ADHD Student Response to a Gamified Language Learning App: A Case Study

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**CHAPTER 1: INTRODUCTION**

**Introduction**

As one of the most common child psychiatric disorders, ADHD impacts approximately 2 million children in the United States (Barkely, 2006). The American Psychiatric Association (2013) reveals 6-10% of children have ADHD. Numerous studies analyzing global epidemiological data show the prevalence rate of ADHD to be consistent in all world populations (Faraone et al., 2003; Polanczyk et al., 2007, 2014; Willcut, 2012).

Low academic achievement of ADHD children is typical due to their inability to organize, focus, and maintain motivation (Teta, 2008). Fidgeting, wandering thoughts, daydreaming, and a lack of engagement are common manifestations of ADHD in children. Academic assignments like reading and problem solving, which require long periods of silence and concentration, are extremely challenging for ADHD children to undertake. A link between executive function impairment and ADHD has been discovered during the past twenty years, facilitated by modern brain imaging technology (Brown, 2013). Children afflicted with this disorder have a disproportionately high degree of school dropouts, social and behavioral disorders, drug use, and comorbid psychiatric issues (Evans et al., 2005).

A change in basic assumptions about the physiological and psychological mechanisms of ADHD has occurred since the discovery of a link between ADHD and executive function impairment. For example, children with ADHD often have difficulty sustaining motivation for tasks, which has been attributed to an impaired rewards system in the brain. Brain dopamine studies have revealed the abnormal dopamine levels that are responsible for the inability of ADHD children to stimulate and maintain motivation for tasks that are not immediately and continuously rewarding (Brown, 2013).

Gamification, the use of game mechanics in non-game settings, is increasingly being applied in educational environments (Dicheva, 2015). The aim of gamification in the classroom is to produce excitement and competition through the application of game elements to academic lessons. Rewards, trophies, leaderboards, and badges are among the game elements used to foster student motivation and engagement (Wiggins, 2016).

**Statement of the Problem**

Impairment of the brain reward processing mechanism is characteristic of ADHD (van Hulst, 2017). This brain component manages individuals’ motivational response to reward stimuli (Smillie, 2013). Brain imaging techniques have revealed the abnormalities associated with the rewards mechanism in the ADHD brain (Oldehinkel, et al., 2016). Research comparing ADHD and control groups reveal a significant difference in response to rewards while undertaking mental tasks. ADHD subjects show a preference for tinier instantaneous rewards as opposed to larger infrequent rewards while undertaking mental tasks (Oldehinkel, et al., 2016; van Hulst, 2017) Reward systems have been introduced to ADHD psychotherapy and brain training programs to sustain motivation and increase positive results (van Hulst, 2017).

Executive function abnormalities cause students with ADHD to process information and stimuli differently than normal children. Gamification’s effect on learning outcomes has been examined in numerous studies; however, there are very few case studies of how gamified learning applications impact ADHD students.

**Purpose**

The purpose of this qualitative case study is to provide an in-depth analysis of students’ and teachers’ perceptions and attitudes regarding the use of a gamified language learning app as a supplementary learning tool for ADHD children. Qualitative data is obtained from focus group interviews with students, pre- and post-intervention teacher interviews, and observational notes made by the teacher during the intervention. Students who receive the app intervention make up the focus group. These students answer questions regarding their experiences and opinions of the app. Teacher journal notes, written throughout the intervention, are an additional source of qualitative data for this study.

 Gamified educational apps present a relatively new way for children to learn material while engaging in fun activities that take players through virtual worlds with animations, narratives, sounds, awards, and levels. Although these apps have become quite popular, research on their efficacy in impacting learning is sparse. The game attributes, especially the rewards component of these apps is of interest to ADHD researchers because of executive function impairments and the unique rewards processing associated with ADHD.

 The results of this study will inform teachers and researchers about ADHD student response to a gamified language learning app. The research will provide information on students’ and teachers’ perceived effectiveness of a supplemental language learning tool for children with ADHD. Teachers, administrators, and education researchers can use the results of this study to guide their curriculum decisions and future research.

