringing games into the classroom may be one way to apply theory to practice. For instance, many studies have shown an increase in the student's enjoyment of the subject matter when games were included in the class. In several of the studies (Afari et al., 2012; Sevy-Biloon, 2017; Herrero, del Castillo, Monjelat, Carcia-Varela, Checa, & Gomez, 2014; Gareau & Guo, 2009; Bodnar & Clark, 2017; Charlier & De Fraine, 2013; Pilkington, 2018), interviews with the students and their instructors indicate students ask to play more games in the class. In Pilkington's (2018) research, a large majority of students shifted their attitude towards the learning from neutral to positive or remained positive towards the subject. Similarly, Charlier and De Fraine (2013) showed that more students in the play group indicated they enjoyed learning than in the control group. Lastly, Tanner (2012) reported the students stating that the games made learning more enjoyable.

Gareau and Guo (2009) looked into this increase in enjoyment of the subject matter further. In their study, graduate students engaged in games that they could incorporate into their own classrooms in the future. Gareau and Guo (2009) examined students as both players and game designers and found that not only did the students learn, but they also enjoyed it. Similarly, Stieler-Hunt and Jones (2015) found that teachers that incorporated game design into their classroom became what she called *believers,* "a person who is persuaded that using DGP (digital game-play) in the classroom can be beneficial for learning" (Stieler-Hunt & Jones, 2015, p. 3). These believers would look for other ways to add games to their class and try and spread the

idea to other teachers at their schools. This spread of games shows the belief that games have a motivating and interest-increasing capability in the classroom. When teachers are exposed to games in the classroom, such as in Charlier and De Fraine (2013) and Gareau and Guo (2009) studies, there are many who state they will incorporate games in their own classrooms. Similarly the Stieler-Hunt and Jones (2015) study found that teachers who had success in their learning of games in the classroom want to replicate that success in their own classrooms.

Another area of strength is the gameplay itself generating interest in the subject of the game, even if the student had no previous interest or knowledge of the subject (Gates & Kalczynski, 2016). For example, in a recent study, Gates and Kalczynski found that urban youths who had little or no experience with geosciences, discovered new knowledge about the science through playing a game about it. In addition, the game also fostered interest in careers in the geoscience area, as indicated by 65.9% of the students - significantly higher than the 9.7% in a benchmark survey. While the authors acknowledge that it is unlikely that 65.9% of the students would ultimately pursue a career in the geosciences field, the game did generate interest, informing students of options they previously did not know were available to them.

Likewise, Subrahmanyam and Renukarya (2015) stated that games are “pathways of influence” (p. 335) for the student. In the study they report that the various elements and features of a game influence interest in the game’s subject in many different ways, so that a majority of the students would become more interested, and subsequently more knowledgeable, about the topic at hand. These pathways provide multiple opportunities for the students to generate their own interest in the subject.

Many of these studies look to investigate if the interest generated by the game connects to extrinsic and intrinsic motivation about the subject itself (Abdulmajed, H., Park, Y. S., & Tekian, A, 2015; Echeverri & Sadler, 2011; Sorebo & Hæhre, 2012; Hess & Gunter, 2013). In Hess and Gunter's (2013) study, for instance, they found that the student experiences in classes that played games generated intrinsic motivation and had significant improvement in course grades over those who did not have games as part of their curriculum.

Interest has been shown to be a positive effect in the classroom, but it is a broad concept to understand. Even the word interest itself can have multiple meanings depending on the context it is present in. In order to have a better frame of reference to understand how interest develops, we need to look at a model that looks at interest in that manner.

### *The Four-Phase Model of Interest Development*

In order to better understand interest, how it develops and its impact on motivation, we turn to the four-phased model of interest development created by Hidi and Renninger. Their goal of the model is to help support educational interventions and to help students increase their desire to reengage with material (Hidi & Renninger, 2006). The model proposes that as the students' interest increases, they are motivated to learn more about the subject, transitioning from an extrinsic motivation to an intrinsic one (Hidi & Renninger, 2006). Interest itself has both affective and cognitive components and is the result of an interaction between the individual and the content they encounter (Hidi & Renninger, 2006). What is note-worthy about interest itself is that while it is a personal attribute in the individual, the direction the interest takes can be influenced by both the

content and the environment encountered (Hidi & Renninger, 2006). It is content and environment specific.

As indicated by its name, there are four phases in the model, with each phase building on its predecessor, transitioning from external to internal interest (Hidi & Renninger, 2006). These phases are Triggered Situational Interest, Maintained Situational Interest, Emerging Individual Interest, and Well-Developed Individual Interest.

Triggered Situational Interest – A short-term change in the subject's cognitive and affective processing. This is generally triggered externally, enacted by the environment, personal relevance, puzzles, or surprising information (Hidi & Renninger, 2006). This state is influenced by environmental stimuli (Knogler, Harackiewica, Gegenfurtner, Lewalter, 2015) and is triggered by some encounter with the environmental stimuli (Rotgans & Schmidt, 2014).

Maintained Situational Interest – Here the subject's psychological state adjusts to engage with the triggering incident for an extended period of time. Typically the tasks performed have some meaning to the subject and is again externally supported. Maintained Situational Interest can be a precursor to reengage with the content (Hidi & Renninger, 2006). This stage requires that the subject has a connection to the concept that they find meaningful (Rotgans & Schmidt, 2014).

Emerging Individual Interest – The subject now has an internal psychological state of interest in the subject and an association with positive feelings, stored knowledge, and stored value. This is typically self-generated and can spark additional self-driven research into the subject through curiosity. Environmental conditions can help enable the development of this phase (Hidi & Renninger, 2006). The subject will seek out more

engagements with the topic and seek them more frequently (Rotgans & Schmidt, 2017).

Well-Developed Individual Interest – Here the subject has an enduring affinity for the subject and continues to engage over extended periods of time. There are additional positive feelings and stored knowledge above the previous phase, and a greater ability to see connections in the subject and predict effective next steps. This phase is typically self-generated although again environment and instructional conditions can help to foster and continue it (Hidi & Renninger, 2006). The subject feels that their attachment to this topic also helps define who they are (Rotgans & Schmidt, 2017).

This model provides a useful guide for helping teachers better foster interest in a particular subject. That interest can help the students sustain attention when faced with challenging tasks, give the students opportunities to perform exploratory learning in the subject and explore their curiosity, and help create or select student resources to promote problem solving and devise stratagems (Hidi & Renninger, 2006; Chen & Wang, 2017; Lynch, 2017; Huang & Gao, 2013; Rodriguez-Aflecht, Jaakkola, Pongsakdi, Hannula-Sormunen, Brezovsky, & Lehtinen, 2018).

### *Triggers of Situational Interest*

Given the positive association between interest and learning, it is important to look at ways a teacher can trigger this interest (Rotgans & Schmidt 2014). Rotgans and Schmidt (2014) noted that interest can be situational, meaning it is not always stable and can potentially be triggered by precipitating events. Similarly, Lynch (2017) discussed the theory of how using the Four-Phased Model can be helpful in guiding high school students in which major and occupation to pursue, again by triggering their interests, rather than using assessments and interest inventories.

Rotgans and Schmidt (2014) looked at whether depriving students of knowledge (the "why" something happened) would increase their interest in the subject. They discovered that Situational Interest was aroused when the students felt they lacked knowledge on the topic and that the knowledge present or absent was relevant to the task they had to accomplish. That is, if the teacher gave the students some, but not all, of the information about an event in history and asked what impact the event had, the Situational Interest of the students was triggered as opposed to being giving intriguing information but not having their knowledge tested. Applying the information gained and then discovering the missing information lead to greater interest in the students. By manipulating the environment (the withholding of knowledge), Rotgans and Schmidt were able to increase their student's Situational Interest.

One last aspect of the Rotgans and Schmidt (2014) study that is relevant to triggering Situational Interest was their discovery that initially triggered situational interest is not sustained at a high level. Once the students understood more of the context of the event, that is their knowledge deprivation was satisfied, the Situational Interest began to wane. We see that in Hidi and Renninger's model as phase 1 is only triggered situational interest and phase 2 is maintained situational interest (Hidi & Renninger, 2006). Therefore to truly employ the Four-phase model in education, it is important to not only trigger the student's interest but to also provide a method to maintain interest in the subject enough to move to phase 3.

### Situational Interest Influences Individual Interest

In order to get individuals to engage with a subject over time, the interest of the individual needs to shift from Situational to Individual (Hidi & Renninger, 2006).

Triggering Situational Interest, as has been discussed, can be influenced by teachers (Rotgans & Schmidt 2014, Lynch 2017). Likewise, there is a connection between Situational Interest at the beginning of a course and the level of Individual Interest at the end (Linnenbrink et al., 2010).

In addition to those concepts, other researchers have looked at different ways to arouse a subject's initial interest and transition it to long-term interest. Rotgans and Schmidt (2017) looked at the impacts of repeated arousal of Situational Interest on the subject's Individual Interest and noted that Individual Interest did indeed grow over time, validating predictions of the Four-Phase Interest model. Likewise, they also looked at how to maintain Situational Interest to give the student the best chance to transfer the subject matter to Individual Interest through a consistent transfer of new information. This also is an application of Dewey's "catch" and "hold" concept of interest (Dewey, 1913), where the individual's interest first has to be engaged and then maintained. These two actions, the catch and the hold, do not necessarily use the same approach. The environmental trigger that "catches" the individual's interest, initiating it, is what Hidi and Renninger have called Triggered Situational Interest (Linnenbrink-Garcia et al., 2010). The "hold" aspect is what Hidi and Renninger have called Maintained Situational Interest which requires a more involved and personally connecting manner of keeping the individual's interest so they can begin to form a meaningful connection (Linnenbrink-Garcia et al., 2010).

Similarly, Knogler and colleagues (2015) looked at what makes Situational Interest situational and found that similar experiences or circumstances trigger Situational Interest in different ways for different individuals. This finding shows that repeated

similar exposure has less effect on Situational Interest than varied repeated exposure (Knogler, 2015). In looking at a game to trigger Situational Interest, it requires some variety to continue to have an effect. Lastly, they found that the situational aspects of Situational Interest, the manipulation of the environment, had high levels of impact, that it is transient, and if this impact is not triggered, possibly multiple times, it will not transition to Individual Interest.

### *Games and Interest*

As previously shown, in order for interest to develop from Situational to Individual, repeated exposure over time in a manner that continues to entice is important. One area that researchers have looked at to help increase interest in the classroom is through games; both physical and video (Chen & Wang, 2017; Huang & Gao, 2013; Rodriguez-Aflecht et al., 2018).

In looking at Physical Education games and their impact in interest, Chen and Wang (2017) found that tasks that had a high cognitive demand also had high Situational Interest, irrespective of the actual physical demand required by the activity, creating a link between a mental challenge and Situational Awareness. They also state that high Situational Interest tends to stay high regardless of gender, ability, or grade. One set of data in the study came from a dance unit in a Physical Education class which found a strong association between the Situational Interest the students had in dance and the number of steps they took. The more interest the students had in the subject, the more physical activity they performed.

Similarly, Huang and Goa (2013) examined the impact on goals and interest when students played a Dance Dance Revolution™ (DDR) video game. This game has the

player step on various large pads on the floor in rhythm to a song playing on the screen. The player needs to quickly identify which pad to step on and when to do it in order to win the game. The study found that students with high mastery in the game likewise scored significantly higher in Situational Interest than those who did not have mastery.

Lastly, in the Rodriguez-Aflecht and colleagues study (2017), the researchers looked at how a digital math game impacted students' Situational Interest. One aspect they discovered was that Situational Interest did decline over time, attributed to the novelty of the game wearing off. However, over half of the participants did maintain Situational Interest, due to the game and information acquired being meaningful to the students. Students who had a previous interest in mathematics were also more likely to have their Situational Interest triggered and maintained by the game. This does show that the game play itself needs to have some interest for the students in order to trigger Situational Interest.

Games and Situational Interest have a connection that flows both ways. A game that an individual enjoys will help continue Situational Interest in the subject and likewise, Situational Interest in the subject helps master the skills required to succeed in the related game. The game can help sustain Situational Interest in a subject and lead it to eventual Individual Interest.

### *Mastery Goals and Interest*

Mastery goals are the methods a student uses when they want to become more competent in a task (Harackiewicz, 2008). Mastery goals are used when a student is working on gaining new skills and knowledge in the pursuit of competence (Harackiewicz, 2008). Positive associations have been documented between gaining

mastery goals and the student's interest, mostly that when mastery goals are being adopted at the beginning of the task learning, subsequent interest is developed (Harackiewicz, 2008). In the Harackiewicz (2008) study, they considered the question if Situational Interest would predict the adoption of mastery goals, in essence the opposite of the previously determined connection between mastery goals and interest. What they discovered was not only that Situational Interest had a direct positive correlation to mastery goals, but also the development of these mastery goals led to generating Individual Interest over the long term. "The mastery goals can be viewed as both a product and a predictor of interest…" (Harackiewicz, 2008, p. 117).

Similarly, Rotgans and Schimdt (2017) looked at the impact on interest when no goals were presented towards students. In the class assignment, one group received neither inquisitive questions on the topic they were looking at nor asked to create any academic goals regarding the information. Subsequently, these students showed a decrease in Individual Interest over a period of four weeks while the other group that did receive those additional assignments showed an increase in Individual Interest.

Both of these studies show the interconnectedness of mastery goals and interest, and combining the two in classroom design should help to drive the students to engage more with the topics.

### *Research Questions*

Examining Expectancy Value Theory provided a look at the underlying theory behind the concept of interest in this context. From there, we examined the concept of interest in the classroom and the potential impact it can have on student's motivation. Hidi and Renninger's four-phase model of interest development provided the theoretical

framework for the first section of the intervention. The four-phase model has two general sections, Situational Interest and Individual Interest. With the goal of using games to help create Situational Interest in students, I examined the triggers of Situational Interest as well as how Situational Interest influences Individual interest. Next, the relationship between games and interest was looked at, seeing how games have interacted with interest and what the potential outcome of their use in classrooms are. Finally, mastery goals and interest were discussed as methods for how students applied their interest in a subject with the goal of actually succeeding in the subject.

The four phase model of interest provides a useful lens to look at interest and its potential impact on students. Games have the potential to help influence a student's interest in a subject, especially over time, and this interest can lead to positive learning outcomes. Lastly, games themselves can introduce students to concepts they have never encountered before, generating interest in these very concepts. Therefore, the following research questions will be investigated:

(a) Do students who play a U.S. History-related game in the classroom have higher Situational Interest in U.S. History than students who do not?

(b) What is the impact on students who play a U.S. History-related game in the classroom on their Individual Interest in U.S. History versus students who do not?

**Self-Determination Theory**

Increased motivation of the student can be one of the argued benefits of gameplay in the classroom, but in order to test and understand it better, it is important to determine what underlying motivational theory is most applicable to this type of learning. Multiple

studies look at the gameplay motivational effects through the lens of Ryan and Deci's Self-Determination Theory (SDT) of motivation (Van Roy & Zaman, 2018; Conway & Elphinstone, 2017, Plass et al., 2015, Pilkington, 2018; Prouix, 2017; Sorebo & Hæhre, 2012; Hess & Gunter, 2013).

