3-1-2022

Impact of Gamification on an Online Middle School Classroom

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A Thesis Submitted to the Graduate Faculty of

GRAND VALLEY STATE UNIVERSITY

In

Partial Fulfillment of the Requirements

For the Degree of

Master of Education

Educational Technology

August 2021

Thesis Approval Form

GRAND VALLEY STATE UNIVERSITY

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Acknowledgements

In conducting this study and writing this thesis, I have been the recipient of encouragement, direction and inspiration from Professors Sean Lancaster, Beomkyu Choi, and Jonathan Bartels. My thanks go to them and to many others at Grand Valley State University. I want to express my most sincere gratitude to Scott Kirschner for developing the leaderboard app used in this study. I also would like to thank Clare Mckennas and Renna Varano for allowing me to conduct this study in their school and their classroom.

Jeremy Hein

Abstract

Gamification is defined as the use of game elements in non-game contexts. The gamified element explored in this thesis is a leaderboard with various forms of engagement being tabulated. This study investigates the impact a leaderboard has on the behavioral engagement of an online middle school classroom. Research has revealed that elements of gamification can increase engagement but there is a gap in research that focuses solely on a leaderboard as an intervention to increase engagement. Also missing from the literature were studies conducted in middle school settings. The study presented in this thesis addresses these limitations and provides value to the knowledge base. A quasi experimental study using classroom observations was conducted. During the study, a total of 8 classes (4 control and 4 intervention) of an online English Language Arts class were observed over the period of 5 weeks. During the intervention, a leaderboard was used to measure behavioral engagement.

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Chapter One Introduction

Problem Statement

The global pandemic of 2020 forced many K-12 classes online, and caused many teachers to begin online instruction with little to no preparation on effective practices. Teachers quickly discovered that engaging and interacting with students had become difficult, and that the personalization of teaching children was damaged. Subramaniam et al., (2018) found that the level of student engagement is lower in a virtual setting than in a face-to-face setting and that engagement is a catalyst for positive student performance. And, students are generally less motivated in online settings (Zamora-Polo et al., 2019). To maximize student engagement in online learning, various instructional approaches were introduced (see e.g., flipped learning model, blended learning, etc.). Recently, many researchers and practitioners have paid considerable attention to gamification. This approach can help motivate students to want to learn (Hussain et al., 2018; Groccia, 2018; Dichev & Dicheva, 2017).

Importance

Student engagement helps students feel motivated to learn and feel connected to the classroom and engagement is necessary for learning (Hung, 2018). Engagement presents a strategy that merits investigation. During the Covid-19 Pandemic, schools were unprepared for the demands that going fully online presented as were teachers (Lynch, 2020). Parents reported that their children lacked motivation during online learning and this led to failure to follow school rules and even lack of participation (Gunbas & Gozukucuk, 2020). Students who are learning in virtual environments find that relationships and a feeling of social presence are best developed in person (e.g., social functions) and not during online learning (Borup, Walters, &

Call-Cummings, 2020). Engagement is considered necessary for student learning and the lack of engagement can lead to lower student outcomes and a less positive online experience (Husssain et al., 2018). Finn et. al (1995) explained that academic performance decreased as students became less engaged. Creating engagement in online classes is a necessary component to helping students learn, and gamification is potentially a strategy that can address this need.

Background of the problem

Student engagement means having students concentrate on a learning task while also showing interest and enjoyment in what they are learning (Groccia, 2018: Kim, 2018: Shernoff et al., 2017). One of the earliest educational scholars to study engagement was Ralph Tyler who focused on time on task (Kuh, 2009). The concept of an engaged learner has roots in many theories of academic learning such as interest, effort, motivation, and time on task (Brill & Park, 2008). Students learn better when they are alert and attending to instruction; teachers face the challenge of keeping students engaged, and this has long been the case (Dichev & Dicheva, 2017).

Indicators of disengagement include not paying attention, failure to complete school work, withdrawal and disruptive behavior (Murray et al., 2004). Educators should consider motivational factors, so students remain engaged because student engagement is one of the best predictors of learning (Groccia, 2018).

Forms of engagement can vary across classrooms and situations. Engagement is influenced not only by external and environmental factors, but also by the choices students make. Little is known about classroom practices and perceptions of students from one class to another, which means that levels of engagement are varied (Shernoff et. al, 2017). And Bulger et al. (2008) explained that engagement is often invisible for teachers to recognize and measure easily.

Schools of all levels from pre-K up through universities were forced to abruptly switch to online teaching because of the global pandemic in 2020. Teachers were required to completely switch their instruction to online platforms, with no time allotted to properly prepare to teach in a virtual environment. During the global pandemic, much has been learned, and the effect of virtual education is contingent on the capacity and experience of the classroom teacher (Zhang et al., 2018).

Statement of Purpose

The purpose of this research study is to explore how gamification can increase student engagement in an online middle school language arts class. This study addresses the impact of gamification on behavioral engagement in an online setting. The gamification element that is employed is a leaderboard to acquire points. This study contributes to the limited body of research concerning the use of gamification in an online middle school setting.

The gamification of the online classroom may aid in helping motivate and engage students. For example, gamification helps foster students to take an active role in their learning and this engagement can potentially lead to higher student achievement (Fotaris et al., 2016). The varying degree of engagement in classrooms makes the idea of game-based learning intriguing. Shernof et al. (2017) suggested that "student engagement is a dynamic, unfolding, process best understood and operationalized through repeated measures of individuals as classroom activities and contexts change" (p. 3).

The current study is proposed to benefit teachers. Some teachers do include gamified elements in their teaching, however the empirical research on gamified learning is quite fragmented and more research is needed (Dichev & Dicheva, 2017). In fact, much of the research on gamification happens at the post secondary level (e.g., Hung, 2018; Fotaris et

al.,2016; Boverman et al., 2018). There exists almost no research focused on using gamification in an online classroom, especially at the middle school level. Hung (2018) writes that game based learning is under-researched. And, Looyestyn et al. (2017) recommend that further research is needed to explore the effectiveness of gamification. The current study addresses these gaps in the literature.