**Research Questions**

 This case study seeks to answer three research questions. The purpose of this qualitative case study is to provide a detailed analysis of students’ and teachers’ perceptions and attitudes regarding the use of a gamified language learning app as a supplementary learning tool for ADHD children. The research questions are:

1. How do students with ADHD perceive the effect of a supplemental gamified language learning app on their learning outcomes?
2. How do teachers perceive the impact of a supplemental gamified language learning app on ADHD student learning outcomes?
3. How do teachers perceive the impact of a supplemental gamified language learning app on ADHD student behavioral outcomes?

**Assumptions, Limitations, and Delimitations**

 This section summarizes the fundamental assumptions built into the study. It also describes the study limitations and delimitations.

**Assumptions**

The author begins this study with numerous assumptions about ADHD and its impact on student learning. The researcher’s assumptions extend to school and home learning environments. It is the author’s belief that parents and educators of ADHD students will be highly interested in the results of this research.

The assumptions for this research are as follows:

1. ADHD children learn differently than their non-ADHD peers.
2. Teachers support ADHD students using supplemental gamified learning apps.
3. Students have computers to run apps.
4. Teachers are interested in new learning tools for ADHD children.

**Limitations**

 The research has multiple limitations owing to the number of participants, research site, and duration of the study (Sullivan-Carr, 2016). Because the study subjects are selected from a school for special needs children, the research results might be considered specific to the school instead of being broadly applicable to students from all schools. A summarization of the limitations is provided in the following paragraphs.

 The number of study subjects is limited to four students with ADHD diagnosis enrolled in fourth grade language arts at School Z (the identity of the school is protected to maintain confidentiality). The school population is comprised of special needs children with a broad range in diagnosis and cognitive abilities. The study subjects are chosen based upon their ADHD diagnosis, their ability to function independently, and their parents’ willingness to have them participate in the study. This case study aims to deliver a thorough investigation of the students’ and teachers’ insights and attitudes on the use of a gamified language learning app as a supplementary learning tool.

 School Z’s approach to teaching is highly differentiated based upon individual student strengths and abilities. Unlike mainstream school systems, assessments at School Z are tailored to the individual student and tend to be more subjective. Some teachers, administrators and researchers might not consider the results of this study generalizable to mainstream schools because of this difference in teaching approach.

 The length of the study is limited to 12 weeks’ (one semester) access granted by School Z. A longer duration would deliver a longitudinal review of the gamified language learning app intervention (Sullivan-Carr, 2016).

**Delimitations**

 The gamified language learning app *Language Empires* is used in this research. A team of certified speech-language pathologists developed the app. It provides practice exercises in vocabulary, making predictions, figurative language, making inferences, and answering how and why questions. The app was chosen based upon its high ratings, user reviews, teacher recommendations, and developers’ credentials. The game aligns with the fourth grade language arts curriculum at School Z. Due to a multitude of educational apps on the market, it is unclear whether *Language Empires* was the best choice (Sullivan-Carr, 2016).

 The research site is comprised of students who are computer literate and have access to computer tablets. Study subjects have the means to purchase and maintain their own tablet computers. The use of this gamified language learning app intervention might not be possible in schools with limited computer access.

**CHAPTER 2: LITERATURE REVIEW**

**Introduction**

Gamification’s effect on learning outcomes has been examined in numerous studies; however, there are very few case studies of how gamified learning applications impact ADHD students. The literature review explores research on gamification in academic context, as it applies to the ADHD learner, e-therapy programs for ADHD, rewards systems, and gamified educational apps. The examined research gives an overview of the history, theory, and present state of research in this area.

**Relevant Studies and Theory**

**Gamification and the ADHD Learner**

The effect of Kinems Mathloons, a gamified mathematics educational app, on ADHD students’ learning outcomes, was examined by Retalis et al. (2014). The app uses game mechanics to motivate children while they complete mathematics exercises. Retalis et al. (2014) measured the impact of the app on student learning outcomes by analyzing data on two aspects of student problem solving; rate and ability. All study subjects showed significant growth in problem solving rate and ability after use of Kinems Mathloons. Although this research explored the relationship between app use and learning results, it did not explore ADHD student and teacher perceptions of a gamified educational app as a case study.