### *Psychological Needs*

One key area of SDT is the impact of intrinsic motivation (Ryan & Deci, 2017). As the basic needs of autonomy, competence, and relatedness are satisfied, intrinsic motivation increases (Ryan & Deci, 2017). Consequently, if these needs are not satisfied, the motivation resides on the extrinsic side and, in some cases, the person's desire to perform the activity stems not from the internal satisfaction and goal-seeking they have but rather the anticipation of the outcomes once the activity ceases (Ryan & Deci, 2017). Standard school curriculum and assignments are often not presented or received in an intrinsically motivating way, nor relevant to a student's daily life (Ryan & Deci, 2017). This then leads teachers and administrations to rely upon wholly external pressures, such as grades and tests, to help motivate the students to learn (Ryan & Deci, 2017). Extrapolated, this thinking leads to high stakes standardized testing across the district and teachers teaching students how to succeed at the test rather than deeper understanding of the subject itself (Ryan & Deci, 2017).

When teachers are supportive of student needs, like autonomy, they are able to facilitate the student's intrinsic motivation, despite all of the external pressures placed on the student and the teacher (Ryan & Deci, 2017). Likewise, including the social context and student competence in the classroom activities has shown to lead to higher intrinsic motivation, well-being, and learning (Ryan & Deci, 2017). Simply changing some of the

activities in the classroom, such as adding garden-based learning programs, showed a decrease in student failure (Ryan & Deci, 2017). Studies have shown that students motivated by intrinsic motivation have higher grades, participate more, and in general have higher learning outcomes (Van Roy & Zaman, 2018).

One aspect of SDT and its connection with games is the design of the game itself. Different aspects of design appeal to different people in different ways, and thus impart differing amounts of motivation onto the player (Conway & Elphinstone, 2017). The design choices made in the game itself, or in its implementation in the classroom have a direct influence on the impact the game will have on the player, and the motivational needs the game fulfills (Conway & Elphinstone, 2017; Pilkington, 2018; Proulx, Romero, & Arnab 2017). Thus, it is important to see that adding any game into any classroom is not a faultless motivational solution. The game needs to be relevant and interesting with autonomous choices made by the players (Tanner et al., 2012).

Hess and Gunter (2013) make direct comparisons in motivation between classes that used games versus classes that did not. In their study, they showed the game-using class had a higher grade point average than the non-game classes. More interestingly, when they measured the intrinsic motivation of the students, both groups showed high motivation in regards to social interactions and innate psychological needs, but the game-playing students reported an additional motivation in that they were motivated to and by interacting with the game itself. The authors go on to state that the game-playing class appeared to have a higher intrinsic motivation, determined both from interviews of the students and interviews of the teachers. The researchers did not discover what specific needs the games fulfilled versus the control group and stated that this is an area that could

use further study.

### *Games and Need Satisfaction*

Games can tap directly into the three psychological needs in SDT. In fact, part of the issue with video games is the fact that they satisfy those needs so well that the player continues to spend more time gaming (Mills et al., 2018). Indeed, popular video games have actually been designed based around the needs of competence, autonomy, and relatedness (Mills et al., 2018). For example, in using a business strategy video game in a business class, the researchers found that the most important need that the game met with the students was that of autonomy (Sørebø, & Hæhre, 2012). The students wanted to be the ones that were the genesis of the business decisions their company made and influence the results of the game. Secondarily, the need for competence was the next source of the student's motivation towards succeeding at the game, showing a desire to be skilled in the game itself (Sørebø, & Hæhre, 2012). In looking to find the optimal circumstances for intrinsic motivation, Deci and Ryan (2017) claim that the subject needs to fill autonomy and competence.

With regards to the need for relatedness in video games, it was found in multi-player games, but not as strong in single-player only games (Ryan et al., 2006), which is as expected given the social nature of multi-player games. In addition, Ryan and colleagues found that the more these needs were being met by the multi-player video game, the more hours per week the players put into the game, again as expected given the motivational affects that happen when the psychological needs are met.

In another study of video games, the researchers measured not only how the game met the three SDT needs of the players, but also how the game play addressed how they

felt about their "ideal" self, that is the characteristics that person wanted to have (Przybylski, Weinstein, Murayama, Lynch, & Ryan, 2012). As the players felt closer to their ideal selves, the motivation to continue playing rose and also increased the variability of their emotional state post play (Przybylski et al., 2012). In addition, they found that subjects who had the greatest divergence between their perceptions of their current self versus their in-game ideal self, also had the highest level of intrinsic motivation (Przybylski et al., 2012).

All of these studies show the ability for video games to meet or fill the three needs found in Self-Determination Theory. Still, there remains a significant gap in the literature in regards to non-electronic games and their ability to fulfill the needs of autonomy, competence, and relatedness.

**Learning Climate**

A key area in Self-Determination Theory is that motivation is a result of the interaction between students and their environment, specifically the social factors found within (Orsini, Binnie, Wilson, & Villegas 2017). These social factors will either enhance the student's motivation or inhibit it (Orsini et al., 2017). In this climate the teacher can be either authoritative and controlling or they can be autonomy-supporting, one of the three psychological needs found in Self-Determination Theory (Orsini, et al., 2017). Similarly, the learning climate includes the feelings the students have towards their teacher and their peers (Daggol, 2019). The methods the teacher employs, also has an impact on the learning climate, strategies such as providing constructive and helpful feedback, encouraging positive peer collaboration, and helping students gain higher self-efficacy (Kaufman, Sellnow, & Frisby, 2016).

As a student's autonomy is supported by the learning climate, the student will tend to find their intrinsic motivation maintained or enhanced (Black & Deci, 2000). Research has shown that indeed, students in autonomy-supporting classrooms do have higher intrinsic motivation (Deci, Schwartz, Sheinman, & Ryan, 1981). In addition, autonomy supported learning has shown to have a positive effect in educational learning (Ryan & Grolnick, 1986).

While positive autonomy-supporting learning climates can help student's motivation and ultimately their learning outcomes, negative autonomy-supporting learning climates have likewise negative impacts (Gillen, Wright, & Spink, 2011). An added complexity is that the student's perceptions, especially about social factors, can affect their autonomy and their motivation even if the instructor is attempting to create an autonomy-supporting climate (Orsini, et al., 2017). If there is a disconnect between the teacher and the student perceptions, the impact of the learning climate can be the opposite of what the teacher intended (Bean, Rocchi, & Forneris, 2019).

### *Promoting Climate to Meet Needs*

In order to best help student's academic motivation, it is important to promote the learning climate to be as autonomy-supported as possible (Filaka & Sheldon, 2008). Research has shown that the teacher support of student autonomy through the learning environment can boost a student's self-regulation of their behavior and actions (Ryan & Deci, 2017). This can have the results where the students are regulating themselves to the point where they are fulfilling their psychological needs on their own rather than the teacher controlling the external events the students find themselves in (Cheon, Reeve, & Moon, 2012). The students themselves want to perform the necessary activities to

succeed in the class and the teacher provides the climate to help them best succeed (Cheon et al., 2012).

To this end, teachers need to be trained in autonomy supporting classroom management techniques and studies have shown that these techniques are successful in creating a more autonomy-supporting climate (Cheon & Reeve, 2015). This training can include the concepts of motivation based on SDT (Ryan & Deci, 2017), instructional behaviors designed to create higher levels of autonomy support and less controlling statements (Perlman, 2015), changing language used in the classroom from controlling language, such as "you will turn in your assignments by Friday," with "you may turn in ...," (Cheon & Reeve, 2015), and continuing the training over time to help refresh it and decrease the chance of the behaviors waning (Cheon et al., 2012).

In multiple studies, teachers received autonomy-supporting teaching and then the researchers looked to see what effect this learning climate had on the students' psychological needs (Cheon & Reeve, 2015; Cheon et al., 2012; Filaka & Sheldon, 2008; Mackenzie, Son, & Eitel, 2018; Perlman, 2015; Young-Jones, Cara, & Levesque-Brisol, 2014). The results show that many different areas of student life can be improved by teachers creating an autonomy-supporting learning climate. Researchers found that classroom engagement had high positive correlation regarding the experimental group, where the teachers engaged in the autonomy-supporting learning climate, showing an increase over time in student engagement, versus the control group which stayed virtually constant (Cheon & Reeve, 2015). Similarly, the students in the Mackenzie and others study (2018) showed a similar increase in their engagement with the subject matter whereas the control group did not. Lastly, classroom engagement in the intervention

group of the Cheon and colleagues study (2012) also showed significant increase over the experimental group.

The teacher training was designed to support a student's autonomy needs. The classrooms with these trained teachers showed a significant increase in student autonomy over the control group (Cheon et al., 2012). Likewise students self-reported motivation in a significantly greater amount when their teacher received the autonomy-supporting training than those in the control group (Perlman, 2015). Also when looking in what specifically changed in the teaching style, video-only, audio-only, or a combination of audio/video, the audio-only and combination showed a significant increase in an autonomy-supporting learning climate than in the control group (Young-Jones et al., 2014).

Another area that this autonomy-supporting learning climate can impact is in the student's perception of skill development. These skills increased significantly in the intervention group over time whereas the control group's skills stayed static (Cheon et al., 2012). One aspect of this area is that the learning or developing of new skills is being self-reported in a measure and thus their interaction with the learning climate has shown to positively impact their own perception of how much they have learned and progressed (Cheon et al., 2012). The initial baseline values for both the intervention and the control group were the same, but over time, the intervention group's values increased significantly over the control groups (Cheon et al., 2012). Similarly, the same intervention group showed a significant increase in actual academic achievement over the control group, showing positive learning outcomes from this change to learning climate (Cheon et al, 2012).

When teachers employ autonomy-supporting methods in their classroom, it has been shown to also increase instructor approval ratings from students (Filaka & Sheldon, 2008). The three areas of SDT, autonomy, competence, and relatedness, all independently predicted higher teacher approval in the course (Filaka & Sheldon, 2008). Likewise, the students in the Cheon et al.'s (2012) study showed higher teacher approval as their psychological needs were better met through the intervention versus the control group, who saw no significant change in their teacher approval.

One last benefit found in an autonomy-supporting learning climate is increased physical and outdoor activity (Cheon et al., 2012; Mackenzie, et al., 2018). The Cheon and colleagues' (2012) study looked at Physical Education teachers and the Mackenzie and colleagues' (2018) study looked at using outdoor adventure to help enhance the learning climate. In both of these studies, the researchers saw a significant increase in physical activity with the intervention groups over the control groups (Cheon et al., 2012; Mackenzie, et al., 2018). The opportunities to be more physically active in these autonomy-supporting learning climates ties well with the students' desire to do more in their learning climate (Mackenzie et al., 2018).

### *Research Question*

This section took a brief look at Self-Determination Theory, specifically the psychological needs a student has to fulfill to help motivate them to continue and succeed. How games can meet those need satisfactions was investigated as well, leading to the learning climate itself and how the learning climate can promote or thwart the needs of the student's, especially autonomy, and help enhance their motivation about the subject they are studying.

The learning climate can play an important role in a student's motivation in the classroom. Specifically, autonomy-supporting teachers and activities can lead to the students' psychological autonomy needs being met and increasing their motivation towards the class itself. Therefore, the following research question will be investigated:

(c) Do students who play a U.S. History-related game in the classroom have a higher measured perceived learning climate than students who do not?

**Engagement**

In the classroom setting, engagement refers to how active a student is involved in a particular learning activity (Nunez & Leon, 2019; Wang, Bergin, & Bergin, 2014). There has been a greater focus on classroom engagement over the years, partly because there is a strong relationship between engagement and positive student outcomes like grades and graduation rates (Merlin-Knoblich, Harris, & McCarty Mason, 2019). Activities and characteristics of a student with high classroom engagement include higher participation in class activities, asking probing questions, showing interest in the material presented, and putting effort in class assignments (Dennie, Acharya, Greer, & Bryant, 2019).

The engagement construct has been composed of four or five mutually dependent components (Nunez & Leon, 2019; Wang et al., 2014). First, is behavior, which refers to the attention, effort, question asking, and persistence the student puts forth when they are participating in a learning activity (Nunez & Leon, 2019; Wang et al., 2014). Second, is emotion, where the student experiences positive emotions like interest, enjoyment, and enthusiasm and the absence of negative emotions like fear, anxiety, or worry (Nunez & Leon, 2019; Wang et al., 2014). The third component is cognition, referring to the mental

effort the student puts forth in the classroom such as employing learning strategies that are more substantial than simple memorization, elaborating on concepts discussed in class, and concentration (Nunez & Leon, 2019; Wang et al., 2014). The fourth component is agency. Agency refers to how the students tailor the learning in the classroom to their needs through asking probing questions, expressing opinions, and asking for what they need (Nunez & Leon, 2019). A fifth component has been added known as disaffection or disengagement (Dennie et al., 2019). This component is used to show active disengagement from the classroom like withdrawal from learning activities, lack of concentration, and boredom (Dennie et al., 2019). In this engagement construct, each component correlates to the others (Dincer, Yesilyurt, Noels, & Vargas Lascano, 2019).

It has been found that motivation and engagement are linked, so that the level a student is engaged in the classroom reflects on how much of their psychological needs of autonomy, competence, and relatedness are met within the class's social context (Dennie et al., 2019). Classrooms that employ autonomy-promoting methods, considered student-centered, give the students the opportunity to engage in the classroom more by having a voice in their choices, providing constructive feedback, and help shape the learning to the student's interest (Dennie et al., 2019). As a student's competence level increases, it better prepares the student for the challenges the classroom presents and helps them deal with the social context of the classroom itself (Dennie et al., 2019). Lastly, the relatedness aspect deals with establishing relationships with others in the classroom, and especially the teacher. As the student's relationship strengthens with the teacher, their engagement in the classroom likewise strengthens (Dennie et al., 2019). Students that

lack motivation and/or engagement, likely have not had their psychological needs met in the classroom (Dennie et al., 2019).

### *Classroom Engagement*

One aspect of engagement is the differentiation between classroom engagement and school engagement. Engagement at the school level is seen at a more macro level where the student bonds with the school itself, engaging in extracurricular activities, having school spirit, and good attendance (Wang et al., 2014). This, however, does not necessarily reflect a student's engagement in the classroom itself. In fact, a student may be highly engaged with the school and highly engaged in some classes but disengaged in other classes (Wang et al., 2014). Engagement at the classroom level has been found to predict a student's intrinsic motivation towards the class and also predict their self-regulation in regards to the class and its activities (Dincer et al., 2019). Similarly, it has been found that intrinsic motivation was a strong predictor of classroom engagement (Dincer et al., 2019). Lastly, it has been found that classroom engagement has been found to be strongly correlated with higher grades (Wang et al., 2014).

As discussed in the learning climate section, there are many benefits to creating an autonomy-supporting classroom. These benefits extend to higher classroom engagement as well (Nunez & Leon, 2019). In fact, autonomy has been observed to predict changes in the four types of classroom engagement, which then leads to better learning outcomes (Nunez & Leon, 2019). It had the strongest effect on emotional engagement but it did show to have an effect on agentic, behavioral, and cognitive engagement (Nunez & Leon, 2019). In essence, as the classroom promotes a student's autonomy, the student's autonomy increases, which leads to greater engagement in the

classroom (Nunez & Leon, 2019). In addition, classroom engagement has been show to help mediate between the classroom's autonomy support and a student's attendance and achievement in the class (Dincer et al., 2019).