The concept of a leaderboard in the classroom has been explored in the literature without the use of technology. For example, Looyestyn et al. (2017) discussed, “evidence suggests that leaderboards may be a particularly useful form of gamification to increase engagement” (p. 14). These researchers conducted a meta-analysis of many studies around gamification and provided recommendations that influence the current study. The meta-analysis calls for specific research on leaderboards to be added to the scholarly knowledge base. The current study provides much needed research of gamification at the middle school level and in an online environment.

Research Question

How does the gamified learning environment using a leaderboard system impact students' behavioral engagement in an online learning system?

Hypothesis

Students will not participate more in a gamified learning classroom than in a non-gamified classroom.

Research Design

The ages of the students ranged from 11-12. There were a total of 28 students, 26 who participated in the class including 16 males and 10 females. The participants were 100% African

American. Students were in a 6th grade ELA class in an urban charter school in a large Midwestern city. The class was taught 100% virtually and was conducted entirely on Zoom, a web-based conferencing tool. This class was selected because it aligns with the investigator's preparatory period. All human subjects research approvals were obtained from the university's IRB (see Appendix A).

The study took place over 4 weeks with two class periods a week for a total of 8 class periods. During the first 4 classes, students were observed and scored on their level of participation including volunteering to read, answering questions, asking questions, and remaining on Zoom during asynchronous time to receive additional help.

At the conclusion of the first 2 weeks, students learned about how their learning will take place in the gamified online learning environment. The gamification system consists of a leaderboard where student selected avatars appear (e.g., animals and other objects). Students learned that various levels of participation impact the standing on the leaderboard. Students also were told that no student names or identifiers are attached to their generic avatar. Students were instructed that their participation level impacts their avatar's standing on a gaming board for the second 4 classes. SPSS was used for the data analysis with the help of the university statistical center. Student participation was tallied and analyzed using a paired samples t test on individual variables being studied. All of the variables were combined into an overall engagement category and this required a sign test (Sprent, 1989). The sign test was selected because the symmetry assumption was violated, which means that a more simple t test was unable to be computed.

Variables were examined to determine whether any differences existed between a non-gamified classroom and a gamified classroom.

Key Terms-

- **Engagement:** the heightened simultaneous experience of concentration, interest, and enjoyment in the task at hand (Kim et al., 2018, p. 7).
- **Behavioral Engagement:** involvement in learning and academic tasks and includes behaviors such as effort, persistence, concentration, attention, asking questions and contributing to class discussions (Frederick, Blumfield, and Paris, 2004, p.62).
- **Gamification:** use of game design elements in non-game contexts, the process of making activities more game-like (Dichev & Dicheva, 2017, p. 2).
- **Online Learning:** instruction and content are delivered primarily over the Internet (Watson, 2005, p. 11).

Delimitations of the Study

The study took place in a 6th Grade English Language Arts classroom, conducted entirely online via Zoom. Twenty-six out of the 28 students enrolled in the class participated in the study. This class was chosen because the researcher is a teacher at the school and aligns with their preparatory period.

The study addresses the impact of gamification, specifically a leaderboard on behavioral engagement of 6th grade students in an online middle school classroom. The variables measured in this study include attending virtual class, volunteering to read, asking questions, answering questions, and staying on zoom during asynchronous time to receive extra help. All of these variables are observable and easily measurable. There were two variables that were not identified prior to the study that might contribute to engagement. Measuring if a student had their camera on or not is the first variable. This was not included in the study because students having their

cameras on is not an expectation in the classroom that is being observed. The second variable that was not included was the amount of assignments a student submitted. The researcher did not have access to the assignments being submitted to check for completion or accuracy.

Limitations

The first limitation was the number of classes observed (e.g., 4 control and 4 intervention) was too small of sample size to fully answer the research question because of low statistical power. Potentially, collecting more data over time would have made analysis of each variable easier. Another limitation was a threat to the internal validity of the study. The students in the control class were reading and discussing a fictional novel, and in the intervention classes they were reading and discussing informational texts. These 2 different types of texts could potentially create different levels of student engagement independent of the intervention. Finally, the level of engagement was not measured a few weeks after the intervention class ended to observe if the leaderboard had any lasting impact on engagement.

Chapter Two Literature Review

Introduction

This paper describes the impact of gamification on an online middle school classroom; specifically, exploring the effect a virtual leaderboard has on student engagement. The literature review is focused and organized on student engagement and gamification within face-to-face and online classrooms.

This review of the literature begins with a theoretical framework aligned with gamification. I then examine research exploring the concept of engagement, including descriptions of the three types of engagement. Lastly, an extensive literature review on gamification is also provided. This includes a brief overview of gamification, gamification in a traditional classroom and in an online classroom, and engagement in online learning settings.

Theoretical Framework

Gamification, as an instructional approach, draws from multiple learning theories and perspectives, including behavioral sciences and motivational theories. Self-determination theory (SDT) and Achievement goal theory (AGT) could offer a better explanation to help us understand how a gamification approach can promote learning in that these theories focus to foster and increase student autonomy while creating more favorable student outcomes.

Self-determination theory (SDT) is based on the assumption that individuals need autonomy, competence, and relatedness to experience growth. These needs are essential for students to perform at their best and for personal well-being (Ryan & Deci, 2000). A well-designed gamification system can address the aforementioned needs to improve student motivation. A student's motivation is also influenced by the students' learning environment (Kim

et. al, 2018). Ryan and Deci (2000) explained that the types of motivation reside on a continuum moving from amotivation (lacking the intent to act) on the left all the way to intrinsic motivation (doing something without reward given) on the right. They also noted that intrinsic motivation is central to self-determination. A gamification system could enable students to move from being externally motivated because of points, badges, and leaderboard to developing a desire to complete the activity for its own sake (Tsay, Kofinas, Trivedi, & Yang, 2019). When a student is internally motivated, the meaningfulness of the task is what motivates students. The reward or the punishment is the motivator of an externally motivated student, and the motivation will wane when the reward or punishment is removed.