Ranathunga et al. (2014) reviewed an ADHD-centered online math educational program with game elements. Several game mechanics were embedded in the program including animation, rewards, and badges. The game assesses players’ arithmetic skills and ADHD level, and then takes the player through various levels of math training while issuing awards and badges as players advance. Players’ math abilities are occasionally reassessed to measure student progress. The authors indicate positive outcomes from the program, but the study does not include exploration of ADHD student and teacher perceptions of the gamified learning system.

Functionality and user response data for a reading comprehension app with game elements was studied by Wronska et al. (2015). App users pass through levels as they complete reading comprehension exercises. Analysis of survey data on user response revealed positive ratings, but the study did not explore ADHD student and teacher perceptions of the gamified learning app as a case study.

Tan et al. (2012) researched the impact of educational software games on ADHD students’ English language learning outcomes. Although their findings show a marginal improvement in spelling and a small decline in reading accuracy, significant changes were observed in student behaviors and attention. Teachers noted that ADHD students’ motivation and focus improved in response to game-based learning (Tan et al., 2012). The study did not discuss student perceptions of game-based learning.

Bruhn et al. (2017) examine the use of apps for tablets and mobile devices as way to motivate and engage special needs learners in the classroom. They used apps to support the “three C’s” of motivational instruction: “challenge, context, and control” (Bruhn et al., 2017). Students are challenged when they are provided optimal tasks that match their abilities and interests. When students are provided appropriate background knowledge and a solid framework for understanding the material, they can contextualize learning (Bruhn et al., 2017). Students feel ownership and take control of their learning when they are provided with choices and opportunities for self-management. Bruhn et al. (2017) show that when used properly, apps can help achieve these instructional strategies to motivate students with special needs. The study did not specifically address ADHD.

**Gamification in ADHD Therapy**

The mental health field recognizes the merits of gamification as a way to better engage patients in treatment (Bul et al., 2015). Many children with ADHD can engage in video games for hours in spite of their attention issues. Consequently, gamified electronic therapy games have been created for executive function training specifically for ADHD children. Research on the effect of these gamified electronic therapy programs on ADHD patients is reviewed below.

Improved motivation levels and training successes resulting from an electronic executive function therapy game, Braingame Brian, are reported by Dovis et al. (2015). The authors associate gaming with brain dopamine response and improved motivation (Dovis et al., 2015). Braingame Brian immerses players in a virtual world where they can advance through various levels while earning rewards. Feedback from teachers regarding ADHD students’ behaviors following Braingame Brian use shows significant improvement. The study did not explore ADHD children’s perceptions of Braingame Brian.

Organization, time management and social skills are areas where many ADHD children experience significant challenges. Bul et al. (2015) developed Plan-it Commander, a serious game, to train ADHD children in these skills. The game immerses players in a futuristic virtual world, where they advance between levels by completing various tasks with embedded learning objectives. Parents and children gave the game good ratings with ideas for improvement. The authors will apply the suggestions to improve the program with the ultimate goal of creating a viable electronic therapy training system. The study did not include teacher perceptions of the system and observations of students’ outcomes following training sessions.

Working memory is another executive function area where many ADHD children have significant challenges. Dovis et al. (2012) explored the effect of a gamified electronic therapy program designed to specifically address this area in ADHD children. The game immerses players in a virtual world where they must save the world from wicked robots while completing the embedded working memory tasks. Upon comparing the incentive effect of game-play to money rewards, Dovis et al. (2012) determined that the game delivers a strong incentive comparable to 10 euros. The study did not examine the effect of individual game elements, such as rewards, on time-on-task and training outcomes.

Outcomes from another working memory training game were examined by Prins et al. (2011) to assess its impact on motivation levels and therapy success in ADHD subjects. The program resulted in significant improvement in motivation and positive therapy outcomes. Measurements of motivation and therapeutic outcomes included time-on-task, levels reached, and exit questionnaire data provided by study participants (Prins et al., 2011). The study used quantitative and qualitative measures to arrive at conclusions regarding the impact of the technology.