An interesting discussion of Dincer and colleagues' (2019) study was how the different components of classroom engagement predicted different outcomes. Higher cognitive engagement had a high association with less absenteeism, while emotion and agency showed a high association with better grades. In the case of emotion, when a student is emotionally engaged with the class, they have a positive attitude towards it and are more motivated to succeed in the class (Dincer et al., 2019). Students with high agency in the classroom modify the class to better maintain their motivation in it though making suggestions, offering preferences, and adjusting activates within their agency (Dincer et al., 2019). Cognitively engaged students are more likely to participate in the activities in the classroom and devise learning strategies to help them succeed (Dincer et al., 2019). The study did not find that behavioral engagement did not offer any direct predictions of learner outcomes (Dincer et al., 2019), but this can be understood. Think about a student who pays attention in class and puts forth effort in the learning activities but is not finding any joy or excitement in the learning process for whatever reason (Wang et al., 2014). This helps to highlight the interconnectedness of the five components in classroom engagement and cautions focusing on only a few in building the classroom environment (Wang et al., 2014).

### *Relationship Between Engagement and Achievement*

Student engagement in a subject, be it behavioral, emotional, cognitive, or a composite measurement, has been shown to lead to better academic achievement (Hao,

Yunhuo, & Zhou, 2018). In fact, Hao and others (2018) showed a logical relationship between engagement and achievement that went from emotional engagement to cognitive to behavioral, which had the greatest impact on academic achievement.

Subrahmanyam and Renukarya (2015) looked at how games create a "pathway of influence" on the student. These multiple paths all affect the student's engagement with the material, whether it is the time spent on the game, the features of the game itself, their content, or their context. These four paths have an effect on the student in various degrees and have shown to impact their engagement and learning.

Lastly, both Lee and Byun (2014) and Anyanwu (2014) incorporated not only game play but actually designing games into their classroom activities. This had the dual effect of not only engaging the students in the design of the game, what they thought they would like do, but also in having them judge other games, learning what aspects are most engaging (Lee & Byun, 2014). Creating not only the classroom content of the subject, which required understanding of the topic, but also the structure of the game play as well, guided the students to a more rounded understanding of the subject matter itself (Lee & Byun, 2014). Additionally, the judging of other student's games forced them to look critically about the chosen subject's criteria for a good engaging game (Lee & Byun, 2014). Likewise, when students developed an anatomy-based game in Anyanwu's (2014) study, the author noted many aspects of engagement by the students. A majority of the students commented on how it generated group discussions about the topic and improved their level of concentration along with lowering their level of fear they had towards the subject and studying (Anyanwu, 2014). Lastly, Anyanwu (2014) noted that this added a level of fun to the learning process and allowed engagement that otherwise would have

been difficult to express.

### *Research Question*

This section examined engagement, specifically classroom engagement. We looked at the effects classroom engagement can have on student's learning outcomes and motivation along with the components that make up the classroom engagement construct. We examined the differences between school engagement and classroom engagement and took a deeper look at the impact that classroom engagement can have on a student's learning outcomes. Lastly, the relationship between engagement and achievement was examined.

Classroom engagement is connected to a student's intrinsic motivation in the class. Engagement itself is comprised of five components: behavior, emotion, cognition, agency, and disengagement. Games can help a student engage with the class subject, through some or all of these components, and can lead to higher motivation in the class. Therefore, the following research question will be investigated:

(d) Do students who play a U.S. History-related game in the classroom have a higher level of classroom engagement than students who do not?

## Game Design

One aspect of using games in education is the design of the game itself. When designing a game, the main goals are for it to be fun to play, provide a challenge, provide surprises, support social connectedness, and provide a pleasing experience (Ng, Kohng, Nathan, 2018). The difference between a game design and a good game design is that game design is about creating the rules, theme, and content of the game while good game design is also about creating goals within the game that the players are motivated to reach

and that the decisions the player makes are meaningful in the pursuit of these goals (DeAnda & Kocurek, 2016).

This can be a challenge as games are complex systems and the various components can interact with each other in many different ways (Akcaoglu & Green, 2019). This should lead to a design process that follows a process of understanding, designing, implementing, and testing with reflection (Kalmpourtzis, 2019). The design itself serves as a form of technical communication with the player to convey not only the designer's plan, but also the experience the designer hoped the player would encounter (DeAnda & Kocurek, 2016). It becomes critical that the game designer identify and establish an appropriate and satisfying system or systems in the game as the core-component of the design process (Akcaoglu & Green, 2019).

Ultimately, the designer hopes that the game they have created will capture the player's affect and emotion while they play (Ng et al., 2018). As the player becomes invested both cognitively and emotionally, they enter into a flow state that generates positive feelings in the player and deeper involvement (Ng et al., 2018). As the designer continues to work on their game, they should keep in mind that the players need to encounter challenges that evoke an affective response from the players themselves (Ng et al., 2018). This becomes more challenging as game players become more diverse, the need for affect becomes more diverse and designing for an ideal user becomes harder to define (Ng et al., 2018). The design of good games therefore requires analyzing, systems design, planning, testing, and understanding, often requiring higher-order thinking utilizing problem solving and critical thinking (Akcaoglu & Green, 2019).

### *Impact of Game Design*

One interesting aspect of games in today's culture is that while playing games, the players partake in activities similar to what they would do in school or at work, but they enjoy these activities more in the context of the game setting (Gee, 2008). Similarly, the game play itself parallels school and work in ways such as creating specific meaningful language and complex problem-solving as they play (Gee, 2008). This can lead to players coming together to complete a group task, not unlike a group project at school or work. Each member of the group (player) has to hone their skills in an aspect of the challenge being faced and integrate these skills with the group in order to make progress. Each team member has to share their knowledge and their understanding of the game, including the specific skills endemic to their role in the game, with the group in order to make a decision (Gee, 2008).

The game designer needs to take into account many different aspects of the game they are creating in order to make it a compelling and challenging design. The design needs to take into account the player's identity in the game, how they interact both with the game and with the other players, what risks will the player take, how can the player customize their play to their own liking or strategy, what agency does the player have in the game, how understandable are the problems the player will face, is the design pleasantly frustrating so as not to discourage future play, can the players explore within their play space, and does the game reward performance and competence (Gee, 2005). While not every game will encompass all of these aspects, they still need to be considered by the designer in order to create a good design.

### *Learning Outcomes*

Gauthier and Jenkinson (2018) state that "design, rather than medium, ultimately predicts learning outcomes." It is not important the type of game played, be it a card game, board game, video game, or other type. It is the design of the game that can promote learning outcomes. Specifically, how the game handles points of failure in the game can trigger significant learning outcomes (Gauthier & Jenkinson, 2018). In fact, failure is such a critical part of gaming that winning a game without any prior failures creates a sense of disappointment in the win (Hoffman & Nadelson, 2009; Juul, 2009). The game creates the opportunities for failure and learning through its design and the challenges it presents, along with the conflict, helping to develop the key skills necessary to succeed through engaging in the environment and experimenting with different strategies (Gauthier & Jenkinson, 2018).

This loop of trying, failing, making adjustments, and trying again is considered productive negativity (Gauthier & Jenkinson, 2018). The player encounters failure and restructures their comprehension of how the game works, or the odds of an event occurring, and then adjusts in a productive manner (Gauthier & Jenkinson, 2018). What allows this productive negativity to work is the lack of real-world consequences for the player's actions, which allows the player to embrace and utilize this productive negativity (Gauthier & Jenkinson, 2018).

It is critical, therefore, that the game design be good in order to maximize the learning outcomes desired. In fact, learning outcomes from commercially-available educational games have shown to have mixed results (Akcaoglu & Green, 2019). The significant issue here is that often, these games are designed first to educate, not entertain

(Akcaoglu & Green, 2019). Non-educational games are considered play and the learning they create is done in the name of play as much, if not more than, the play facilitates the learning itself (Gee, 2008).

How are the ways that a good design can help facilitate learning outcomes? One way is that they focus on specific problems rather than facts (Gee, 2013). Knowledge of information may enhance the player's strategy, but all of the data they required to succeed in the game is presented to them when needed. Likewise, the player is given the tools to solve the problem presented (Gee, 2013). These tools may also require coordination with other players or may require the player to mitigate some aspects of randomness. The player's themselves have clear goals in mind, but often multiple paths to accomplish those goals (Gee, 2013). The cost of failure is lowered to the point where experimentation and other problem-solving solutions are employed (Gee, 2013). In a classroom assignment, attempting a novel approach to a problem runs the risk of losing points in the class that can never be regained, while in the case of a game, the worst case is losing the game. Another aspect of good design is that it puts performance and experiences in front of competence and knowledge (Gee, 2013). The players learn by doing and they have experiences to relate to after the game when discussing the results or researching new strategies. Next, the game itself gives feedback along the way (Gee, 2013). The players can see their score or the number of pieces on the board or how well their particular strategy appears to be working. With this feedback, they can then make adjustments to try and mitigate any weaknesses they perceive. Good game design also connects the game play to social interaction of some kind (Gee, 2013). In addition to the social context during the game play itself, the game serves as a touch point for future

conversations and social collaboration. Also, the game holds all players to the same standards, the goal of the game, but allows the player to reach that standard in their own way (Gee, 2013). Lastly, the game experience itself can serve as a portal to future, unrelated to the game itself, research and skill building (Gee, 2008).

## Game Use in Education

Lastly, it is important to look at the impacts of using games in education and the opportunities that their successful use have shown. Another area of interest is how broadly applicable games in education can be.

### *Reflection*

One of the results found by Herrero and colleagues (2014) study was the differences between when the students reflected on their game play and the concepts the game taught versus what they had learned about the subject taught in class. In this study, the authors used a commercially available computer game to help teach evolutionary concepts. The game itself, *Spore™* (Wright, 2008), was designed as commercial entertainment first with education as a secondary concept, rather than a game specifically for the classroom. Consequently, not all of the ideas learned in the game were consistent with the evolutionary theories discussed in the class. The instructors added reflection and discussion time to the class to talk about these differences and help the students to apply what they learned in the game to what they learned in class. The quotes from the students showed them tying concepts together between the two, in essence tying the theory of the class to the "reality" experienced in the game.

While many of the other studies did not incorporate direct reflection time like the Herrero and others' (2014) study did, the results from the qualitative methods they

employed with interviews showed games having a similar experience for the students. The students were asked to reflect on the impact the games had for them and what they learned. Again, this forced the students to tie the two areas of what they learned in the game and what they learned in class together in their mind and increased their knowledge and interest in the subject (Plass et al., 2015).

The model that Obikwelu, Read, and Sim (2013) put forth has specific methods of reflection built in to it. With collaborative learning and peer tutoring, students need to explain to their peers how what they have done is effective and what the repercussions of their choices were. Likewise, through the concepts such as scaffolding and Vygotsky's Zone of Proximal Development (ZPD), where a More Knowledgeable Other (be it a teacher or a game) helps the student progress in the subject through learning just enough to move to the next concept, as mentioned by Obikwelu, and others (2013) and Gareau and Guo (2009), both success and failure in the game itself acts as a prompt for the student to reflect on their actions and results.

Reflection has shown to help connect the concepts learned in class with the concepts learned while playing a game. The game itself can act as a guide towards the desired concepts through both success and failure, given that the player has the opportunity to reflect on the lessons learned.

### *Skill Acquisition*

While many of the studies looking at games in education settings look at the motivational factors of the games, quite a few also look at the ability of the game to assist the student in building skills related to the game's subject. Plass and others (2015) looked at how the design of the game itself leads to the player acquiring skills in areas such as

collaboration, communication, and systems thinking. Likewise, Subrahmanyam and Renukarya (2015) looked at how the games helped to build social skills such as negotiating the various roles and responsibilities as a team member. These game experiences gave the students the opportunity to explore and practice these skills within the safe controls of the game and classroom themselves.

In addition to the social skill building presented in the previous studies, games in classroom settings have also been shown to help students build other skills. In Kafai and Burke's (2015) study, a significant portion of the computer science students developed computational strategies to solve programming challenges through gameplay and another significant potion reported learning specific subject matter content like mathematics, science, or other areas of study. Lastly, in their study, Jimenez-Silva, White-Taylor, and Gomez, (2010) found that mathematics board games helped improve the accuracy and understanding of mathematics concepts in their players and overall improved their academic skills.

Nicholson (2011) strives to talk about designing the game towards the learning outcome that is desired. He discusses that the skills learned need to be relevant to the game and to the student's needs or desires themselves to truly be effective. So, while the student may be less interested in learning the names of the bones of the body, for instance, if within the context of the game that knowledge is important and useful, then the student will be inclined to learn that particular skill. Indeed, Bayir (2014) found that incorporating chemistry games into learning promoted permanent learning. The students themselves talked about how the game play showed them how chemistry related to their everyday life and how it gave them an opportunity to employ previously learned

knowledge.

### *International in Scope*

Games have been incorporated into the curriculum of classrooms around the world. For example, the studies cited that took place in the United States (Gareau & Guo, 2009; Bodnar, & Clark, 2017), Ecuador (Sevy-Biloon, 2017), Finland (Hamalainen, Oksanen, & Hakkinen, 2008), Australia (Stieler-Hunt & Jones, 2015), Spain (Herrero, del Castillo, Monjelat, Garcia-Varela, Checa, & Gomez, 2014), Turkey (Karadag, 2015), Korea (Lee & Byun, 2014), Belgium (Charlier & De Fraine, 2013), Brazil (Martins, de Almeida, & de Pavia, 2017) and the United Arab Emirates (Afari, E., Aldridge, J. M., & Fraser, B. J., 2012). This broad range of countries and cultures shows that the experience of the students in the classroom transcends national borders. For example, both the Ecuadorian students and the UAE students had similar quotes about how the games made their particular subject more interesting and the class more entertaining. Both groups also stated they enjoyed how it broke up the typical school day.

The results from the studies show that the students from diverse contexts found the material engaging when incorporated into a game format, whether it was video game based (as the majority were) or board or card game based. In addition, some of the studies (Gareau & Guo, 2009; Kafai & Burke, 2015; Lee & Byun 2014) showed that not only playing games but also creating them in the classroom created engagement with the students and the subject matter.

These results show that game play in classrooms is not limited to small sections of the world. They can be incorporated in classes around the globe and have shown that the impact to students from different cultures is largely the same.

### *Not Subject Based*

In addition to the multi-cultural applicability of incorporating games into the classroom, the studies likewise showed a broad range of subjects that games can successfully be used in. In the studies different games helped students with English (Sevy-Biloon, 2017), Math (Afari, Aldridge, & Fraser, 2012), Biology (Herrero et al., 2014), Vocational studies (Hamalainen, Oksanen, & Hakkinen, 2008), Engineering (Bodnar & Clark, 2017), and Education (Gareau & Guo, 2009). While the games in each of the studies differed, the incorporation and results transcended subjects and could be found to be applicable to all. Interestingly, in multiple studies a game-show, Jeopardy-like, game featured as one of the games used in the classroom. While the design of such a game is fairly straight-forward, the instructor needs categories and questions for the students to figure out, placing the questions in this structure along with the competitive aspect of the game itself, appears to excite and increase the interest of the students playing it (Afari et al., 2012; Sevy-Biloon, 2017; Gareau & Guo, 2009).