Achievement goal theory (AGT) provides a lens to better understand how learning occurs in a gamified learning environment. This theory was developed to understand student's responses to achievement challenges. AGT consists of two primary goals of mastery and performance. Mastery goals focus on attaining and developing competence whereas performance goals focus on demonstrating knowledge and outperforming others (Senko, Hulleman, & Harackiewicz, 2011). AGT suggests that individuals can be motivated by their belief or desire to achieve a specific goal. In the case of gamification, that goal can be an unlocked level, a badge, or a place on a leaderboard (Kim et al., 2018). Gamification, designed well, could leverage both mastery and performance goals to help foster student success in a variety of learning environments, including the virtual environment. My study aims to use the performance goal of students' desire to show higher achievements on the leaderboard, which may lead to increased motivation.

Synthesis of Research

Engagement

Engagement entails having students concentrate on a learning task while also showing interest and enjoyment in what they are learning (Bond et al., 2020; Groccia, 2018; Kim, 2018; Shernoff et al., 2017). Engagement has been defined and studied in the literature for over 80 years with Ralph Tyler being one of the earliest pioneers of engagement research as noted by Groccia (2018). This chapter reviews how engagement is impacted by gamification.

Types of Engagement

Frederick, Blumfield, and Paris (2004) defined three categories of engagement as the following:

1. Behavioral engagement pertains to participation in academic, social, and or extracurricular activities which is needed for positive academic performance.
2. Cognitive engagement encompasses the idea of thoughtfulness and willingness to put in the effort to master difficult skills and comprehend complex ideas.
3. Emotional engagement draws on the positive and negative reactions to teachers, students, academics, and school and is presumed to influence the willingness to do the work

Boeheim at al. (2020) explored behavioral engagement in a study that involved 266 high school students in grades 8 through 10. The 14 classrooms (9 science and 5 math) were videotaped and the amount of times students raised their hands were recorded. This study investigated hand raising as a viable example of behavioral engagement and its relation to student performance. The hand raising was classified as either prompted by the teacher or self-initiated. Boeheim at al. (2020) suggested that hand raising is an indicator of behavioral

engagement and is positively associated with academic achievement. In their study, the results also suggested that hand raising is associated with cognitive engagement as well. Hand raising is also an unbiased, time efficient, and easily observed measure of student behavior.

Cognitive engagement is the psychological investment students make toward their learning (Rotgans and Scmidt, 2011). Yuan (2020) studied the cognitive engagement of students by creating a qualitative study using a group-questionnaire and a semi structured interview in a university setting.

Emotional engagement refers to the emotions experienced when participating in academics. Yu, Huang, Wang, and Tu (2020) examined the relationship between emotional engagement and learner persistence. Data was collected from 328 university students in China using an online survey. Emotional engagement was measured through four items on the survey. Yu et al. (2020) noted that emotional engagement is positively affected in order of importance by the students' interactions with the content, the instructor, and finally with other students. The study also concluded that emotional engagement is one of the main determinants of learner persistence (Yu et al. 2020).

Gamification

There is a growing body of evidence reporting the effectiveness of gamification in educational contexts. Gamification is the use of game design elements in non-game contexts; it is the process of making activities more game-like (Boverman et al., 2018, Dichev & Dicheva, 2017, Mert & Samur 2017). The term “gamification” was first documented in 2008 in a blog written by Brett Terill (as cited in Welbers et al., 2019) and the underlying concept has been researched in educational contexts since 1980 (Fotaris et al., 2016). Gamification is an approach that enhances students' engagement and positively affects their learning outcomes (Hung 2018,

Mert & Samur, 2018). When gamification is used in a classroom, students are more excited to learn, they complete more work, come to class on time, and their attention spans are increased (Barlow & Fleming, 2016; Buckely et al., 2015; Looyestyn et al., 2017; Majuri et al., 2018). Multiple researchers have noted that more research is needed to better understand the value of gamification (Dichev & Dicheva, 2017; Abdul Jabar & Felicia, 2015; Dichev & Dicheva, 2017; Kalogiannakis et al., 2020).

Face-to-Face Classroom Setting. Tsay, Kofinas, Trivedi, and Yang (2019) created a two-tiered essential learning and super learning online gaming system they implemented over two years for 333 students. The mixed methods design measured student engagement and performance. This study examined a gaming system using two iterations and altered the second iteration to adjust for the novelty effect. Students engaged and performed better in the gamified intervention than they did in the non-gamified course. Results also suggest that students in the second year exhibited sustained engagement. This finding is surprising when the novelty effect is often prevalent in these studies. The novelty effect was conceptually proposed by Hamari, Koivisto, and Sarsa (2014).

Barlow and Fleming (2014) developed an action-research based case study in a 9th grade science classroom. Two classes from successive years were compared. The first class did not receive any gamified elements, and the second class received two gamified elements. They provided students with the ability to earn stars/points for extension work completed. The extension work was two units of study that were not discussed in class or assessed. Students receive points for each task they completed. The second gamified element allowed students to use the stars to progress through levels of an evolutionary story game board. The researchers established a baseline of how a typical non-gamified classroom behaves in the first year. Barlow

and Fleming (2014) noted that no students completed extension work in year one. In the gamified year 17% (n=4) completed some extension work and 9% (n=2) completed all the tasks. A total of 64 stars were awarded in year two.

Hung (2018) studied 48 sophomores at an English Listening and Speaking practice class at the University of Taiwan, and he investigated the effects of a gamified classroom on their motivation to take part in classroom activities. The study focused on the use of technology-enhanced board games (TEBG) to foster student engagement. The control group in the study was taught in a conventional classroom using printed worksheets and group discussions. The experimental group was taught using teacher created TEBGs. The intervention in the study lasted three weeks. The main finding was that gamified classrooms are beneficial for English as a foreign language learners, as it reduces their anxiety and enhances their motivation.

Fotaris, Mastoras, Leinfellner, and Rosunally (2016) created a mixed methods quasi experimental study in two fundamentals of software courses at a university during two consecutive semesters. The study included real time feedback, live quizzes, and live coding using programs like Code Academy's Interactive Platform, Kahoot, and a classroom version of Who Wants to be a Millionaire. Two classes were compared, one using a gamified approach using the aforementioned programs and a non-gamified class taught more traditionally using lectures, laboratory classes, and seminars. Attendance in the gamified class was up 13% and final grades in the course were 14% higher in the gamified classroom. Online surveys revealed students were generally more motivated to come to the gamified class. The authors conclude that the improvements in engagement may be attributed to the novelty associated with the introduction of new technology and learning techniques.