**Apps for ADHD**

Kumaragama et al. (2015) conduct a search to identify mobile health apps specifically designed for ADHD. After reading reviews and available information through iTunes, the researchers downloaded and tested 32 apps. The apps were organized and classified in to 10 functionality categories: cognitive training, conference, diagnostic, educational, guidelines, journal, productivity, profiling, reminder, and strategies (Kumaragama, 2015). The study reveals available apps offer various functionalities that can provided assistance for ADHD subjects in their daily lives at minimal cost. The price of apps reviewed ranged between $0 and $11.00.

Schuck et al. (2016) tested the ability of iSelfControl, an iPad app, to manage ADHD student behavior. The app prompts students to self-evaluate their own behaviors every half hour. Teachers simultaneously evaluated students on their own iPad. The researchers concluded that iSelfControl delivers a valuable self-evaluation system that can be used together with traditional classroom management practices to positively impact ADHD behaviors (Schuck et al., 2016). The study did not include a focus group with students to receive feedback regarding their perceptions of the app.

**Virtual Rewards in Gamified Learning**

A gamified version of GraphoGame employs a rewards system that uses virtual tokens to reward players as they complete assignments related to reading. Ronimus et al. (2014) examined the impact of the token system on student engagement levels. Upon collecting 5 virtual tokens, players are granted access to “reward games”. System data on player’s time-on-task and levels completed were collected and analyzed along with student and parent questionnaire data. An experimental group was assigned the gamified version of GraphoGame, while a control group was assigned the normal version without the rewards system. Study results showed there was no significant gains in time-on-task due to the rewards system. Data analysis also revealed no significant increase in reading outcomes in the experimental population. Parent questionnaire responses show significant gains in concentration levels among the experimental group. This study did not explore teacher perceptions of the game and student outcomes. Nor did it analyze the impact of a virtual rewards system on ADHD children, who might be particularly sensitive to a gamified rewards system given their abnormal rewards processing.

Denny (2013) examined the impact of virtual badges and trophies on student engagement. The researcher conducted a randomized experiment with over 1000 participants to measure the effect of a virtual achievement system in online learning. Student time-on-task and contributions to online discussions increased significantly in response to the badge system. Feedback collected from students indicated enjoyment and enthusiasm for earning badges, and a desire to continue the use of the badge system in the online learning system (Denny, 2013). The study did not examine the effect of virtual achievements on students with learning disabilities.

**Summary**

 Gamification’s effect on learning outcomes has been examined in numerous studies; however, there are very few case studies of how gamified learning applications impact ADHD students. The literature reviewed includes current research on gamification in academic context, as it applies to the ADHD learner, e-therapy programs for ADHD, rewards systems, and gamified educational apps.

From the perspective of the current study, shortcomings of existing research include a lack of case study research on the impact of educational apps as supplemental learning tools for children with ADHD. Very few studies look at qualitative data collected from teacher questionnaires and ADHD student focus groups to evaluate the strengths and shortcomings of the use of educational apps to complement traditional classroom instruction. Such studies provide the education community with detailed analysis of targeted situations, specific technologies, and specific outcomes related to ADHD students. The purpose of this qualitative case study is to provide a detailed analysis of students’ and teachers’ perceptions and attitudes regarding the use of a gamified language learning app as a supplementary learning tool for ADHD children.

**CHAPTER 3: RESEARCH METHODOLOGY**

 **Introduction**

 Chapter 3 delineates the study design, basis, site, population, and information collection methods for this research. This qualitative case study is designed to closely examine students’ and teachers’ perceptions regarding a gamified language learning app as a means to supplement traditional classroom instruction for ADHD children. This study is founded upon the premise that gamified computer-based learning provided together with normal classroom instruction improves ADHD learner attitudes and outcomes. This idea is based on research of gamified education and mental characteristics associated with ADHD. Studies on ADHD subjects have revealed positive responses to gamified computer-based learning (Oldehinkel, et al., 2016; van Hulst, 2017).

The research questions are:

1. How do students with ADHD perceive the effect of a supplemental gamified language learning app on their learning outcomes?
2. How do teachers perceive the impact of a supplemental gamified language learning app on ADHD student learning outcomes?
3. How do teachers perceive the impact of a supplemental gamified language learning app on ADHD student behavioral outcomes?