Games used for reinforcing learning and understanding of course work are successful due to many factors. First, they provide an opportunity for active, problem-based, application of the information presented (Charlier & De Fraine, 2013). Second, the game provides immediate feedback, either through success or failure, on their application of the information (Charlier & De Fraine, 2013), on their facilitation for social networking and team dynamics (Echeverri & Sadler, 2011), and third, opportunities to assess their strategies and reflect on better ones (Plass, Homer, & Kinzer, 2015).

There are differences between a typical lecture-and-question classroom procedure, as opposed to one where games are included, where the same information and

questions are communicated, but the interactivity and interest of the students is less. For one, the students playing the games had more interest in the subject matter (Sevy-Biloon, 2017; Nicholson, 2011; Gates & Kalczynski, 2016). Second, the repercussions of their failure was lessened compared to receiving a failing grade on an assignment (Tanner, Stewart, Totaro, & Hargrave, 2012; Plass et al., 2015). Third, it gives the students an opportunity to employ and build skills using the concepts learned (Subrahmanyam & Renukarya, 2015; Kafai & Burke, 2015; Jimenez-Silva, 2010). Finally, the incorporation of games allows affects the teacher's attitudes towards the students and the lessons (Crews, 2011; Marklund & Taylor, 2016; Casanoves et al., 2017).

### *Problem-based Learning*

Problem based learning (PBL) is a concept where a real-world situation is taken from the normal routine of a professional in the subject area (Martins et al., 2017). It serves as a way to help students bridge the theoretical and the practical in their area of learning and also to motivate students and help them acquire new knowledge (Martins et al., 2017). In addition, PBL also pushes the students into story-driven learning tasks, like those found in games (Warren, Dondlinger, Jones, & Whitworth, 2010). The scenarios created in a game designed to emphasize PBL in the classroom helped the students to work together and learn the skills necessary to complete the tasks presented (Warren et al., 2010).

A key component to successful implementation of PBL is that the students need to be motivated to "own" the learning that is needed to accomplish the tasks before them (Echeverri & Sadler, 2011). Likewise creating opportunities for cooperative learning is critical and requires the teacher to cultivate the necessary dynamics inside of their

classroom (Echeverri & Sadler, 2011). Inherent in gameplay is both an internal motivation, honed over years of game design, and the social dynamic the other players bring, whether it is a cooperative or competitive game (Echeverri & Sadler, 2011).

In addition, the games themselves need to be designed in such a way that the game play is directly related to the learning desired. Early games, as mentioned in Virk, Clark, and Senupta's (2015) study had the game part as rewards for accomplishing the learning part. This purely extrinsic integration did little to help the student solve the problem or motivate them much (Virk et al., 2015). Rather the synchronization of the game's design and the problem-based learning outcomes are where the true impact of PBL and games happen (Virk et al., 2015).

The skills the students learn while engaging in PBL-based gameplay allow them to not only test different methods of attempting the tasks, but also use similar thought patterns and steps to accomplish these tasks outside of the classroom (Casanoves, Salvadó, González, Valls, & Novo, 2017). Multiple studies looked at implementing PBL-based gameplay and each met with increases in correct answers (Casanoves et al., 2017), lowered class drop rate (Warren et al., 2010), and increase in student motivation (Martins et al., 2017).

### *Teacher Attitudes*

In order to effectively introduce new areas such as games into a teacher's curriculum effectively, it is necessary for the teachers themselves to see the value of it. Various studies have looked at the attitudes of the teachers that have been asked to include games into their lesson plans and what impact the inclusion has had. Tanner et al., (2012) found that a majority of business college professors felt that business games

were effective learning tools and that they provided a structure to help deliver the course material in, with the additional possibility of creating some efficiency in preparing for class and thus reducing the time out of class required to adequately prepare for class time.

Karadag (2015) took a similar approach with pre-service teachers, surveying and looking into their attitudes towards game-based learning. The students stated that it promoted a "fun" learning environment and helped to promote a more abundant learning-teaching environment. They also stated that they would be likely to implement game-based learning in their own career. Lastly, the study determined that these pre-service teachers felt that game-based learning would also be helpful in evaluating the student's skill levels and that it would establish an environment that fostered student-teacher communication and feedback.

One interesting area that Marklund and Taylor (2016) brought up was a conflict in how the students, in this case elementary-school aged, played games at home versus how they were "supposed" to play them in class. The teachers focused on the educational aspects of the games and altered or removed other aspects that could be thought of as distracting or counter-productive. This caused the students themselves to have to alter how they interacted with the game as opposed to how they were initially inclined to. This in turn made the games themselves too labor-intensive and unreliable in this situation. This shows the potential impact that the teacher attitude can have over the implementation of games in the classroom.

**Summary**

The literature from these authors shows that games can have a positive impact on a student's learning, but there is a struggle in identifying what that impact is and

quantifying it. Due to the difficulty in determining what exactly can cause an student's learning outcomes to increase, and how exactly to measure those outcomes, some of the results can be left up to interpretation or educated deduction on the cause of the effect. There is a great need for additional studies in the impact of games in the classroom to help expand the current body of knowledge.

Similarly, measuring a student's true motivation can be a challenge due to the immense number of factors that can affect it. It is important to focus on aspects of that motivation, like Self-Determination Theory's Autonomy, Competence, and Relatedness, which can be accessed through inventories. While many of the articles talk about the motivating, and fun, factors of the games in the classroom, there is a question of if other methods, like video, could generate the same motivation and fun. A more specific and measureable aspect of motivation is to look into the student's interest in a subject and compare the changes in the student's interest in the topic.

Lastly, the large majority of these articles dealt with the impact of video games in the classroom. While video games are an excellent method of delivering game play into the classroom, they are not the only one. In addition, the incorporation of a video game into the classroom requires some significant technological infrastructure to be in place and some kind of method to keep all of the students involved while they are not the ones using the computer or interface. The opportunities that traditional board and card games bring allows multiple students to be simultaneously involved in the game at the same time, make adjustments to their strategies (and therefore their learning) based on the interaction with other students, and scale easier to larger class sizes. All of this without any technological requirements and a relatively low price point.

# CHAPTER III – METHODOLOGY

The purpose of this quasi-experimental study is to investigate whether (a) students who play a U.S. History-related game in the classroom have higher Situational Interest in U.S. History than students who do not; (b) students who play a U.S. History-related game in the classroom have higher Individual Interest in U.S. History than students who do not; (c) students who play a U.S. History-related game in the classroom have a higher measured perception of learning climate than students who do not; and (d) students who play a U.S. History-related game in the classroom have a higher level of classroom engagement than students who do not. The hypothesis is that students who play a U.S. History-related game will have a statistically significantly higher level of interest, engagement, and perceptions of the learning climate than those who do not, after controlling for previous interest and achievement.

In order to investigate these questions, seven different classes of high school U.S. History, taught by two different teachers, were assigned as either control or intervention groups. The control groups received the standard classroom activities and assignments of lectures, discussions, and videos, while the intervention group will add the game play of the card game *Timeline: American History* by Asmodee (Henry 2014). Both groups filled out an inventory that measures their interests in each of the four phases of the model, their perception of the learning climate, and their level of classroom engagement.

## Participants

There were multiple classes, with a mixture of sophomores, juniors, and seniors,

in on-level U.S. History classes that took place in the research. Two teachers were selected by the administration of the school and each of the classes they teach were paired up and randomly chosen to be either in the control or intervention group so that there was a control and intervention for the on-level classes. The school currently did not off pre-AP or AP U.S. History classes, so no students were selected from those levels. Each teacher had a mixture of control and intervention groups so that all intervention groups were not taught by the same teacher.

The students attended a large Midwestern high school, a public institution in the community of a suburb of a large city in the state. The school serves the entire suburb, housing grades 10 – 12 with an enrollment of over 3,700 and a student-teacher ratio of 19:1. Minority enrollment is between 30 and 35%. Teacher 1 had four classes of U.S. History, each with around twenty-four students and Teacher 2 had two classes of U.S. History with around nineteen students each. Teacher 1's class consisted of 61 males and 37 females, while Teacher 2's class consisted of 18 males and 20 females.

**Instruments**

To measure the impact the intervention has on the students, a combination of four instruments was used, *Measures of Situational Interest* (Høgheim, & Reber, 2015), a measure of student's Emerging Individual Interest and Well-developed Individual Interest developed by Wininger, Adkines, and colleagues (2014), *Learning Climate Questionnaire* (LCQ, Black & Deci 2000), and *Classroom Engagement Inventory* (CEI, Wang, Bergin, & Bergin, 2014). All four instruments use a seven point Likert scale ranging from 1 (Not true at all) to 7 (Very true). The inventory items are presented in Appendix A. The final order of the items was randomized. In addition, direct observation

by the researcher was employed to help better understand the impact the environment may have had on both groups, including but not limited to the teacher's interaction with the students, the learning climate of the classroom as perceived by the researcher, and the rapport the teacher appeared to have with the students. The instrument was distributed electronically through Qualtrics and filled out through the students' Chromebooks.

There were a total of 49 questions on the instrument and the specific questions can be found in Appendix A. These questions in the Appendix are grouped by what they measure, but in the on-line instrument the students filled out, the question order was randomized. Items marked with a minus sign indicate items that were reverse coded.

***Interest***

To measure the student's Triggered Situational Interest and Maintained Situational Interest, *Measures of Situational Interest* (Høgheim, & Reber, 2015) was used. The *Measures of Situational Interest* has demonstrated high reliability across multiple studies with Cronbach's Alpha ranging between .90 - .93 for the Triggered Situational Interest subscale and between .87 - .93 for the Maintained Situational Interest subscale (Høgheim, & Reber, 2015; Bernacki & Walkington, 2018). This instrument was based on the *Student Interest Survey* (SIS) designed by Linnenbrink-Garcia and colleagues (Linnenbrink-Garcia et al., 2010). The design of the SIS followed three iterations with factor analysis and regression of the results to determine validity and model fit. The first change involved modifying the items in the inventory to be more specific to the class the students attended instead of the domain itself, changing some of the questions to focus on the instructor rather than a lecture to make the scale more applicable to different class types, and refining the instrument to better focus on

Situational rather than Individual Interest (Linnenbrink-Garcia et al., 2010). In the second iteration, they dropped a few items from the instrument and added others to better measure Situational Interest (Linnenbrink-Garcia et al., 2010). This methodical approach, along with the statistical analysis that followed each iteration serve to give the instrument construct validity.

Lastly, the creators of the measure applied multiple tests to validate that the measure had high reliability with a chi-squared result of 113.32 ($p < .001$) and a strong correlation between Triggered Situational Interest and Maintained Situational Interest-feelings ($r = .88$, $p < .001$) and Triggered Situational Interest and Maintained Situational Interest-value ($r = .61$, $p < .001$). The two factors of Triggered Situational Interest were likewise strongly correlated with each other ($r = 76$, $p < .001$) (Linnenbrink-Garcia et al., 2010). The validity of this instrument has been shown through correlations with Individual Interest ($r = .71$ - $.85$, $p < .001$) (Rotgans & Schmidt, 2017), scores on subject posttests ($r = .23$ - $.26$, $p < .05$) (Bernacki & Walkington 2018), and perceived competence in a subject ($r = .53$ - $.56$, $p <.001$) (Linnenbrink-Garcia et al., 2013).

To measure the student's Emerging Individual Interest and Well-developed Individual Interest, the scale developed by Wininger, Adkines, and colleagues (2014) was used. The development of the measure showed correlations among various interest subfactors including value, knowledge, and behavioral engagement from between .25 to .43 (Wininger et al., 2014). Likewise, the results of the study did show support for both validity and reliability (Wininger et al., 2014). The questions related to Emerging Individual Interest had a Cronbach's Alpha of .71 (for questions related to Value) and .87 (for question related to Knowledge). The questions that related to Well-developed

Individual Interest had a Cronbach's Alpha of .83 (measuring Engagement). Like the Measures of Situational Interest, this instrument also went through multiple iterations to verify its validity and reliability, including looking for correlations between items on the inventory and multiple methods for the goodness of fit tests. Using a standardized root mean square residual (SRMR) test, a squared error of approximation (RMSEA), and a comparative fit index (CFI), the measurement showed a good fit for all three. SRMR = .07 (< .08 is considered a good fit), RMSEA = .06 (< .06 is considered a good fit), and CFI = .96 (> .95 is considered a good fit). Correlations among the factors of the measure ranged from .28 to .69.

Like the Situational Interest instrument used, this instrument went through multiple iterations to provide construct validity. The changes included revising the scale and removing "engagement in school" items along with adding new value items (Wininger et al., 2014). Again statistical analysis was performed to support the changes made and to increase the reliability and validity of the instrument (Wininger et al., 2014). In the present study, Cronbach's alpha was .898.

***Learning Climate***

To measure students' perceptions of the learning climate, the short version of the *Learning Climate Questionnaire* (LCQ, Black & Deci 2000) adapted from the *Health-Care Climate Questionnaire* (Williams et al., 1996) was used. *The Learning Climate Questionnaire* has high internal consistency with Chronbach's Alphas ranging from .93 - .94 (Black & Deci 2000), and ranging between .94 - .96 in a second study (Williams et al., 1997). The correlation between the items in the *Learning Climate Questionnaire* was .50 with a $p < .0001$ (Black & Deci 2000). The results of this questionnaire have shown

validity in the measuring of the autonomy support the teacher provides the individual student. The *Learning Climate Questionnaire* has shown to be correlated to the interest and enjoyment of the subject ($r = .45$, $p < .001$), and perceived competence ($r = .39$, $p < .001$) (Black & Deci, 2000). Similarly, the 1997 study showed correlations with interest ($r = .35$-$.36$, $p < .001$) and perceived competence ($r = .35$ - $.48$, $p < .001$) (Williams et al., 1997) showing the measure's validity.

During the instrument's creation, it too went through multiple iterations to provide construct validity. These iterations went through and refined the questions asked based on statistical results as well as interviews at a later date to determine if the scored behaviors continued to be displayed (Williams & Deci, 1996). These iterations help provide construct validity. In the present study, Cronbach's alpha was .847.

***Classroom Engagement***

To measure classroom engagement, the *Classroom Engagement Inventory* (CEI, Wang, Bergin, & Bergin, 2014) was used. This is a twenty-four item inventory that measures classroom engagement through affective, behavioral – compliance, behavioral – effortful participation, cognitive, and disengagement. The design of this inventory occurred over two iterations with factor analysis and validity testing through correlating factor scores guiding the creation. The CEI has demonstrated acceptable reliability with Chronbach's Alpha coefficients ranging from .74 - .93 (Aycicek, & Yelken, 2018; Sever, Ulubey, Toraman, 2014). The Chi Square values for the model were also all significant with a $p < .001$ (Wang et al. 2014). *The Classroom Engagement Inventory* has shown to be a valid measure as well. Correlations between the engagement factors it measures and validity variables (e.g., self-efficacy $r = .55$ - $.67$, performance-approach goals $r = .25$ -

.39, teacher behavior $r$ = .37 - .57, mastery goals $r$ = .60 - .77, school-prompted interest $r$ = .49 - .61) were all significant with $p < .001$ (Wang et al. 2014). Lastly, there is significant consistency between the subscales themselves. The inventory's model fit value for NNFI =.97, CFI = .97, NFI = .95, and IFI = .97 (Aycicek, & Yelken, 2018).