Beemer, Tiwaloluwa, Ajibewa, DellaVecchia, and Hasson (2019) studied nine under-resourced classrooms from third to sixth grades, and they explored adding game design elements in a classroom including goal setting, feedback, and external rewards. The study focused on embedding physical education class activities into a regular education classroom, and the participating teachers were provided inservice training to implement the intervention with fidelity. Researchers first established a baseline without gamification elements present. Gamification elements were coded as sedentary, light activity, and moderate to vigorous activity. The gamification resulted in a statistically significant increase in moderate to vigorous physical activity. Beemer et al. (2019) do note some moderate differences for third and fifth grades, where results were not as substantive. They suggest the reward system may not have been as appealing to these students (e.g., stickers) and that students might have benefited from being involved in choosing rewards. Multiple limitations are present including a failure to use a control group, lack of randomization in classroom selection, researchers were not always present to observe impacts, and this study is not looking at how academic performance changes as a result of embedded physical activity and gamification.

Bal (2019) created an action research based case study in a 7th grade Turkish language classroom. Twelve of the 15 students participated in the 12-week study. Werbach and Hunter's six-stage gamification model guided the teacher process (Bal, 2019). The online storytelling game application called Storium was used to bring gamification into the classroom. Data were gathered in the forms of a student diary, a semi-structured observation form, semi structured interviews, and the digital texts produced by the students. The study revealed that the gamified elements of Storium kept students engaged throughout the 12-week course.

The studies reviewed in this chapter have all concluded that a gamified classroom has a positive impact on student engagement. Hanus and Fox (2014) created a longitudinal study (16 weeks) involving two communication courses in a large Midwestern university. The main finding of this study revealed that student motivation and satisfaction of the gamified course waned over time relative to the non-gamified course. Hanus and Fox (2014) called for more research involving specific elements of gamification. They concluded that educators should be careful when designing gamified courses involving points, badges, and leaderboards because it may harm the motivation of the students because student interest is shown to wane over time.

Online Setting. Groenning and Binnewies (2019) developed an experimental study to investigate three research questions to gain insight into the effects of gamification on motivation and performance. The research questions were all centered around the use and effectiveness of digital achievements. The digital achievements were a combination of a signifier (name), completion logic (conditions to complete the goal), and a reward (badge). This study aimed to focus on the effect of achievements, which the authors state is rare in gamification studies (Groeninng & Binnewiwes, 2019). The study consisted of three different experimental groups of 245 college aged students. Results strongly suggest that the achievements increase student performance and student persistence was also higher, but the results for motivation are contradictory. The main limitation of this study was that students only interacted with the gamification element for a limited amount of time.

Boverman, Weidlich, and Bastiaens (2018) created a mixed methods case study to investigate students' attitudes toward gamification in online learning. A distance learning undergraduate class was used to study the concept of awarding badges and displaying progress bars in a Learning Management System (LMS) called Moodle. Quantitative (n=32 participants)

and qualitative (n=8 participants) surveys were administered. Students were largely motivated and satisfied with the gamified elements. In fact, 80% of the participants were matched to autonomous motivation which is the type of motivation that represents high quality learning (Boverman et al., 2019).

Zamora-Polo, Corrales-Serrano, Sanchez-Martin, and Espeajo-Antunez (2019) developed a mixed methods experimental study investigating the effect on students' motivation. The study consisted of a quantitative survey and a qualitative interview. The participants were 2nd year primary preservice teachers. There were a total of 18 students in the study. Students were more motivated after the gamified activities. The gamified activities made the difficult science content more accessible.

Looyestyn et al. (2017) conducted a systematic review of literature pertaining to the effect of gamification in online programs. They examined 15 studies over a three-year period. The most common gamification elements were leaderboards (n=7), badges (n=6), points (n=6), and rewards (n=5). Six studies evaluated a single element while nine examined the combined impact of elements (Looyestyn et al., 2017). Nine studies reported significant positive effects on engagement and six reported no significant effect on engagement (Looyestyn et al., 2017). The researchers conclude, “this review also provided preliminary evidence that leaderboards are a particularly effective form of gamification. This is consistent with previous research indicating that social comparison promotes motivation through competition amongst peers” (Looyetyn et al., 2017, p. 15).

Engagement in an Online Setting

Engagement of students in an online setting can pose significant challenges to educators. Student engagement can be challenging because of many distractions in home environments and,

unlike a face-to-face classroom, using proximity and body language are not available to get a student's attention (Martin, 2019). Lack of spontaneous formative feedback can be a frustrating disconnect for many students (Martin, 2019). Students often feel isolated, which leads to a lack of engagement (Midcalf & Boatwright, 2020). Eisenbach and Greathouse (2019) argued that little is known about what motivates students in online environments. Although there is a plethora of studies regarding engagement in an online setting, researchers still call for more studies on engagement in an online class, especially at the primary and secondary levels.

Summary and Conclusions

Ryan and Deci (2000) note that intrinsic motivation is central to self-determination and Karimi and Nickpayam (2017) discovered that using a leaderboard makes a class more enjoyable, which in turn leads to more intrinsically motivated students which supports the concept of Self Determination Theory. The literature reviewed in this chapter also supports the concept that AGT can help students feel motivated to achieve a specific goal using gamified learning. For example, in the Barlow and Fleming (2016) study, the researchers utilized a game board which allowed students to progress up levels by attaining stars (points) for turning in work In face-to-face classrooms, gamification leads to increased student engagement and motivation (Tsay et al., 2019), students in a gamified class are more engaged and active in their learning (see e.g., Beemer et al. 2019), and student performance was shown to increase in classes where gamification was present (Fotaris et al., 2016).

The review of the literature also allowed me to uncover a lack of research that was focused solely on a leaderboard as an intervention to increase engagement. Also missing from the literature were studies conducted in middle school settings. Even the limited research on gamification in online settings was conducted in high school settings and above; middle school

focused research is absent. The study presented in this thesis addresses these limitations and provides value to the knowledge base.