**Research Design**

 This qualitative case study seeks to enlighten teachers and researchers on the response of students and teachers to the use of a gamified language learning app as supplemental language instruction and practice for students with ADHD. Creswell (2015) defines a case study as “a variation of an ethnography in that the researcher provides and in-depth exploration of a bounded system (e.g., an activity, an event, a process, or an individual) based on extensive data collection” (Creswell, 2015). The bounded system in the current case study consists of four fifth grade ADHD students and their Language Arts teacher.

 The research design flows through four steps. Step 1 entails enrollment of the study subjects. Step 2 consists of a pre-intervention interview with the teacher. Step 3 involves the introduction of the gamified language learning app intervention and teacher journal writing. In step 4, the researcher organizes a focus group with study subjects and conducts a post-intervention interview with the teacher.

 Qualitative data for this research is gathered from multiple sources. A focus group is conducted with students involved in the study. The data is tri-angulated with pre- and post-intervention interviews with the teacher. Additional data is gathered from a journal where teachers record their observations as study subjects engage in language arts classwork throughout the intervention period.

**Methodological Approach to Research Questions**

 The following table summarizes the methodological approach associated with each research question.

*Table 1*. Methodological Approach to Research Questions

|  |  |
| --- | --- |
| **Research Question** | **Methodology** |
| How do students with ADHD perceive the effect of a supplemental gamified language learning app on their learning outcomes? | Focus group with research subjects |
| How do teachers perceive the impact of a supplemental gamified language learning app on ADHD student learning outcomes? | Teacher interviews |
| How do teachers perceive the impact of a supplemental gamified language learning app on ADHD student behavioral outcomes?  | Teacher journal  |

**Method**

Upon reviewing literature, including app reviews, app ratings, teacher recommendations, and app sales, Language Empires was deemed the most appropriate game for this study. A team of certified speech-language pathologists developed Language Empires to target eight language arts skills; “how, which and why questions, predictions, figurative language, sequencing, vocabulary and making inferences” (Fleming, 2013). The app engages users by having them navigate through ancient civilizations-themed levels that provide a sense of exploration and adventure with animations, narrations, and rewards. The app offers players the opportunity to earn up to 95 trophies, which maintains motivation for many sessions (Windman, 2013).

Language Empires has 8 built-in activities with 53 questions per activity, for a total of over 415 questions (Fleming, 2013). Players answer questions regarding images and narrations to earn gold coins, trophies, and advance to more difficult questions and stages. The Ancient Greek Empire-themed module contains the vocabulary activity with 53 questions and 2 levels of difficulty. The Ancient Mayan Empire-themed module contains the predicting activity with 53 questions and 3 levels of difficulty. The Roman Empire-themed module contains the “how” activity with 53 questions and 1 level of difficulty. The Ancient Egyptian Empire-themed module contains the figurative language activity with 53 questions and 1 level of difficulty. The Empire of the Future-themed module contains the sequencing activity with 53 questions and 3 levels of difficulty. The Medieval Empire-themed module contains the inferencing activity with 53 questions and 2 levels of difficulty. The Chinese Empire-themed module contains the “why” activity with 53 questions and 3 levels of difficulty. The British Empire-themed module contains the “which” activity with 53 questions and 2 levels of difficulty.

Language Empires includes detailed and visual data collection. Students’ skill level and progress towards mastery is graphically summarized (Fleming, 2013). The data can be retrieved and emailed or printed. The app costs $29.99 and is available via iTunes.

 The research involves students from one 5th grade Language Arts class at a school specializing in students with disabilities. Students with a primary diagnosis of ADHD are identified as potential study subjects.

**Population and Sample**

 The research site is a private co-educational school located in a suburb of Philadelphia, PA, specializing in educating children in fourth through twelfth grade with dyslexia, non-verbal learning disabilities, and executive function impairments. The school uses a continuous feedback system approach to educate their students. The site was chosen based upon the author’s familiarity with the school’s focus on educating children with ADHD. The study request letter (See Appendix A) was submitted to the school principal.

 The research is limited to the subject of fifth grade Language Arts. All students have iPads that they bring to and from school each day. Language Empires is loaded on to the iPads of study subjects via iTunes. The researcher funds the purchase of the app.