Again, during the design the instrument when through multiple iterations to better refine its construct validity. The changes that occurred during the iterations included consolidating the items in the instrument and adjustments based on the results of the statistical analysis (Wang et al. 2014). In the present study, Cronbach's alpha was .764.

***Demographic Information***

The information collected was at the individual level. There was an indicator to identify those in the control group and those in the experimental group. The demographic data collected was Student ID (to link the pre-test and post-test results), Grade (10, 11, 12), Sex (0 = Male, 1 = Female, 2 = No answer or chose not to answer), Teacher (1 = First teacher in the study, 2 = Second teacher in the study), Class level (1 = on-level, 2 = pre-AP, 3 = AP), Group (0 = control, 1 = intervention), and a sample grade.

***Observation***

Both the control and intervention groups were observed by the researcher during class. The main purpose of the observation was to record the learning environment the students were in and to understand better how the different teachers approached the subject. The researcher sat near the back of the classroom to minimize the disruption his presence may have brought. A sketch of the classroom was drawn indicating the layout of the room and where the students sat, along with the placement of cabinets, shelves, white boards, and other items of note in the classroom.

The observation took note of areas such as the teacher's teaching method, their enthusiasm in the subject matter, and their interaction with the students with the classroom material. It also looked for student interaction with each other and their interactions with the teacher. One specific area observed was to note the questions the students asked, especially if they appeared to be asking for clarification or if they were asking questions regarding relatedness of the discussed topic with other topics. In addition, the researcher noted the students' reactions to the material presented and how they interacted with the teacher.

**Procedures**

The primary intervention in this quasi-experiment was to have one class play a history-related game and compare their results on the measurements with a control group that did not play the game. Originally, there was to be a mixture of class levels (on-level, pre-AP, AP) and two different teachers. The class levels were to be paired up so that the on-level classes would have one control and one intervention group, the pre-AP classes would have one control and one intervention group, and the AP classes would have one control and one intervention group. However, due to how the district scheduled classes this academic year, only on-level U.S. History classes were available (see Chapter 5 for more information). The classes that were in the control group were randomly determined within each class level, which also gave a random mixture so that each teacher had classes in both the control group and in the intervention group. If the randomization placed the control groups with only one teacher, the randomization process was repeated until each teacher had a mixture of control and intervention groups.

The intervention in this quasi-experiment was done on three separate occasions: T1, T2, and T3. There were no differences in each of the occasions to the process for both the control groups and the intervention groups. Before T1, the students in both groups completed the survey as a pre-test to gather a baseline for the groups. At the end of T3, the students in both groups again completed the survey as a post-test.

### *Control Group*

For the control group, before the first day of the intervention, the teacher sent out a link to the survey for the students who then logged into on their Chromebooks and filled out the instrument. On the day of the intervention, the teacher introduced the researcher to the class and mentioned he would be there to observe the class to better understand students' interest in history. The researcher took a seat in the back or side of the classroom, out of the way. The teacher continued with their prepared lesson on U.S. History that encompassed lecture, activity, and video. The researcher observe red the classroom and recorded both the classroom layout and wrote down what he observed in the classroom, both the teacher's actions and the students' actions. The researcher did not observe every control group each day of the intervention, as he was needed at the same time for the intervention group.

### *Intervention Group*

For the intervention group, before the day of the intervention, the teacher sent out a link to the survey for the students who then logged into their Chromebooks and filled out the instrument. On the day of the intervention, the teacher introduced the researcher to the class and mentioned he was there to observe the class to better understand students' interest in history and to lead the class in playing a history related game later in the class.

The teacher instructed the class for the first ten minutes. During this instruction, the researcher observed the teacher and students and recorded what occurred along with the layout of the room. After that, the teacher turned the class over to the researcher. The researcher broke the class into groups of five to six students and handed out a copy of *Timeline: American History* to each group. The researcher explained the rules of the game and showed an example turn. Next, the researcher explained that the youngest player will be the start player and told the students they had twenty minutes to play the game. Lastly, the researcher told the groups to start playing. The researcher then observed the students playing the game and also what the teacher did during this time.

This control and intervention process occurred three separate times with at least one week between each occurrence. The entire process took less than a month and was designed to limit the disruption in the teacher's and students' day.

***Gameplay***

The *Timeline* series of games are from international game producer Asmodee and have won the American Specialty Toy Retailing Association (ASTRA)'s 2014 Best Toys for Kids award (Newswire, 2014). There are many different versions of the game focusing on inventions, cinema, history, pop culture, and diversity. For the purposes of this study, the American History version of the game was used.

Each student had a set of cards placed in front of them with pictures and the title of an event in American history. On the back side of the card was the same picture and title with the year that event happened. The players were not allowed to flip the cards in front of them over.

In the middle of the table, between all of the players, one card from the deck was

placed with the year showing. The first player in the game, determined by whoever was the youngest player, looked at his or hers cards in front of them and chose one. They then decided if the card they had chosen happened before or after the event in the middle of the table. If it happened before, they placed it to the left of the card on the table and if it happened after, they placed it to the right of the card on the table. The player then flipped over the card they placed, revealing the year. If they guessed correctly and the card they just played is in the correct order of the timeline, then their turn ended. If they guessed incorrectly, then the card was discarded and the player drew a new one. Play then passed to the next clockwise player.

For example, refer to Figure 1:

| Abraham Lincoln elected President | The Nineteenth Amendment | Beginning of the Great Depression | NASA was formed |
|---|---|---|---|
| 1860 | 1920 | 1929 | 1958 |

*Figure 1.* Sample Timeline game in mid-play.

The player had the card "First Miss America Pageant." They would have to choose where in this timeline, the first Miss America pageant occurred. Before 1860, between 1860 and 1920, between 1920 and 1929, between 1929 and 1958, or after 1958.

As the game progressed, the timeline becomes more granular and the game's challenge increases. Players were forced to make choices based not only on their knowledge of US historical events, but also on the pictures on the cards themselves. Fashion, architecture, and even the number of stars on the US flag itself can help lead clues as to when a particular event occurred. The first player that successfully placed all of their cards in the timeline won the game. The game was played for a set time, 20 minutes, or until game completion.

In order to succeed in the game, the player needs to not only have a general idea of the years events happened in American History, but they also need to employ what they know about events around the same time, fashion, product design, and world events to best determine where each card can go.

**Data Analysis**

In looking at the question of whether students who play a U.S. History-related game in the classroom have higher Situational Interest in U.S. History than students who do not, the mean was computed from the responses given by each student on the instrument related to Triggered Situational Interest for each student, giving them a Triggered Situational Interest value. A similar process occurred for the Maintained Situational Interest values, the Emerging Individual Interest values, and the Well-Developed Individual Interest values. These values were then analyzed in SPSS using multivariate analysis of covariance (MANCOVA) to see if the hypothesis that students who played the game have a higher average Triggered Situational Interest, Maintained Situational Interest, Emerging Individual Interest, and Well-Developed Individual Interest in U.S. History than those who did not, using their pre-test as a covariate.

Second, the questions on the instrument related to the perceptions of learning climate and classroom engagement had the same procedure. The mean was computed from the responses given by the students on the instrument related to perceived learning climate and the mean was also computed from the responses given by the students on the instrument related to classroom engagement. These values were then analyzed in SPSS using ANCOVA, again using pre-test as the covariate, to see if the hypothesis that students who played the game have a higher average perception of learning climate value

and also if they have a higher average classroom engagement value in U.S. History than those who did not.

Third, a correlation comparison was done between the various subscales on the instrument to determine what level of relationship existed between the different areas of interest, perceptions of learning climate, and classroom engagement. Also, descriptive statistics using the demographic data were calculated to give further insight into the results.

Fourth, the observations were written up and analyzed through qualitative methods to provide a picture of the environment during the interventions. It also showed any differences or similarities in the manner the two teachers presented U.S. History information and was available to answer any questions about the class experience itself.

Additionally, these various groupings, the four Interest phases, the learning climate, and classroom engagement, that show significance between the control and experimental group could be further analyzed through the demographic data gathered to see if there were any significant differences between class levels, grades, or gender.

## CHAPTER IV – RESULTS

As stated earlier, this study examines the possible relationship between playing a game in the classroom and a student's interest in the subject matter, their engagement with the material and their perception of the learning climate. Specifically, the research questions posed by this study were:

(a) Do students who play a U.S. History-related game in the classroom have higher Situational Interest in U.S. History than students who do not?

(b) Do students who play a U.S. History-related game in the classroom on their Individual Interest in U.S. History versus students who do not?

(c) Do students who play a U.S. History-related game in the classroom have a higher measure of perceived positive learning climate than students who do not?

(d) Do students who play a U.S. History-related game in the classroom have a higher level of classroom engagement than students who do not?

Based on these research questions, the following null hypothesis were tested with the collected data:

1) Students who play a U.S. History-related game in the classroom do not have a greater change in Triggered Situational Interest than those who did not play a game in class.
2) Students who play a U.S. History-related game in the classroom do not have a

greater change in Maintained Situational Interest than those who did not play a game in class.

3) Students who play a U.S. History-related game in the classroom do not have a greater change in Emerging Individual Interest than those who did not play a game in class.
4) Students who play a U.S. History-related game in the classroom do not have a greater change in Well-Developed Individual Interest than those who did not play a game in class.
5) Students who play a U.S. History-related game in the classroom do not have a greater change in perceived learning climate than those who did not play a game in class.
6) Students who play a U.S. History-related game in the classroom do not have a greater change in classroom engagement than those who did not play a game in class.

**Response Rate and Data Cleaning Methods**

Two U.S. History teachers were recruited for this intervention. The classes were split between control and intervention groups with intervention groups in both teachers' classes. For the pretest, a total of 123 completed responses were received. For the posttest, a total of 89 completed responses were received. There were a number of students that filled out the pretest and not the posttest and vice versa. The total number of students that completed both a pretest and a posttest were 75. Any responses that were not completed or did not have both a pretest and posttest were not included in the statistical analysis. One record was discarded due to all answers being 4 for all 49

questions including reverse-coded ones.

The first step in cleaning the data once the survey closed was to identify which area each question measured and then group all the items that measure different subscales, such as Triggered Situational Interest or learning climate, together. Next, a few of the items were reverse-coded, that is the question asked for a response the opposite of what other items were. Since the Likert scale on the instrument went from 1 to 7, in order to adjust these reverse-coded items, the selected value was changed to its inverse in the scale. For instance, if a respondent selected in the question "I found the material boring" a value of 2 (meaning that did not apply to them very much), it would actually be coded as a 6.

Once all of the reverse-coded answers were converted to be in line with the rest of the items, each subscale for each respondent was averaged to give them a score in the following categories: Triggered Situational Interest (TSI), Maintained Situational Interest (MSI), Emerging Individual Interest (EII), Well-Developed Individual Interest (WDII), Perceptions of Learning Climate (LC), and Classroom Engagement (CE).

In addition, the question regarding name of the student's teacher was an open text field. This required an additional field to be created with a value of 1 for the first teacher and a 2 for the second. This was manually coded based on the results entered. The remaining demographic information transferred directly from the survey tool used.

Lastly, the sample grades and the indicator if the individual was in the control group (code 1) or the intervention group (code 2) were manually entered based on information received from the two teachers. These values were connected to the pretest

posttest data by the student's ID number which they entered in the survey and which the teacher provided.

**Descriptive Statistics**

After cleaning up the data, descriptive statistics were used to better understand the data from the respondents. First, the Cronbach's Alpha for all of the measured items in the instrument was .915, indicating a high reliability. I also did analysis for each of the subscales with the items related to Interest having a Cronbach's Alpha of .898, the perceptions of Learning Climate having a Cronbach's Alpha of .847, and the subscale for Classroom Engagement having a Cronbach's Alpha of .764. Overall the instrument shows high reliability.

From there, I looked at the results of the data collected. Starting with Triggered Situational interest, on a scale of 1 (low Triggered Situational Interest) to 7 (high Triggered Situational Interest), the data is summarized in the table below:

Table 2

*Post Test Triggered Situational Interest Descriptive Statistics*

| Grouping | Mean | N | SD |
|---|---|---|---|
| Total | 4.6053 | 75 | 1.19502 |
| Control | 4.7000 | 48 | 1.17781 |
| Intervention | 4.4370 | 27 | 1.22918 |

Next, looking at Maintained Situational Interest, on a scale of 1 (low) to 7 (high), the data is summarized in the table below:

Table 3

*Post Test Maintained Situational Interest Descriptive Statistics*

| Grouping | Mean | N | SD |
|---|---|---|---|
| Total | 4.9440 | 75 | 1.17798 |
| Control | 5.0333 | 48 | 1.14582 |
| Intervention | 4.7852 | 27 | 1.23901 |

Next, looking at Emerging Individual Interest, on a scale of 1 (low) to 7 (high), the data is summarized in the table below:

Table 4

*Post Test Emerging Individual Interest Descriptive Statistics*

| Grouping | Mean | N | SD |
|---|---|---|---|
| Total | 4.8393 | 75 | 1.15851 |
| Control | 4.9458 | 48 | 1.17110 |
| Intervention | 4.7333 | 27 | 1.14489 |

Looking at Well-Developed Individual Interest, on a scale of 1 (low) to 7 (high), the data is summarized in the table below:

Table 5

*Post Test Well-Developed Individual Interest Descriptive Statistics*

| Grouping | Mean | N | SD |
|---|---|---|---|
| Total | 3.3433 | 75 | 1.70837 |
| Control | 3.3854 | 48 | 1.69868 |
| Intervention | 3.2685 | 27 | 1.75538 |

Next, looking at the students' perception of learning climate, on a scale of 1 (low)

to 7 (high), the data is summarized in the table below:

Table 6

*Post Test Learning Climate Descriptive Statistics*

| Grouping | Mean | N | SD |
|---|---|---|---|
| Total | 4.7956 | 75 | 1.17646 |
| Control | 4.7917 | 48 | 1.29214 |
| Intervention | 4.8025 | 27 | .95970 |

Lastly, looking at classroom engagement, on a scale of 1 (low) to 7 (high), the data is summarized in the table below:

Table 7

*Post Test Classroom Engagement Descriptive Statistics*

| Grouping | Mean | N | SD |
|---|---|---|---|
| Total | 4.7083 | 75 | 1.05193 |
| Control | 4.8438 | 48 | 1.05453 |
| Intervention | 4.4676 | 27 | 1.02234 |

A bivariate correlation was run between the four Interest subscales, the classroom engagement, and the perception of learning climate, both the pre-test and the post-test. The analysis looked at the pre and post-survey of Triggered Situational Interest (TSI), Maintained Situational Interest (MSI), Emerging Individual Interest (EII), Well-Developed Individual Interest (WDII), perceptions of Learning Climate (LC), and Classroom Engagement (CE). To interpret the magnitude of the correlation, the conventions discussed by Cohen were used; specifically $r = .10$ is weak, $r = .30$ is

moderate, and $r = .50$ is strong (Cohen, 1988). The results of this analysis is listed in Table 8 below.