Chapter Three: Research Design

Introduction

The purpose of this study was to explore the impact gamification has on the behavioral engagement of middle school students in an online setting. Students are generally less motivated in an online setting. Thus, an online classroom provides a promising environment to apply the principles of gamification, which can positively impact the motivation of students (Mert & Samur, 2018). This study specifically attempted to answer the following question: How does the gamified learning environment using a leaderboard system impact students' behavioral engagement in an online learning system? To answer this question, a quasi-experimental study design was used to examine the impact of a gamification element on students' behavioral engagement in an online learning setting.

This chapter contains a description of the subjects this study is sampling along with a rationale for the instrumentation used, and an explanation of the data collection. Finally, a description of the treatment and analysis of the data gathered are included.

Participants

There were 26 sixth grade students (16 male and 10 female) participating in this study. The student body was 100% African-American. The students were all enrolled in the same ELA class. This class was chosen because it aligns with the primary researcher's preparatory hour allowing the researcher to be a passive observer of the class. Placement of the students in the classroom was done randomly by Powerschool, an online school management software package.

Instrumentation

The instrumentation used in this study was a classroom observation. A total of 8 classes (4 control and 4 intervention) of an online English Language Arts class were observed over the period of 5 weeks.

During the control classes, students were observed and scored on the basis of four observable behaviors. Students scored a point any time they did any of the following: volunteer to read (VR), ask academic questions (ASQ), answer academic questions (ANQ), and stay on zoom during asynchronous time for extra help (STZ). For the VR, ASQ, and ANQ variables, students could score multiple points during one class. The observer watched the classes live and recorded the scores by hand on a tally sheet. Students were not aware of the scoring system during the control class, they only knew the class was being observed, and they were instructed to participate in class as they normally do. A fifth variable called Frequency of Engagement (FOE) was created to capture the totality of all forms of engagement. FOE was the sum of VR, ASQ, ANQ and STZ to demonstrate overall engagement in the study.

During the week between the control and intervention classes, students were introduced to the gamification system that served as the intervention. During this week, students selected an avatar to be displayed on the leaderboard. The gamification system consisted of a leaderboard app (see Appendix B) where the student selected avatars appeared (e.g., animals and other objects). Students could view the leaderboard on their phones and their computers. Students learned that they would score points for doing any of the four variables (VR, ASQ, ANQ, and STZ) and that their level of participation impacted their standing on the leaderboard. They also learned that no student names or identifiers are linked to their avatar.

During the four control classes, students were observed by the researcher and scored on the four variables (VR, ASQ, ANQ, and STZ). The researcher manually tallied the points on a sheet of paper and logged the points into the gamification app. The researcher then reviewed the recorded Zoom classes to verify the reliability of the scoring. Once scores were loaded into the leaderboard, students were informed of the points they scored and their standing on the leaderboard. Students also had access to the app and could see their standings on the leaderboard.

Variables were selected to ensure that the behavioral engagement of the students was being measured properly and that the variables were observable. All the variables chosen target measurable student participation. Volunteering to read (VR), asking academic questions (ASQ), and answering academic questions (ANQ) are common indicators of student participation in a class. These three variables are closely related to the hand raising that Boeheim et al. studied in 2020. The rationale behind choosing these variables comes from both Conrad and Donaldson (2012), who stated that online student engagement is related to participation and Boeheim et al. (2020), who concluded that researchers should focus on particular student behaviors that are easily measured and observable.

Staying on Zoom (STZ) was chosen to ensure equity with the scoring on the leaderboard. The researcher met with the classroom teacher and leadership team members from the school, and they concluded that STZ would help lower performing students score points and allow them to improve their position on the leaderboard.

Data Collection

The data for this study was collected during the second semester of the 2020/2021 school year. The data was collected in an ELA Classroom that would meet twice a week that was conducted virtually on Zoom. The control classes began on January 26th, 2021 after the study

was approved by the Institutional Review Board (IRB) and ended on February 4th. The intervention classes began February 18th and ended on March 2nd. There were a total of 4 control and 4 intervention classes observed. The researcher was a classroom observer. Since the classes were conducted on Zoom, the researcher was able to rewatch the classes to verify the reliability of the behaviors coded.

An email was sent to the parents (included in Appendix C), this email included an informed consent statement, details about the study, the role of the researcher and contact information for both the researcher and the researcher's advisor. This information allowed students the opportunity to contact either the researcher or the researcher's academic advisor if they had any questions or concerns regarding the study. The email made it clear that participation was optional and parents could opt their child out of the study at any time and stated that no identifying data would be collected. The email also included a link to the online consent process.

Once parental consent was obtained, the researcher described the study to the students and answered any questions they had. The researcher provided students with a research assent discussion and documentation (included in Appendix D). The assent form provided information to describe a research study, inform the students about the study, explain why the study was being conducted, and made it explicitly clear that the student gets to decide if they want to participate or not. The researcher then provided a link to the online assent process. Of the 28 students in the class 26 decided to take part in the study. Since the study asked students to participate in class like they normally would, the 2 non-respondents just normally attended class and no data was collected from these 2 students.

Data Analysis

Data was gathered in an Excel spreadsheet and the GVSU Statistical Counseling Center (SCC) helped analyze the data. Researchers used a paired samples *t* test on the four original variables. The combined variable, which took into account all 4 of the original variables, was analyzed using a sign test (Sprent, 1989) because it produces the most useful results. Descriptive statistics were employed by the researchers to describe the increase in engagement for each of the variables. The researchers used SPSS to analyze data.

Summary

This study used t tests, a sign test, and descriptive statistics to examine any change in engagement between the control and intervention classes. The instrument used in this study was a classroom observation by the primary researcher. The instrument was used to measure engagement using the following variables, volunteering to read (VR), asking academic questions (ASQ), answering academic questions(ANQ), and staying on zoom during asynchronous time for extra help (STZ)) in an online middle school ELA classroom. Rationales for the variables were explained and the findings are reported in the next chapter.