**Research Participants**

 School Z’s administration identifies potential study subjects and aids in communication with parents. Four potential study participants with ADHD enrolled in fifth grade Language Arts are identified. Purposeful sampling is used as the method to recruit study subjects. Creswell (2015) describes purposeful sampling as, “a qualitative sampling procedure in which researchers intentionally select individuals and sites to learn or understand the central phenomenon” (p. 621).

Parents of the potential research subjects are sent letters by the school requesting consent for their children to participate in the research. A consent form (see Appendix B) is also sent to parents with a request to sign and return to the researcher within 14 days of receipt. The consent form includes a description of the research methodology. Questions about the research are directed to the researcher. Upon receipt of permission from the parents, the teacher discusses the study with the selected students and obtains the students’ agreement to participate in the research.

A vital aspect of this research is collaborating with School Z’s Language Arts teacher. The teacher assists with the study by making time and a separate space available within the classroom, where the researcher can introduce Language Empires to the research participants. The teacher also adds Language Empires to the practice component of the research participants’ classroom practice guide. The teacher interview (See Appendix C for interview questions) is an important component of this qualitative study, as it frames the results of the research.

**Researcher’s Position**

 The researcher’s motivation to undertake this study is driven by his personal experience with ADHD. He was diagnosed with ADHD at a young age after years of behavioral problems in school. Behaviors included an inability to sit still, lack of attention, class disruption, and poor organizational skills.

 The researcher found that he always excelled in classes that involved hands-on learning, as opposed to lecture style instruction. For example, the author was always successful in his science courses. Indeed, his entire career to date has been in the sciences as a graduate student, researcher, business owner, and teacher.

 Despite his ADHD diagnosis, the researcher found that he can engage in games for lengthy periods without losing focus. These games include computerized and non-computerized educational games. For example, Reader Rabbit and Math Blaster were two 1980’s video games that the author could spend at least an hour sitting still and playing quietly when he was in elementary school.

 Given the researcher’s close relationship with this study topic, he exercises deliberate caution not to influence the research through his interactions and analysis. An unbiased person shall validate all study findings (Sullivan-Carr, 2016).

**Qualitative Data Collection**

 Following is an explanation of the qualitative data collection methods employed in this study. The data is used to draw conclusions on the use of a gamified language learning app and ADHD students.

**Focus Group**

 The researcher arranges for a focus group with the study subjects. Creswell (2015) describes focus group interviews “in survey research involves the researcher locating or developing a survey instrument, convening a small group of people – typically a group of four or six people – who can answer the questions asked on the instrument, and recording their comments about the questions on the instrument” (p. 617). A focus group with four participants is suitable because, according to Onwuegbuzie et al. (2009), “Krueger (1994) has endorsed the use of very small focus groups, what he terms “mini-focus groups”, which include 3 (Morgan, 1997) or 4 (Krueger, 1994) participants, when participants have specialized knowledge and/or experiences to discuss in the group” (p. 3). The focus group meeting is conducted at the school in order to provide a familiar and comfortable setting.

 The focus group shares their thoughts and experiences about the use of the supplemental gamified language learning app. Positive and negative aspects of the intervention are assessed. Focus group questions are listed in Appendix D.

**Teacher Interviews**

 Two semi-structured teacher interviews are conducted before and after the Language Empires intervention. During the first interview, the teacher answers questions regarding his understanding, experience, and opinion of gamified learning apps. (See Appendix C for teacher interview questions) The teacher also shares his results expectations for the intervention. After the intervention, the teacher is interviewed a second time to capture his understanding, experience, and opinion of the supplemental gamified language learning app. The teacher is asked about students’ engagement, motivation, and behavior during the intervention. Gill et al. (2008) describe semi-structured interviews as consisting “of several key questions that help to define the areas to be explored, but also allows the interviewer or interviewee to diverge in order to pursue an idea or response in more detail” (p. 291). Gill et al. (2008) further assert that “the flexibility of this approach, particularly compared to structured interviews, also allows for the discovery or elaboration of information that is important to participants but may not have previously been thought of as pertinent by the research team” (p. 291).