Table 8

*Bivariate Correlation Between Pre and Post Tests (df=75 for all items)*

| | 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | Mean | SD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. PreTSI | - | | | | | | | | | | | 4.46 | 1.26 |
| 2. PreMSI | .882** | - | | | | | | | | | | 4.95 | 1.19 |
| 3. PreEII | .539** | .537** | - | | | | | | | | | 4.92 | 1.03 |
| 4. PreWDII | .483** | .388** | .493** | - | | | | | | | | 3.22 | 1.55 |
| 5. PreCE | .537** | .487** | .531** | .440** | - | | | | | | | 4.79 | 0.97 |
| 6. PreLC | .569** | .660** | .444** | .102 | .428** | - | | | | | | 4.92 | 1.17 |
| 7. PostTSI | .699** | .710** | .551** | .394** | .409** | .498** | - | | | | | 4.60 | 1.20 |
| 8. PostMSI | .663** | .701** | .511** | .283* | .370** | .517** | .915** | - | | | | 4.94 | 1.18 |
| 9. PostEII | .455** | .478** | .791** | .385** | .453** | .348** | .695** | .651** | - | | | 4.87 | 1.16 |
| 10. PostWDII | .360** | .318** | .491** | .736** | .267* | .097 | .497** | .393** | .526** | - | | 3.34 | 1.71 |
| 11. PostLC | 433** | .472** | .364** | .105 | .307** | .735** | .621** | .583** | .489** | .186 | - | 4.80 | 1.18 |
| 12. PostCE | .511** | .419** | .490** | .364** | .621** | .324** | .718** | .648** | .656** | .507** | .511** | 4.70 | 1.05 |

*Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

## Assumptions

For the four items in the Interest subscale, the data was analyzed for the basic assumptions of MANCOVA. The Shapiro-Wilk test did not reveal any skewing ($p$ = .368) and the Leven's Test of Equality did not show any issue with the homogeneity of variance. Triggered Situational Interest's $p$ = .478, Maintained Situational Interest's $p$ = .763, Emerging Individual Interest's $p$ = .606, and Well-Developed Individual Interest's $p$ = .377.

The other two items, classroom engagement and perception of learning climate, were tested for the basic assumptions of ANCOVA. For the classroom engagement items, the Shapiro-Wilk test did not reveal any skewing of the data ($p$ = .179) and Levene's Test of Equality showed that the homogeneity of variance assumption was met ($p$ = .448). Lastly, for the learning climate items, the Shapiro-Wilk test did not reveal any skewing of the data ($p$ = .618) and Levene's Test of Equality showed that the homogeneity of variance assumption was met ($p$ = .231).

Lastly a post hoc power analysis was run for both all items in the subscales and also for Interest, perceptions of Learning Climate, and Classroom Engagement. Power was low for each of these indicating more responses were needed.

## Interest Subscale MANCOVA Results

The items regarding the four subscales of interest were analyzed using a MANCOVA. The dependent variables were the four subscale posttest results, the independent variable was the group the individual was assigned to (control or intervention) and the covariates were the four subscale pretests results. The results of the MANCOVA analysis on the four Interest subscale questions (Triggered Situational

Interest, Maintained Situational Interest, Emerging Individual Interest, and Well-Developed Individual Interest) can be found in Table 9:

Table 9

*MANCOVA Results for Interest Subscale Questions*

| Source | Dependent Variable | *df* | *SS* | *MS* | *F* | *p* | *Power* |
|---|---|---|---|---|---|---|---|
| Group | Triggered Situational Interest | 1 | .410 | .410 | .613 | .436 | .121 |
| | Maintained Situational Interest | 1 | .715 | .715 | 1.030 | .314 | .170 |
| | Emerging Individual Interest | 1 | .708 | .708 | 1.361 | .247 | .210 |
| | Well-Developed Individual Interest | 1 | 1.586 | 1.586 | 1.191 | .279 | .190 |

**Research Question One**

For the question "do students who play a U.S. History-related game in the classroom have higher Situational Interest in U.S. History than students who do not," the instrument broke Situational Interest into two subcategories: Triggered Situational Interest and Maintained Situational Interest. Given that Triggered Situational Interest occurs based on environmental stimulus, it was expected that there would be significant difference between the control and intervention groups. For Triggered Situational Interest, students answered five items on the survey. The Likert scale ranged from 1 to 7 with 7 indicating factors that showed the most Triggered Situational Interest. The

resulting MANCOVA showed that there was no significant difference in Triggered Situational Interest between the intervention group and the control group ($F(1, 72) = .613$, $p = .436$). The mean Triggered Situational Interest value of the control group was 4.70 and the intervention group was 4.44. Therefore, the addition of the game into the classroom did not change a student's Triggered Situational Interest in U.S. History.

For Maintained Situational interest, students answered five items on the survey. The Likert scale ranged from 1 to 7 with 7 indicating factors that showed the most Maintained Situational Interest. Again it was expected that there would be significant difference between the intervention and the control groups. The resulting MANCOVA showed that there was no significant difference in Maintained Situational Interest between the intervention group and the control group ($F(1, 72) = 1.030$, $p = .314$). The mean Triggered Situational Interest value of the control group was 5.03 and the intervention group was 4.79. Therefore, the addition of the game into the classroom did not change a student's Maintained Situational Interest in U.S. History. In addition, the power for the Situational Interest subscales were low with Triggered being .121 and Maintained being .170.

**Research Question Two**

For the question "do students who play a U.S. History-related game in the classroom on their Individual Interest in U.S. History versus students who do not," the instrument broke Individual Interest into two subcategories: Emerging Individual Interest and Well-Developed Individual Interest. Individual interest takes a longer period of time to establish itself than Situational Interest, therefore it was not expected that there would be a difference between the intervention and the control group. For Emerging Individual

Interest, students answered five items on the survey. The Likert scale ranged from 1 to 7 with 7 indicating factors that showed the most Emerging Individual Interest. The resulting MANCOVA showed that there was no significant difference in Emerging Individual Interest between the intervention group and the control group ($F(1, 72) = 1.361$, $p = .247$). The mean Emerging Individual Interest value of the control group was 4.95 and the intervention group was 4.73. Therefore, the addition of the game into the classroom did not change a student's Emerging Individual Interest in U.S. History.

For the question Well-Developed Individual Interest, students answered four items on the survey. The Likert scale ranged from 1 to 7 with 7 indicating factors that showed the most Well-Developed Individual Interest. Again, due to the time required to establish, it was not expected that there would be a difference between the two groups regarding Well-Developed Individual Interest. The resulting MANCOVA showed that there was no significant difference in Well-Developed Individual Interest between the intervention group and the control group ($F(1, 72) = 1.191$, $p = .279$). The mean Well-Developed Individual Interest value of the control group was 3.39 and the intervention group was 3.27. Therefore, the addition of the game into the classroom did not change a student's Well-Developed Individual Interest in U.S. History. In addition, the power for the Individual Interest subscales were low with Emerging being .210 and Well-Developed being .190.

**Research Question Three**

For the question "do students who play a U.S. History-related game in the classroom have a higher measure of perceived positive learning climate than students who do not," students answered six items on the survey. The Likert scale ranged from 1

to 7 with 7 indicating factors that showed the most positive perception of learning climate.

Table 10

*ANCOVA Results for Learning Climate Questions*

| Source | *df* | *SS* | *MS* | *F* | *p* | *Power* |
|---|---|---|---|---|---|---|
| Group | 1 | 1.395 | 1.395 | 2.199 | .142 | .310 |

It was expected that the addition of game play in the intervention group would significantly increase that group's perception of the learning climate. The resulting ANCOVA showed that there was no significant difference in learning climate between the intervention group and the control group ($F(1, 72) = 2.199$, $p = .142$). The mean learning climate value of the control group was 4.79 and the intervention group was 4.80. Therefore, the addition of the game into the classroom did not change a student's perception of the learning climate. The power level here was high than the other subscales, but still low at .310.

**Research Question Four**

For the question "do students who play a U.S. History-related game in the classroom have a higher level of classroom engagement than students who do not," students answered twenty-four items on the survey. The Likert scale ranged from 1 to 7 with 7 indicating factors that showed the most classroom engagement.

Table 11

*ANCOVA Results for Classroom Engagement Questions*

| Source | *df* | *SS* | *MS* | *F* | *p* | *Power* |
|---|---|---|---|---|---|---|

| | | | | | | |
|---|---|---|---|---|---|---|
| Group | 1 | 1.026 | 1.026 | 1.498 | .225 | .227 |

It was expected that the addition of game play in the intervention group would significantly increase that group's classroom engagement. The resulting ANCOVA showed that there was no significant difference in classroom engagement between the intervention group and the control group ($F(1, 72) = 1.498$, $p = .225$). The mean classroom engagement value of the control group was 4.84 and the intervention group was 4.47. Therefore, the addition of the game into the classroom did not change a student's classroom engagement. The power level for the Classroom Engagement questions was again low at .227.

**Classroom Observation**

Observations were made for both classrooms to better understand the environment and teaching styles both classrooms brought. The students of each class were also observed and helped with the playing of the card game. At the end, reflective questions were asked of the students to see if they had any thoughts on the game play or if it had any notable impact to them. The details of the observations can be found in Appendix B.

A few themes did emerge during the analysis of the observation data. I went through the notes and tagged various aspects of what occurred and consolidated those tags into similar themes. All of these themes focused on the fact that the game played prompted questions and interactions that did not happen in the control classes. In addition, a few weeks after the intervention concluded, I asked the teachers involved for their reflections on the game's use in their classroom. In looking at the notes from the observations there were three things that did occur in all intervention classes observed.

First, the students *raised questions* about the events on the cards or expressed surprise as to when an event occurred. In addition on multiple occasions, a student asked about what made the event historically significant. This lead to a brief discussion about the event and its impact on U.S. History. This is not a discussion that happened in any of the control classes, given that the events were not being currently discussed in the class. Likewise there were multiple times when students expressed surprise at when an event actually happened, often long before they thought it did. This also prompted a brief discussion about the other events around that time to attempt to put context around the date.

Second, the game *provided the students an opportunity to interact in a social manner* that the control classroom often did not. While the control classes did have various social interactions, it was often in the context of one-on-one, while the intervention classes broke into groups of four or five to play the game. During the game play, it was observed that in multiple groups, the students worked together to help the current player determine when they thought an event occurred, even though the design of the game is competitive. These opportunities for social interaction in small groups gave the students interactions they otherwise would not have had during the class time.

Lastly, both *teachers felt the game was a good addition* to their class. They said they saw the value in it and enjoyed the game play and felt that it would be an excellent end-of-the-year review tool for the students. They did agree that the game itself would probably not be impactful on its own, but incorporating it into their normal classroom procedures could lead to positive outcomes, although they did not specify what those outcomes could be.

## Summary

This chapter looked at the research questions, the hypotheses tested, the methods used to prepare the data for analysis, the descriptive statistics of the data, the results of the data analysis, and the observations of both teachers in their classrooms. The data met the assumptions necessary for both the MANCOVA and the ANCOVA analysis. All of the null hypotheses of there being no difference between the control group and the intervention group were upheld in the analysis. In addition, correlations between the different subscales of the measurement were performed, showing most of the items were strongly correlated.

The observation of the classroom showed the two environments the students learned in and the methods the two teachers employed. Discussions about the Great Depression dominated both classes with different instruction methods used to teach the concepts. The game play itself, along with the students' reflections, brought up some of the impact the game play had on the students.

# CHAPTER V – DISCUSSION

The purpose of this study is to understand the impact playing subject-related board and card games in the classroom can have on students' Situational Interest, Individual Interest, their perception of the learning climate, and their engagement in the subject. Research shows that interest in a classroom subject connects to motivation about the subject itself (Abdulmajed, H., Park, Y. S., & Tekian, A, 2015; Echeverri & Sadler, 2011; Sorebo & Hæhre, 2012; Hess & Gunter, 2013). Likewise, while interest is a personal attribute, the direction the influence takes can be influenced by both content and environment (Hidi & Renninger, 2006). The Four-Phase model provides a useful guide for helping teachers better foster student interest in a particular subject. That interest can help the students sustain attention when faced with challenging tasks, give the students opportunities to perform exploratory learning in the subject and explore their curiosity, and help create or select student resources to promote problem solving and devise stratagems (Hidi & Renninger, 2006; Chen & Wang, 2017; Lynch, 2017; Huang & Gao, 2013; Rodriguez-Aflecht, Jaakkola, Pongsakdi, Hannula-Sormunen, Brezovsky, &Lehtinen, 2018).

In classroom engagement, it has been found that motivation and involvement in the classroom activities are linked, so that the level a student is engaged in the classroom reflects on how much of their psychological needs of autonomy, competence, and relatedness are met within the class's social context (Dennie et al., 2019). This

engagement has been found to lead to better academic achievement from the students as well (Hao, Yunhuo, & Zhou, 2018).

With regards to the students' perceptions of learning climate, the methods the teacher employs, also has an impact on the learning climate. These include such behaviors as providing constructive and helpful feedback, encouraging positive peer collaboration, and helping students gain higher self-efficacy (Kaufman, Sellnow, & Frisby, 2016). Likewise, supporting the student's autonomy helps the students improve or maintain their intrinsic motivation towards the class (Black & Deci, 2000).

Lastly, most of the extant research has examined the impact of video games in the classroom (Afari et al., 2012; Przybylski et al., 2012; Annetta et al., 2006; Bodnar & Clark, 2017; Caruana et al., 2016; Casanoves et al., 2017; Echeverri & Sadler, 2011; Gates & Kalczynski, 2016; Gauthier & Jenkinson, 2018; Gee, 2003; Gee, 2005; Gee, 2008; Herrero et al., 2014; Hess & Gunter, 2013; Juul, 2009; Manero et al., 2015; Marklund & Taylor, 2016; Mills et al., 2018; Ng et al., 2018; Pilkington, 2018; Rodriguez-Aflecht et al., 2018; Ryan, et al., 2006; Stieler-Hunt & Jones, 2015; Subrahmanyam & Renukarya, 2015; Tanner et al., 2012; Virk et al., 2015) . While video games are an excellent method of delivering game play into the classroom, they are not the only one. In addition, the incorporation of a video game into the classroom requires some significant technological infrastructure to be in place and some kind of method to keep all of the students involved while they are not the ones using the computer or interface. The opportunities that traditional board and card games bring allows multiple students to be simultaneously involved in the game at the same time, make adjustments to their strategies (and therefore their learning) based on the interaction with other students,

and scale easier to larger class sizes. All of this without any technological requirements and a relatively low price point.