Chapter Four: Results

Context

The participants in the study were all enrolled in the same 6th grade ELA classroom. The students were placed in the classroom using an algorithm that the school's Student Information System (SIS) Powerschool uses. The ages of the students ranged from 11-12. There were a total of 28 students enrolled in the class. Out of the 28 students enrolled, 26 students participated in the study. The sample consisted of 16 male and 10 female students.

Findings

The statistical analysis of results was reported using a paired sample t test for the four variables. As noted, the Frequency of Engagement was a combination of the four variables. This merger required a sign test, which is available in SPSS. The sign test is a non-parametric test that is used to determine whether or not two groups are equally sized. The sign test is used when dependent samples are ordered in pairs, where the bivariate random variables are mutually independent. It is based on the direction of the plus and minus sign of the observation, and not on their numerical magnitude. It is also called the binomial sign test, with $p = .5$. The sign test was employed because the symmetry assumption was violated when the original variables were combined into one overall variable. The symmetry assumption violation means a more typical t test could not be computed for the overall Frequency of Engagement.

Research Question- How does the gamified learning environment using a leaderboard system impact students' behavioral engagement in an online learning system?

A summary of the paired sample t test is presented in Table 1.

Table 1

Paired Sample t Test

	Paired Differences					*t*	*df*	*Signed (2-tailed)*
	Mean	*Std. Deviation*	*Std. Error Mean*	*95% Confidence Interval of the Difference*				
				Lower	*Upper*			
Volunteer to Read	*-.3077*	*1.2254*	*.2403*	*-.0803*	*.1872*	*-1.280*	*25*	*.212*
Ask Questions	*-.6153*	*1.9815*	*.3886*	*-1.417*	*.1849*	*-1.584*	*25*	*.126*
Answer Questions	*-9231*	*3.2854*	*.6443*	*-2.2501*	*.4039*	*-1.433*	*25*	*.164*
Stayed On Zoom	*.0385*	*.7736*	*.1517*	*-2.740*	*.3509*	*.254*	*25*	*.802*

The analysis of data relating to the independent variables studied in the research question revealed that none of the forms of behavioral engagement were significant between the control and intervention groups where $p < .05$. Only the overall engagement variable was found to be significant -- Frequency of Engagement (FOE). FOE is the sum total of all engagement measures, and it is the total frequency of engagement. This variable captures all forms of engagement observed into a single variable that required a sign test to analyze. Frequency of Engagement significantly increased from the control setting to the intervention ($p=.0169$).

Table 2 provides a comparison of the number of students engaged in the control compared to the intervention for each variable.

Table 2

Number of Students Engaged

	Students Engaged		
	N	Control	Intervention
Volunteering to Read	26	6	7
Asking Questions	26	9	14
Answering Questions	26	11	20
Stayed on Zoom	26	15	12
Frequency of Engagement	26	22	24

In the intervention class more students volunteered to read, more students asked questions and answered questions, and more students engaged in at least one of the variables. Fewer students stayed on zoom in the intervention classes. None of these observations are statistically significant.

Table 3 provides a summary of each of the raw numbers of behavioral engagements observed.

Table 3

Total Number of Engagement Instances Observed

	Control	Intervention
Volunteering to Read	7	18
Asking Questions	19	39
Answering Questions	66	82
Stayed on Zoom	23	18

In the intervention class more instances of volunteering to read were observed. More instances of asking questions occurred. More questions were answered as well. However, fewer

instances of students staying on Zoom for extra help were observed during the intervention sessions.

Table 4 provides descriptive statistics for the control and intervention sessions for participants.

Table 4

Descriptive Statistics

	Control			Intervention	
	N	Mean	SD	Mean	SD
Volunteering to Read	26	0.23	0.43	0.69	1.26
Asking Questions	26	0.85	1.41	1.5	2.40
Answering Questions	26	2.58	4.39	3.50	3.62
Stayed on Zoom	26	0.85	0.97	0.81	0.94
Frequency of Engagement	26	2.65	2.24	4.31	2.84

Summary

A paired sample t test was implemented and none of the original four variables were found to be significant. Frequency of Engagement (FOE) is a variable that was needed to capture the totality of different options students had to demonstrate engagement. FOE was significant in demonstrating that a leaderboard can increase engagement.

Chapter Five: Conclusion

Summary

This study attempted to address the problem of engagement in an online middle school classroom. The research shows that students are less motivated in an online setting (Zamora-Polo et al., 2019; Midcalf & Boatwright 2010). In response, various studies were examined to promote students' motivation in online learning (Hussain et al., 2018; Looyestyn et al., 2017). Gamifying instruction has recently garnered great attention to the research community as a promising instructional approach (Groccia, 2018; Dichev & Dicheva, 2017). The present study was in line with such an endeavor. Specifically, this study attempted to answer the following research question: *How does gamification impact students' behavioral engagement in an online setting?*

Data was collected during 8 classroom observations of an online middle school ELA classroom in an urban charter school in a large Midwestern city. The class was conducted entirely on Zoom. During the study, the researcher observed and scored participants on their level of participation. Students were given points for doing the following things: volunteering to read, answering questions, asking questions, and remaining on Zoom during asynchronous time to receive additional help. The first 4 classes served as the control group where students were instructed to participate in class as they normally would. The researcher then introduced the gamification system, which consisted of an online leaderboard. Students learned that they would score points for volunteering to read, answering questions, asking questions, and remaining on Zoom during asynchronous time and these acquired points would impact their standing on the leaderboard.

Data was gathered in an Excel spreadsheet and the GVSU Statistical Counseling Center (SCC) helped analyze the data. Researchers concluded that a paired sample t-test could be

implemented on the individual variables, and that a sign test would provide the most meaningful results for overall total engagement. Descriptive statistics were employed to describe the increase in engagement for each of the variables. SPSS was used to analyze the collected data.

None of the original variables were statistically significant; however, combining all the original four variables provided enough data to discover that the intervention caused a significant increase in engagement. The sign test for Frequency of Engagement revealed a statistically significant increase from the control to the intervention ($p = .0169$).