**Teacher Journal**

 The teacher maintains a daily journal of thoughts and observations throughout the intervention period. This documentation makes it easier for the teacher to recall specific observations during the second interview. With regards to the use of journals and diaries for data collection, Jacelon et al. (2005) note that “although diaries might lack the nuances present in verbal communication (Begley, 1996), through diaries the researcher can gather information about the day-to-day activities of participants and then explore those activities during a subsequent interview (Elliot, 1997; Zimmerman & Wieder, 1997)” (p. 991). This can generate rich qualitative research data. Journals can reveal important events for research participants and their reactions to those events (Jacelon et al., 2005).

**Interview Procedures**

 A recording device is used to record the focus group and teacher interviews, which are later transcribed. The teacher and students are informed of the recording. The recorded information is solely for the purposes of this study and not made available to anyone besides the researcher and dissertation committee.

 The researcher documents the interviewees’ body language, hand gestures, and facial expressions throughout the interviews (Sullivan-Carr, 2016). This information is incorporated in to the interview transcription to enrich the data.

**Ethical Standards**

The researcher obtains approval for this study from the institutional review board of New Jersey City University. The researcher abides by the Belmont Report’s moral and ethical guidelines for behavioral and biomedical research (The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979) (Sullivan-Carr, 2016). Respect, beneficence, and justice are three ethical values emphasized in the Belmont Report.

**Handling of Data**

 Focus group data is reported as themes (Sullivan-Carr, 2016). Names of participants are not divulged. All data is stored in a secure place, with a backup of electronic data stored on an external hard drive in a locked desk drawer.

**Standards of Quality**

 The case study research design follows the qualitative research framework of Creswell (2015). The research generates and draws upon multiple data sources including a focus group with participants, pre- and post-intervention interviews with the teacher, and the teacher’s journal. The study follows the qualitative research methodology outlined herein in order to understand the response of students and teachers to the use of a gamified language learning app as supplemental instruction and practice for students with ADHD.

 Research quality is maintained by adhering to Billups’ (2014) four elements of trustworthiness. They are “credibility (truth), dependability (consistency), transferability (applicability), and confirmability (neutrality)” (Billups, 2014; Sullivan-Carr, 2016). Credibility is maintained by corroborating evidence from the student focus group, teacher interviews and journal. Dependability is maintained by having multiple individuals on the dissertation committee review the research on multiple occasions to check for consistency in the research process and data reporting. Transferability is thought of throughout the research. Several factors, including the school’s unique approach to educating students with special needs, might impact transferability of the findings. All data collected throughout the study is securely kept, documented and made available in an audit format in order to maintain confirmability of the data.

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Appendix A

Study Request Letter



Appendix B

Parent Consent Form



Appendix C

Teacher Interview Questions

**First Interview (Pre-Intervention):**

1. Due to executive function impairments and associated attention/retention problems, ADHD children often fall behind in language arts. Learning strategies have been developed to aid students with ADHD. What strategies you have seen succeed? What strategies have you seen fail? (Sullivan-Carr, 2016)
2. What are the most challenging aspects of managing ADHD students’ behaviors and motivation to learn?
3. How do you feel about introducing a gamified language learning app in your Language Arts class?
4. Do you think your ADHD students stand to benefit academically from the use of a gamified language learning app?

**Second Interview (Post-Intervention):**

1. Based on your experience during the use of the gamified language learning app in your classroom, what are your perceptions of this intervention?
	1. Did it achieve positive results?
2. Do you feel it benefitted ADHD student engagement?
3. Do you feel it benefitted ADHD student motivation?
4. Do you feel it benefitted ADHD student behavior?
5. Do you feel it benefitted ADHD student learning outcomes?
6. How would you rate Language Empires’ overall effectiveness?

Appendix D

Focus Group Questions

1. How do you feel about using a gamified language learning app as a supplemental learning approach in your language arts class?
2. Do you feel the gamified language learning app helped you to concentrate on the language arts work?
	1. If yes, then how?
3. Do you feel the gamified language learning app was helpful in enhancing your understanding of the content?
	1. If yes, then how?
	2. How would you rate your motivation during use of the app?
4. Do you feel the gamified language learning app should be a routine part of language arts learning?

Appendix E

Additional Resources from Project #1

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