**MANCOVA and ANCOVA Analysis**

Overall, the results of both the MANCOVA for the four phases of Interest and the ANCOVAs regarding classroom engagement and the students' perception of the learning climate showed that playing the game had no significant impact on the students' scores. All six of the null hypothesis were upheld, stating that there was no significant difference between the post test scores of the control group and the post test scores of the intervention group. Of all of the groups, the ANCOVA for classroom engagement did show the most significance ($p$ = .142) and the mean of the intervention group was higher than the control group, showing at least a promising result even though it was not significant.

In looking at the potential reasons for this lack of significance, a few possibilities emerge. The triggering of Situational Interest can have a short life span (Hidi & Renninger, 2006), and it is possible that the triggering happened early in the intervention, but was not measured until a few weeks later, so that the increase could have happened but it was not recorded. In the case of Well-Developed Individual Interest (WDII), it takes a significant amount of time for interest to transition to WDII (Hidi & Renninger, 2006), likely more than the three weeks the intervention took place over. If a student already had a strong interest in U.S. History, the game play could have pushed them into WDII, but the time frame was not adequate enough to take a Situational Interest level and transition it all the way to WDII. There is no specific range of time for WDII to develop, but it does require repeated self-initiated interactions with the content (Hidi & Renninger,

2006).

Many of these same limitations apply to Emerging Individual Interest. This transition to EMII is typically self-created although external environmental influences can continue to help the student move towards it (Hidi & Renninger, 2006). Likewise, the learning climate and classroom engagement can help enable the development of EMII, but ultimately it requires the student's to desire to engage with the content more deeply than before (Hidi & Renninger, 2006). Three weeks may have been enough time to transition a student from Maintained Situational Interest to Emerging Individual Interest, but it would require a supportive environment to do so.

The intervention itself took place right after the students returned from winter break and continued for the next three weeks. The pre-test time would be while they were getting back into the routine after multiple weeks off while the post-test occurred almost a month back into the school year where the realities and responsibilities of the school year are more realistic to the students. This could lead to a general lack of enthusiasm about school and therefore interest in the subject.

Another area looked at was how well the card game itself fit in with the classes. In the original discussion with the teachers, all classes were just beginning to study about the Great Depression. Three-quarters of the cards dealt with moments of U.S. History that happened before or during the Great Depression and it was thought this could be a good review for the students. Ultimately, though, the students only really looked at events from 1865-1945 in the U.S. History class so the time frame the game covers (1492-2008) is much broader than what the students looked at. This is also a possible explanation for the lack of significance in the intervention. Additionally, one of the teachers mentioned that

he routinely includes various games in the classroom to review concepts, so adding another game may not be as impactful as if the class was a more lecture driven one. Better integration between the game and the curriculum being taught could help increase the impact the game itself has on the students' Interest. Both teachers did say that the game would be an excellent end-of-the-year game to help reinforce dates and events.

Lastly, in looking at the game play intervention from the perspective of Expectancy Value Theory of motivation, the game play itself should have reasonably high intrinsic value if the student enjoys playing games in general, but it would have little utility value as there is little direct connection between the game play and succeeding at the class in order to graduate. For attainment value, if the student sees being good at history as something they value, then the game presents an opportunity to show these skills in a semi-public socially acceptable setting. Research shows that students finding value in an activity is crucial to developing enduring (or Individual) interest in the subject (Hulleman, Kosovich, Barron, & Daniel, 2017.) In addition, connection frequency, how often a student makes a connection with the activity and their values, has been found to be a pathway to increase a student's interest in the subject (Hulleman et al., 2017). To help increase the game's attainment and possibly utility value, and therefore its usefulness in building interest in the subject, integrating the game into the curriculum and adding features like regular reflection on connections between events (Herrero et al., 2014), a leaderboard for students to foster friendly competition (taking in consideration the negative motivational impacts that competition could introduce), and opportunities to play as a team rather than individuals could all enhance impact the game has on interest, perceptions of learning climate, and classroom engagement.

The sample of students that participated in the intervention had a unique makeup that potentially impacted the study. The school system where they attended was in the middle of standardizing when U.S. History is taken. The plan is for all students taking U.S. History to take it in their 11th grade year rather than sometime during their 10-12th grades. This process had begun last year, making sure all of the students had already taken it and the students coming into the school from the 9th grade would not need the class until 2021. Thus, in theory there would be no U.S. History classes needed for the 2019-2020 school year. Since there would be students new to the district needing a U.S. History credit in the 2019-2020 school year, or students that did not pass U.S. History yet, they did have some classes, but there were all on-level (no AP or pre-AP) and there were only five classes held. This restricted the number of students that could participate in the intervention and the academic level of those students.

It is important to note that although survey data failed to capture increases in classroom engagement, observation data provided evidence that learning may have occurred during the intervention. All of the intervention classes mentioned at least one thing that surprised them to learn, whether it was when the World Trade Center was built, what happened in Roswell New Mexico, or how far apart the Civil War and World War II were. In addition, the social nature of the game itself, with groups of students in friendly competition, given the lack of stakes for winning, helped the students interact with one another in a manner that they had not previously done so. One American student was in a group of foreign exchange students and wondered if they would have more knowledge of her country's history than she did. They would talk about the decisions they were making in the game with their opponents and often the opponents would give

helpful (or sometimes inadvertently unhelpful) advice as to where in the timeline the card should go.

**General Relationships**

An interesting observation regarding gender and interest is that for the two Situational Interest categories (Triggered and Maintained), females had a higher mean score than males (4.62 vs. 4.60 and 5.03 vs. 4.88) whereas in the two Individual Interest categories (Emerging and Well-Developed), the males had a higher mean score than females (4.89 vs. 4.84 and 3.48 vs. 3.16). Research has shown that different levels of interest can be triggered based on gender and variations of the topic of interest (Ainley, Hillman, & Hidi, 2002), but little research has been done on gender differences between the four phases of interest themselves. While these differences were not statistically significant, they do point to possible future research regarding gender and Situational vs Individual interest. It is possible that high school females' interest in history is more influenced by their environment while high school males' interest is more connected to their identity. Alternatively, if one has little interest individual interest, the impact of the environment on triggering Situational Interest could be greater (Hidi & Renninger, 2006). Further research will also be required to see if this difference between gender and Situational and Individual interest is maintained over different subjects and different times.

Looking at the means between 11$^{th}$ and 12$^{th}$ grade students (10$^{th}$ grade was ignored since there was only one student in that grade), there was a difference between 11$^{th}$ graders' Well-Developed Individual Interest and 12$^{th}$ graders (3.28 vs. 4.13). Similarly, 12$^{th}$ grade scores on classroom engagement were higher than 11$^{th}$ grade (4.91

vs. 4.67), suggesting that they were more engaged in the History class than the 11th graders. Again, these findings were not statistically significant, but a 12th grader would have had an extra year to develop interests and was poised to think more about what they are going to do upon graduation.

In examining the correlations between the various subscales, results reveal significant and strong correlations between the pre-test and post-test results. All of the correlations (TSI .699, MSI .701, EII .791, WDII .736, CE .621, and LC .735) were significant at the 99% level and positive showing a significant relationship between the pre-test scores in the various subscales and the corresponding items in the post-test. This helps show that the instrument used to measure Interest was internally consistent.

Also of interest were the strong correlations between the four subscales of interest with each other in the post test. The transition from Situational Interest, often triggered by environment, to Individual interest where the individual chooses to continue to encounter the content on their own volition (Hidi & Renninger, 2006) could use some further investigation. Triggered Situational Interest correlated with Emerging Individual Interest strongly and with Well-Developed Individual Interest moderately, both again significant at the 99% level which shows a strong connection between Triggered Situational Interest and the two subscales of Individual Interest. Maintained Situational Interest likewise had high correlations with the two Individual Interest subscales with EII strongly and WDII moderately, also at the 99% level. This continues to support the Four-Phase Model and the progression from Situational to Individual interest in content.

Another correlation comparison is between the Interest subscales and the perceptions of the learning climate. Here, we again see strong correlations between

perceptions of the learning climate and the Situational Interest subscales both significant at 99%, but in the Individual Interest subscale, only the Emerging Individual Interest was significant and moderately correlated (significant at 99%). Well-Developed Individual Interest was not significantly correlated with perceptions of learning climate. In the Well-Developed Individual Interest phase, the student is typically more resourceful regarding the content and this interest is part of their personal identity (Hidi & Renninger, 2006) therefore if a student with this level of interest in the content encounters a learning climate that they feel is inadequate, they are more likely to seek the interaction with the content on their own rather than need the classroom to provide that interaction. Also, based on the means across all classes of 3.34 for the Well-Developed Individual Interest, we can see that the average student in the classes has a low WDII in U.S. History, lower than the mathematical average of 3.5. U.S. History is not that important to them and while the learning climate may help them pass the class, it does not necessarily provide the motivation to become a history buff. Another possible interpretation is that perception of the learning climate has little impact on a student's WDII in the subject. There are too many steps between an autonomy supporting classroom environment and a student identifying U.S. History as one of their characteristics. It would be interesting to see if, at the end of the school year, rather than in the beginning of the semester, if the correlation between WDII and perceptions of learning climate became stronger as the student spent more time in the classroom environment. This longer time in the environment could be necessary to better influence the student.

Examining the interaction between the four Interest subscales and the classroom engagement subscale again continued to show a significant relationship between them.

All of the correlations between Interest and classroom engagement were significant at the 99% level and all strong showing a connection between the student's interest in the subject of U.S. History and the engagement in the U.S. History classroom. A classroom with high classroom engagement potentially offers students a considerable amount of autonomy in the classroom which has shown to generate more positive emotions, interest, and enthusiasm (Nunez & León, 2019). The results of this correlation show this relationship and presumably the reverse is true with high interest in the subject leading to greater classroom engagement, but further study would be required. After doing research into the ways to increase classroom engagement and perceptions of learning climate, interventions could be used that attempt to trigger one without triggering the other to help better define the relationship between the two concepts. This could then show indications that an increase in classroom engagement leads to higher perceptions of learning climate or the reverse.

The last correlation is between the perception of the learning climate and classroom engagement subscale. These two items were significant at a 99% level with a strong correlation. This makes logical sense as when a student is engaged in the classroom, participating in activities and asking questions, they will likewise have a high perception of the learning climate and vice versa. If the student were only engaged with the material, rather than the classroom, their feelings on the learning climate may be less important to them since they could just do private research on the topic they are engaged with. Given how both concepts are based on the Self-Determination Theory of motivation, the relationship between the two constructs is understandable. As the learning climate meets the student's needs of autonomy, competence, and relatedness (Bean,

Rocchi, & Forneris, 2019), those same needs are being met in regards to the student's Engagement in the classroom (Nunez & León, 2019).

**Limitations**

The results of this study have some limitations that should be noted. First, as was previously discussed, this specific school year was a special year in regards to U.S. History enrollment. There were no higher level (pre-AP or AP) classes available and the students that were currently taking the class either had just moved into the district, had previously failed the class and needed the required credit, or had put off taking U.S. History until the last moment. It is possible that these circumstances could lead to lower motivation in the class itself or possibly lessened the impact of the intervention. Each of these categories may have contributed to the lack of results found in the statistical analysis.

Next, the response rate of the post-test vs. the pre-test was noticeably less. While there were 123 responses on the pre-test, there were only 88 on the post-test and of those, 13 did not take the pre-test. This lead to a smaller sample-size than originally hoped for. In addition, the timing of the research during a school year when there were fewer U.S. History classes taught than during other years reduced not only the number of participants in the intervention, but also the opportunity for different levels of students (on-level, pre-AP, and AP) to participate. Likewise, post-hoc power analysis showed that for each of the subscales, the total power was low, indicating that a larger sample would be needed for greater reliability of the results.

Attempts were made to help ensure that the students were answering the questions answered honestly. To help address this issue there were some reverse coded items on the

survey. Looking at the records used, the reverse coded items did show the same trends as the other items on the inventory. However, one post-test respondent showed nothing but 4s on all 49 questions in the inventory (this record was discarded for this and because there was no corresponding pre-test). Similarly, students may not have answered honestly thinking they were helping their teacher, by recording more positive responses than they actually personally felt, even though they were informed that all answers were confidential.

**Future Research**

Overall, the mean scores for each of the different subscales (with the exception of WDII) all were over 4.4 (out of 7) meaning that, on average, these students all had above average interest, above average classroom engagement, and above average perceptions of the learning climate before the intervention ever began. It is possible that this interest lessened the impact of the intervention itself. Redoing the intervention with students identified as lesser motivated and higher motivated could show this type of intervention is more or less effective with certain types of students.

The current intervention added the gameplay to the existing class activities. It would be interesting to develop more of a curriculum around the gameplay and help better integrate the game into the class itself. As the game becomes better supported by both what happened in the class before the game was introduced and references to the game well after it is played could also help better engage student's attention and motivation.

Due to the uniqueness of this school year in the U.S. History classes, only on-level classes were taught and therefore took part in the intervention. It would be

interesting to see not only if pre-AP and AP U.S. History classes had significant differences between the intervention and the control groups, but also if their mean scores in the inventory were significantly different as well. Looking into the level of Interest, classroom engagement, and perceptions of the learning climate could potentially show ways that the different levels of classes could be taught to help maximize these items for each of the different levels of students or that they are already highly motivated and do not need an intervention such as this.

Another interesting avenue to pursue for future research is looking at younger grades, like middle school, and see if the game has a significant impact on interest, perception of learning climate, and classroom engagement. Younger students may be more motivated by gameplay than older students and thus the impact of the game could be greater.

The correlation of perception of learning climate and classroom engagement in the inventory also suggests further research to look at the connection between the two constructs. Looking to see if one leads to the other or which aspects of each construct are correlated to each other can help better define specific areas of the class environment itself that can lead to better learning outcomes and engagement with students.

Another option for future research is to look for ways to adjust the game play in such as a way to increase the motivational value the game provides, especially for utility value, but also finding ways to increase the intrinsic value of the play. This could lead to potentially higher motivation to play and also to better understand U.S. History, which should lead to a higher interest in U.S. History itself or vice versa. Theoretically, incorporating leaderboards (taking great care of the potential motivation-lowering effects

they can have), reflection and acknowledgement of learned items, and possibly even holding a game tournament are all possible ways to adjust the Expectancy Values the game provides.

Lastly, by incorporating student choice as option to play the game in the class, or choices about who to play against, the teacher could increase the autonomy of the class itself, which should lead to higher perceptions of learning climate and classroom engagement. It would be interesting to see if adding this feature to the gameplay element would be enough to help increase a classroom's autonomy in a statistically significant manner.

**Conclusion**

While the main intervention did not show any statistically significant changes between the intervention and the control group, the results did help shape future research opportunities. In addition the strong correlations between the items in the inventory help to support the idea that it is internally consistent in capturing the information hoped for.

Discussions with the teachers after the analysis were completed did lead to ideas of better ways to incorporate the game into the classroom, and both teachers liked the game itself, and stated it had obvious learning potential and would be a welcome addition to their class. It may not be enough to increase a student's interest in the subject by itself, but it may be an important piece in the rest of the classroom environment to help facilitate not only interest and engagement, but learning as well.