Conclusions and Discussion

The purpose of this study was to determine if gamification, specifically a leaderboard, would lead to an increase in the behavioral engagement of students in an online setting. The study aimed to answer the research question "How does gamification impact students' behavioral engagement in an online setting?" The current study provides definitive results to conclude that a leaderboard does increase students' behavioral engagement in an online setting.

The results of this study are aligned with the concepts in Self-determination theory (SDT) and Achievement goal theory (AGT). The results show that students' behavioral engagement increased in a gamified classroom that employs a leaderboard. Ryan and Deci (2000) stated that intrinsic motivation is driven by interest and enjoyment of the task itself and Karimi and Nickpayam (2017) discovered that using a leaderboard makes a class more enjoyable, which in turn leads to more intrinsically motivated students.

The results of this study demonstrate that behavioral engagement has increased in the gamified class compared to the non-gamified class. The results are consistent with the findings of previous literature (Tsay et a., 2019; Barlow & Fleming, 2014; Hung, 2018; Fotaris et

al.,2016; Groenning & Binnewies, 2019) that engagement increases in a gamified class in an online setting.

Recommendations

Based on the finding of this study, educators are encouraged to use gamification elements in their online or virtual classrooms. Yet, educators need to be cautious because of the novelty effect of gamification. Research shows that student engagement can even begin to wane after a few weeks (Tsay et al., 2019). More longitudinal studies are being recommended to further investigate the novelty effect associated with gamification. Research is also needed to determine if the engagement experienced in a gamified classroom continues after the gamification element is removed. More research is recommended to determine whether gamification can have a positive impact on student outcomes. There is a limited amount of research that states that gamification leads to positive student outcomes (Looyestyn et al., 2017; Landers & Armstrong, 2015). This study should be replicated using existing instruments like the Intrinsic Motivation Survey (Ryan and Deci, 2005) to better understand the motivations that are impacting student behavior.

Appendixes

Appendix A

DATE: February 1, 2021

TO: Sean Lancaster, Ph.D.
FROM: GVSU Institutional Review Board (IRB)
STUDY TITLE: Impact of Gamification on Student Engagement in an Online Middle School ELA Classroom.
REFERENCE #: 21-146-H
SUBMISSION TYPE: IRB Initial Submission

ACTION: Approved
EFFECTIVE DATE: February 1, 2021
EXPIRATION DATE: None
REVIEW TYPE: Expedited Review

Thank you for your submission of materials for this research study. The IRB has approved your research plan application as compliant with all applicable sections of the federal regulations, Michigan law, GVSU policies and IRB procedures. All research must be conducted in accordance with this approved submission.

Please insert the following sentence into your information/assent/consent documents as appropriate.

> This research protocol has been approved by the Institutional Review Board at Grand Valley State University. Study No. 21-146-H

Please remember that informed consent is a process beginning with a description of the study and assurance of participant understanding followed by a signed consent form. Informed consent must continue throughout the study via a dialogue between the researcher and research participant. *Federal regulations require that each participant receive a copy of the signed consent document.*

This approval is based on the IRB determination that no greater than minimal risk is posed to research participants. This study has received expedited review, 45 CFR 46.110 Expedited Categories 6 and 7, based on the Office of Human Research Protections 1998 Guidance on Expedited Review Categories.

The following personnel are approved to work on this research:

- Sean Lancaster, Ph.D. - Principal Investigator
- Jeremy Hein - Co-Investigator, Student

The IRB made the following additional regulatory determinations:

1. **Subpart D risk determination**: This research has been determined to be of no greater than minimal risk to children, consistent with 45 CFR 46.404.
2. **Parental permission**: The written permission of one parent or guardian is sufficient for the research to be conducted, consistent with 45 CFR 46.408(b).
3. **Assent**: Per 45 CFR 46.408(a), written assent is required from all children.

Further, it is the researcher's responsibility to continue to monitor this GVSU website for additional corona virus guidance provided by GVSU as well as all state, federal, and CDC guidelines for minimizing the risk of infection. In the event that new data regarding transmission minimization or guidelines for risk

mitigation emerge, the researcher should submit a change in protocol to remain in compliance with new recommendations for safety to the participants and the researchers.

Please note the following are required in order to comply with federal regulations and IRB policy:

1. Any major change to previously approved materials must be approved by this office prior to initiation. Please use the *IRB Amendment Request* form for this submission. This includes, but is not limited to, changes in key personnel, study location, participant selection process, etc.

   See *IRB policy 1010, Modifications to approved protocols*.

2. All UNANTICIPATED PROBLEMS and SERIOUS ADVERSE EVENTS to participants or other parties affected by the research must be reported to this office within 7 days of the event occurrence, using the UP/SAE Report form. If the adverse event includes a fatality, hospitalization, or security breach of sensitive information immediately notify the Office of Research Compliance and Integrity (rci@gvsu.edu or 616-331-3197), the IRB chair, Dr. Kevin Lehnert at (616) 331-7471 **and** the Research Integrity Officer Jeffrey Potteiger at 616-331-7207.

   See *IRB policy 1020, Reportable events: protocol deviations, unanticipated problems and adverse events.*

3. All instances of non-compliance, including protocol deviations, or complaints regarding this study must be reported to this office in a timely manner. Use the *IRB Reportable Event form* in IRBManager to report this information.

   See *IRB policy 1030, Research non-compliance.* Refer to *IRB policy 1020, Reportable events: protocol deviations, unanticipated problems and adverse events* for examples of reportable protocol deviations.

4. All required research records must be securely retained in either paper or electronic format for a minimum of 3 years following the closure of the approved study. This includes original or digitized copies of signed consent documents. Research studies subject to the privacy protections under HIPAA are required to maintain selected research records for a period of at least 6 years after the close of the study.

5. Although IRB approval of this research does not expire, a Closure Form should be submitted through IRBManager upon completion of the research.

   See *IRB policy 1060, Closure of Approved Research Studies*.

If you have any questions, please contact the Office of Research Compliance and Integrity at (616) 331-3197 or rci@gvsu.edu. The office observes all university holidays. Please include your study title and reference number in all correspondence with our office.

Appendix B


Verizon
1:59 PM
60%
scottakdev.com
LeaderBoard
Class Leaders
2
3
12 pts
20 pts
11 pts
4
11 pts
5
9 pts
6
6 pts

Appendix C

Key Information for You to Consider

- **Voluntary Consent**. You are being asked for permission for your child to participate in a research study. It is up to you whether you choose to allow them to participate or not. There will be no penalty or loss of benefits to which you are otherwise entitled if you choose not to participate or discontinue participation.Your child's participation or lack of participation will not influence their grades in ELA or World Studies. No grades are linked to participating or not participating in the study.
- **Purpose.** The purpose of this research study is to examine how gamification can increase student engagement in an online middle school language arts class. Gamification can be described as using game design elements outside of a gaming context or as the process of making classroom activities more game-like. Data may be used to write a future article for publication.
- **Duration.** It is expected that your child's participation will last 4 weeks beginning January 26th and ending February 18th.
- **Procedures and Activities.**
  Students will complete a survey that asks about their perceptions about learning in their online ELA class. This survey will be conducted at the beginning and the conclusion of the intervention.

  During the intervention which will last 2 weeks, the students' engagement and participation will be measured on a leaderboard. The leaderboard will display their avatar, their total points. They will earn points for doing things like showing up to the Zoom class, answering questions, asking questions, and staying online after the class ends to receive extra help. Their grade in ELA will not be connected in any way to their participation in this study.

  The study will last 4 weeks. During the first two weeks (4 classes) I will be observing their participation in their regular ELA class to see normal participation. The second two weeks (4 classes) will involve the gamification I am studying. I will compare the first 2 weeks to the 2nd 2 weeks.

  Five students may be randomly selected and asked to participate in an interview when the intervention is over. This interview will provide additional context to the survey information.

- **Risks.** There are no risks involved in this study beyond what is typically encountered in a normal classroom. Student grades are not impacted by participation or not participating. The nature of the survey is a self-reflection of their learning experience in an online ELA class. All information collected is done anonymously, so there is no way to link responses to individual students.
- **Benefits.** Some of the benefits that may be expected include your teachers learning how to create a more engaging online class for students. The results may help other teachers learn from this study.
- **Alternatives.** Any child who is not in the study will join class and participate as normal. Being in the study or not in the study will not alter the teaching your child receives.

1. **TITLE** Impact of gamification in an online middle school language arts (ELA) classroom.

2. **PRIVACY AND CONFIDENTIALITY**

   Students remain confidential during the study. All information collected will remain anonymous. All data is stored in a password protected thumb drive. Students will select a secret avatar so that their name is not shown to anyone else. They will be able to view the avatar on a leaderboard to see how it changes.

3. **WITHDRAWING CONSENT**

   You have the right to withdraw your consent to this study at any time. If you would like to withdraw your child from participating in this study, please contact the lead researcher: **Jeremy Hein, (313) 483-2614**. If you would like to request that your personal data be removed from this study, please contact the Vice Provost for Research Administration at Grand Valley State University, 1 Campus Drive, Allendale, MI. Phone: 616-331-3197. E-mail: rci@gvsu.edu.

4. **AGREEMENT TO PARTICIPATE**

   By checking the consent box below, you are agreeing to the following:

   - The details of this research study have been explained to me, including what is being asked of my child and the anticipated risks and benefits;
   - I have had an opportunity to have my questions answered;

- I agree to allow my child to participate in the research as described on this form;
- I agree to have my child's personal data used for this study.
- I may ask more questions and my child may quit participating at any time without penalty.

☐ I give my consent for my child to participate in this research project.

Your name:

Childs name:

_____ Date Signed:_

5. **CONTACT INFORMATION**

If you have any questions about the study you may contact

NAME: Jeremy Hein World Studies Teacher

PHONE: (313)-483-2614

E-MAIL: jeremy.hein@uprepschools.com

Professor: Dr. Sean Lancaster (overseeing the study)

Phone: 616-284-1441

E-MAIL: lancasts@gvsu.edu

If you have any questions about your rights as a research participant, please contact the **Office of Research Compliance & Integrity** at Grand Valley State University, 1 Campus Drive, Allendale, MI. Phone: 616-331-3197. E-mail: rci@gvsu.edu.

This study has been reviewed by the Institutional Review Board at Grand Valley State University (Protocol #18-191-H)."

Appendix D

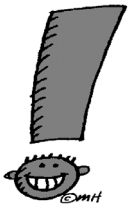
Research Assent Form

What is a research study?

Research studies help teachers learn new things. We can test new ideas. First, we ask a question. Then we try to find the answer.

This paper talks about our research and the choice that you have to take part in it. We want you to ask us any questions that you have. You can ask questions any time.

Important things to know…



- You get to decide if you want to participate.
- You can say 'No' or you can say 'Yes'.
- No one will be upset if you say 'No'.
- If you say 'Yes', you can always say 'No' later.
- You can say 'No' at any time.

Why are we doing this research?

We are doing this research to find out more about the impact of games in an online class and to figure out how to improve teaching in a virtual setting.

What would happen if I joined this research?

If you decide to be in the research, we would ask you to do the following:

- Attend class like you normally do.
- Participate in a typical class and then participate in a gamified class.
- Check the leaderboard and attempt to get as many points as possible.
- Participate in a pre study survey.
- Participate in a post study survey.

- Possibly participate in a post study interview.

Could bad things happen if I join this research?

No. This study is simply being a student in a classroom.

Could the research help me?

Yes, your teachers may learn how to create a more engaging virtual environment.

What else should I know about this research?

If you don't want to be in the study, you don't have to be.

It is also OK to say yes and change your mind later. You can stop being in the research at any time. If you want to stop, please tell your teachers. You will still be a student in the class and still participate like you normally do.

You can ask questions any time. You can talk to Mr. Hein and ask him any questions you have. Take the time you need to make your choice.

The study will last 4 weeks covering 8 classes beginning January 26th and ending February 18th.

Is there anything else?

If you want to be in the research after we talk, please write your name below. We will write our name too. This shows we talked about the research and that you want to take part.

Name of Participant _____
(To be written by child/adolescent)

Printed Name of Researcher _____

Signature of Researcher _____

_____ _____

Date ***Time***

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