While it is a little disappointing to see no significant impact on the students participating in the intervention, the intervention did show promise and a host of other

research opportunities. The reactions of both the teachers and the students participating show that gameplay can have positive impact in the classroom and research will need to continue to hone in on which exact aspects of gameplay have an impact to ultimately lead to a greater student interest and participation in class.

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## Appendix A – Inventory Used

**Phases of Interest Questions**

| | | |
|---|---|---|
| 1 | I liked the learning material. | Triggered SI |
| 2 | The learning material caught my attention. | Triggered SI |
| 3 | I found the learning material boring. | Triggered SI- |
| 4 | The learning material was fun to work with. | Triggered SI |
| 5 | I found the learning material engaging. | Triggered SI |
| 6 | I found class to be boring. | Maintained SI- |
| 7 | I liked what I learned here. | Maintained SI |
| 8 | I thought class was interesting. | Maintained SI |
| 9 | I found class intriguing. | Maintained SI |
| 10 | I did not like what I learned here. | Maintained SI- |
| 11 | Learning about history is helpful. | Emerging II |
| 12 | What I learn in history is useful. | Emerging II |
| 13 | I know a lot about history. | Emerging II |
| 14 | I do well in my history class. | Emerging II |
| 15 | History is easy for me. | Emerging II |
| 16 | I watch shows about history outside of class. | Well-developed II |
| 17 | I look at history websites outside of class. | Well-developed II |
| 18 | I read books about history outside of class. | Well-developed II |
| 19 | I talk about interesting historical facts outside of class. | Well-developed II |

**Learning Climate Questions**

| | | |
|---|---|---|
| 20 | I feel that my instructor provides me choices and options. | Learning climate |
| 21 | I feel understood by my instructor. | Learning climate |
| 22 | My instructor conveyed confidence in my ability to do well in the course. | Learning climate |
| 23 | My instructor encouraged me to ask questions. | Learning climate |
| 24 | My instructor listens to how I would like to do things. | Learning climate |
| 25 | My instructor tries to understand how I see things before suggesting a new way to do things. | Learning climate |

**Classroom Engagement Questions**

| | | |
|---|---|---|
| 26 | I feel interested. | Affective |
| 27 | I feel proud. | Affective |
| 28 | I feel excited. | Affective |
| 29 | I feel happy. | Affective |

| | | |
|---|---|---|
| 30 | I feel amused (smile, laugh, have fun). | Affective |
| 31 | I listen very carefully. | Behavioral engagement - compliance |
| 32 | I pay attention to things I am supposed to remember. | Behavioral engagement - compliance |
| 33 | I complete my assignments. | Behavioral engagement - compliance |
| 34 | I get really involved in class activities. | Behavioral engagement - effortful class participation |
| 35 | I form new questions in my mind as I join in class activities. | Behavioral engagement - effortful class participation |
| 36 | I do not want to stop working at the end of class. | Behavioral engagement - effortful class participation |
| 37 | I actively participate in class discussions. | Behavioral engagement - effortful class participation |
| 38 | I work with other students and we learn from each other. | Behavioral engagement - effortful class participation |
| 39 | I go back over things I don't understand. | Cognitive engagement |
| 40 | If I make a mistake, I try to figure out where I went wrong. | Cognitive engagement |
| 41 | I ask myself some questions as I go along to make sure the work makes sense to me. | Cognitive engagement |
| 42 | I think deeply when I take quizzes in this class. | Cognitive engagement |
| 43 | I search for information from different places and think about how to put it together. | Cognitive engagement |
| 44 | If I'm not sure about things, I check my book or use other materials like charts. | Cognitive engagement |
| 45 | I try to figure out the hard parts on my own. | Cognitive engagement |
| 46 | I judge the quality of my ideas or work during class activities. | Cognitive engagement |
| 47 | I am "zoned out," not really thinking or doing class work. | Disengagement |
| 48 | I let my mind wander. | Disengagement |
| 49 | I just pretend like I'm working. | Disengagement |

## Appendix B – Qualitative Observations

Both teachers involved in the study were observed during class. The intervention in the class itself typically took up around twenty minutes of the class time with the remaining approximately thirty-five minutes given to general instruction, in this case the root causes of the Great Depression. Both classes covered the same material with the same level of students (non-AP or pre-AP).

### Teacher 1

Teacher 1's classroom was on the bottom floor. The classroom itself contained no windows and held enough desks for thirty students, although only twenty-two students were present during the observation. The walls had various student-made posters from previous assignments discussing different periods in U.S. History. The door to the classroom had a US Army sticker in the window and the teacher appeared to be former military. His students referred to him as Coach, presumably he coaches a sport in the school, and had a respectful attitude towards him.

The class itself took place during first period, which meant various disruptions in getting the class moving from the morning school announcements and students making the transition from getting to school to preparing to learn. Many students snacked on food or forced themselves to wake up and pay attention when needed. The teacher had an attention-getting device where he would ask "what do we do?" and the class would reply "our best work" in unison. The teacher employed this a few times in the classroom and it worked to get everyone focused on the task at hand.

In addition to playing Timeline in the classroom, the students engaged in four other pieces of work. First, they had a graph due, but if they still needed to work on it,

they could during the second activity which was a ten-minute video that talked about the causes of the Great Depression in an interesting way. Many students worked on their graphs during the video presentation. Third, the teacher had them fill out a clock with other student's names on each of the hour. The teacher said that he used this to group students together quickly to discuss concepts as a group or work on group projects. He would tell them to get with their 1 o'clock, for example, and this eliminated a lot of confusion and standing around when they needed to group up. Lastly the teacher had them open their text books and he began to lecture and read from the book about the beginnings of the Great Depression.

When the game was presented to the class it took them a few minutes to understand how the game played and to get into groups for four or five to play. The games were handed out and they played. The observer explained the instructions of the game and answered any questions that came up during play. At the end of the game, the observer asked a few reflection questions to help the students think about what they did and anything they learned.

Some quotes from the students regarding the game:

"I knew more than I thought."

"I looked at the drawings to determine when something happened."

"I did not like it at all."

"I did better than I figured I would."

"It was interesting."

For the classroom layout, refer to Figure 2:

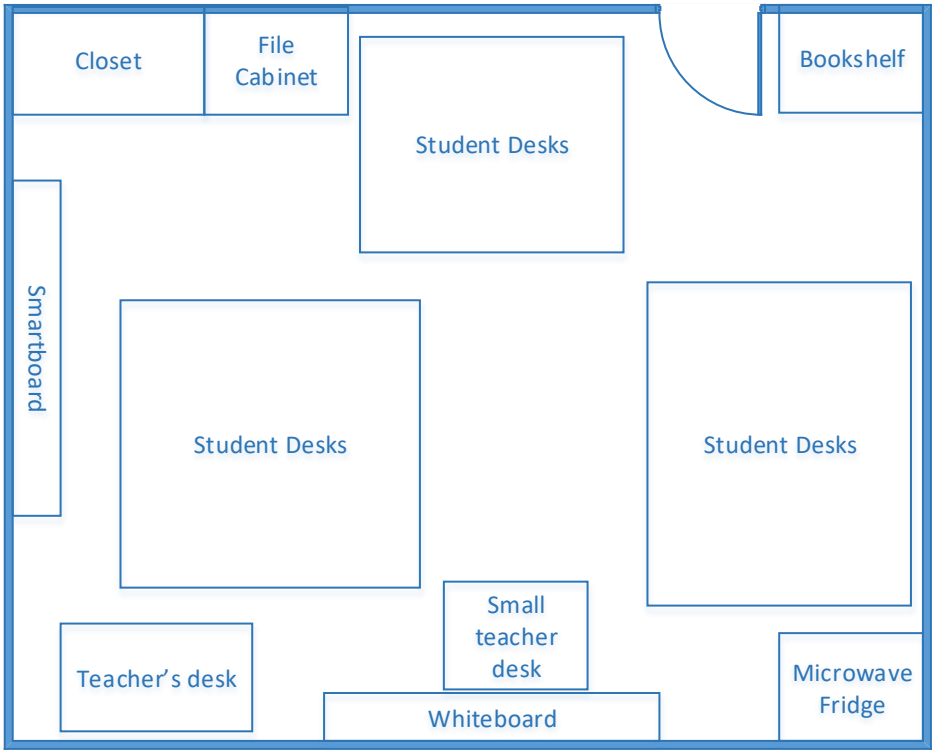


*Figure 2.* Classroom A sketch.

**Teacher 2**

Teacher 2's classroom was upstairs and did have a window to the outside and held enough desks for thirty students with twenty-five students present that day. Various historical pictures covered all of the walls in a progressive timeline. As this classroom also taught Oklahoma History many of the pictures focused on Oklahoma's transition from Indian Territory to a state. The students referred to the teacher with the title of Mr. and his last name.

In addition to the game play in the class, the teacher had the students fill out a reference sheet about all they knew about the various causes and impacts of the Great

Depression. He acknowledged that they had not talked about it yet in class, but wanted them to realize that they already knew something about the era. As the conversation level among the students increased, the teacher started asking students to state some of the reasons that they had written down. Many stated they had nothing in certain sections and so the teacher led a discussion about various causes. One side conversation that came up was the concept of the national debt. The teacher brought up a webpage showing a large number of statistics, including the ever-increasing current national debt. The teacher pointed out various facts presented on the web page and students made a few comments on other facts.

Like the other classes, there was some hesitation from the students in having them break into groups to play. The games were handed out as the observer explained the instructions of the game. While the groups played, the observer answered any questions that came up during play. At the end of the game, the observer asked a few reflection questions to help the students think about what they did and anything they learned.

For these two classes, there were a few interesting observations:

In one game, a student was trying to determine when the World Trade Center was built. She opted for some time in the 90s, and was surprised when the year was actually 1973. She seemed amazed that it was so long ago.

The card “Little Boy explodes over Hiroshima, Japan” generated some discussion about the naming of the two nuclear bombs dropped in World War II and the impact that had on the war and the world.

A student confused the Challenger Space Shuttle disaster and the Columbia Space Shuttle Disaster and a brief conversation came up about both.

The card “Roswell UFO incident” caused a student to ask his teacher what happened at Roswell in 1947. He had not heard of it before and seemed to be surprised about the event. The teacher discussed the official government statement about experimental aircraft and how many believe it was a UFO but that no one is really certain what crashed in the New Mexico desert.

For the classroom layout, refer to Figure 3:

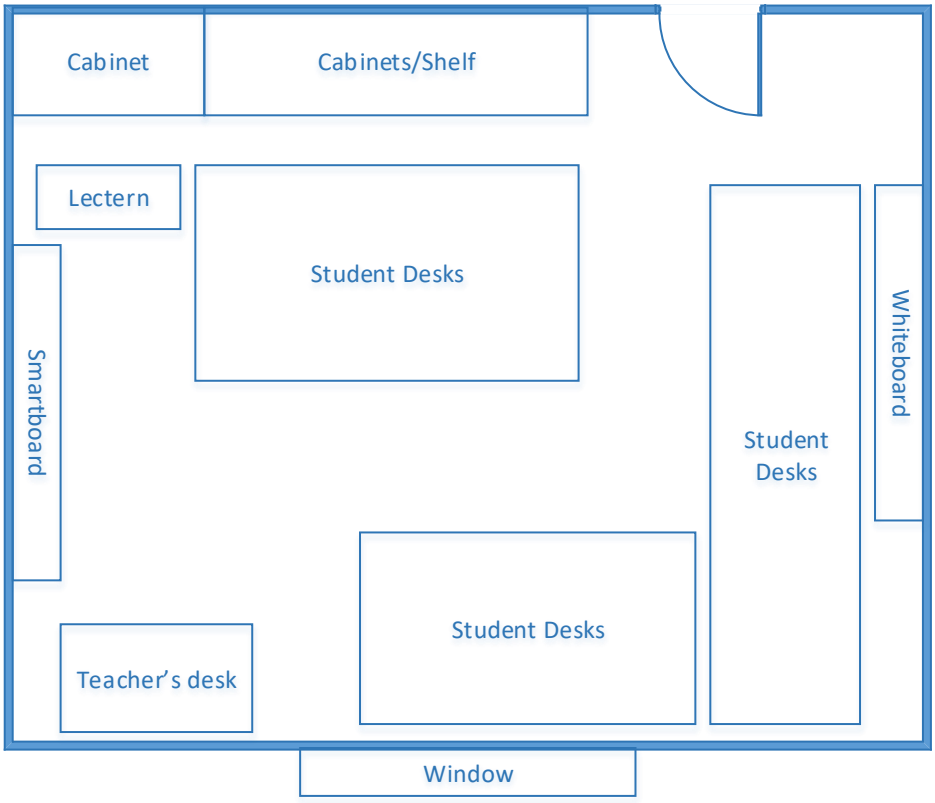


*Figure 3.* Classroom B sketch.

# Appendix C – IRB Approval

**Oklahoma State University Institutional Review Board**

| | |
|---|---|
| Application Number: | ED-19-67 |
| Proposal Title: | TRIGGERING STUDENT INTEREST IN CLASSROOM SUBJECTS THROUGH THE USE OF BOARD GAMES |
| Principal Investigator: | Erik Dewey |
| Co-Investigator(s): | |
| Faculty Adviser: | Mike Yough |
| Project Coordinator: | |
| Research Assistant(s): | |

**Status Recommended by Reviewer(s): Approved**

| | |
|---|---|
| Study Review Level: | Expedited |
| Modification Approval Date: | 11/26/2019 |

The modification of the IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46. The original expiration date of the protocol has not changed.

Modifications Approved:
Modifications Approved: Replace the Self-Determination Theory with Learning Environment and Classroom Engagement.
Also gathering test scores for the participants and using a school ID to connect the test scores and the survey results.

The final versions of any recruitment, consent and assent documents bearing the IRB approval stamp are available for download from IRBManager. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved.
2. Submit a status report to the IRB when requested
3. Promptly report to the IRB any harm experienced by a participant that is both unanticipated and related per IRB policy.
4. Maintain accurate and complete study records for evaluation by the OSU IRB and, if applicable, inspection by regulatory agencies and/or the study sponsor.
5. Notify the IRB office when your research project is complete or when you are no longer affiliated with Oklahoma State University.

Sincerely,

Oklahoma State University IRB
223 Scott Hall, Stillwater, OK 74078
Website: https://irb.okstate.edu/
Ph: 405-744-3377 | Fax: 405-744-4335| irb@okstate.edu

# VITA

Erik Andrew Dewey

Candidate for the Degree of

Doctor of Philosophy

Dissertation: TRIGGERING STUDENT INTEREST IN CLASSROOM SUBJECTS THROUGH THE USE OF BOARD GAMES

Major Field: Educational Psychology

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Educational Psychology at Oklahoma State University, Stillwater, Oklahoma anticipated in May, 2020.

Completed the requirements for the Master of Business Administration at Southern Nazarene University, Bethany, Oklahoma in 2003.

Completed the requirements for the Bachelors of Science in Business Administration in Marketing at The University of Tulsa, Tulsa, Oklahoma in 1994.

Experience:

| | |
|---|---|
| Continuing Education Instructor – Tulsa Community College | 2008 – Present |
| Substitute Teacher – Broken Arrow Public Schools | 2015-2016 |
| Senior Instructor – AutoExec MicroComputer Training Center | 1996 - 1997 |