2023

Middle School Teacher Perceptions of the Use of Serious Games for Students with Attention Deficit Hyperactivity Disorder

LaToyia R. Stewart
Walden University

Walden University

College of Education and Human Sciences

This is to certify that the doctoral dissertation by

LaToyia Jones Stewart

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

Review Committee
Dr. Darci J. Harland, Committee Chairperson, Education Faculty
Dr. Jennifer Courduff, Committee Member, Education Faculty
Dr. Charlotte Redden, University Reviewer, Education Faculty

Chief Academic Officer and Provost
Sue Subocz, Ph.D.

Walden University
2022

Abstract

Middle School Teacher Perceptions of the Use of Serious Games for Students with Attention Deficit Hyperactivity Disorder

by

LaToyia Jones Stewart

M. Phil, Walden University, 2019

M. Ed, Prairie View A&M University, 2008

BS, Prairie View A&M University, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Education

Walden University

November 2022

Abstract

Attention deficient hyperactivity disorder (ADHD) is the most common childhood neurodevelopment disorder, and digital serious game use has recently shown significant promise in this psychotherapeutic area. Digital serious games have also been used as an innovative teaching and learning approach. The purpose of this study was to explore middle school teachers' perceptions of the use of digital serious games for students with ADHD. The conceptual framework for this study was Sherry's model of game engagement. The two research questions for this basic qualitative study focused on middle school teacher perceptions regarding the benefits and challenges related to the use of digital serious games for students with ADHD. Semistructured interviews were conducted with 10 middle school teachers from southern U.S. school districts who had used digital serious games for at least one academic school year. Data analysis using emergent codes showed that middle school teachers reported that the social aspect of digital serious games encouraged teamwork and camaraderie while also emotionally building student confidence. Challenges included students being distracted by their peers, anxiety and frustration caused by not understanding the concepts of the game, and time constraints that influence a student's performance within a game. Results of this study may contribute to positive social change by providing teachers and administrators with the knowledge and leverage they need to understand the benefits and challenges of using serious games when teaching students with ADHD, thereby improving student success through teacher support and professional development.

Middle School Teacher Perceptions of the Use of Serious Games for Students with Attention Deficit Hyperactivity Disorder

by

LaToyia Jones Stewart

M. Phil, Walden University, 2019

M. Ed, Prairie View A&M University, 2008

BS, Prairie View A&M University, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Philosophy

Learning, Instruction, & Innovation

Walden University

November 2022

Dedication

I'd like to dedicate this research to my son. Learning with ADHD is a battle that our family fights on a daily basis. My son's struggle was the driving force behind my decision to pursue a doctoral degree. His determination to keep going even when he is having difficulty learning was my greatest inspiration. He never gives up, which was my main motivation. As a parent, I felt compelled to do everything in my power to be supportive and assist him through this learning curve, and this study provided me with the opportunity to identify a small window that could benefit him and students experiencing similar difficulties. With that said, I love you Marcus.

Acknowledgments

Foremost, I would like to express my love and appreciation to my supportive husband, Tony, and our four sons, who went along this journey with me. Without your patience and understanding, this would not have been possible. To my family, close friends, and colleagues, thank you for your encouragement along this journey; your thoughtfulness was greatly appreciated. Finally, to my amazing Walden team, Dr. Harland and Dr. Courduff, for their guidance and patience throughout this journey. Thank you!

Table of Contents

List of Tables

Chapter 1: Introduction to the Study

Attention deficit hyperactivity disorder (ADHD) is the most common childhood neurodevelopment disorder affecting children worldwide (Avila-Pesantez et al., 2018). ADHD, also known as hyperactivity, is mainly manifested as symptoms of inattention, impulsivity and hyperactivity (Zheng et al., 2021). To improve executive functions, several computerized training programs for ADHD have been developed. Digital serious games have recently demonstrated great potential for adoption in this psychotherapeutic area (Fleming et al., 2017). Digital serious games are applied games that are not necessarily geared towards entertainment but rather to teach specific skills and combine learning strategies using game components (Lameras et al., 2017). As a result, digital serious games are becoming more prevalent in the educational setting in the 21st century classroom structure.

The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. This study contributes knowledge to the field of educational technology by sharing the experiences of middle school teachers' usage of games to support student learning, particularly with students ADHD. I designed this study to fill a gap in the literature by exploring insights from middle school teachers who use digital serious games for students with ADHD. Data from this study may provide insights and challenges into how teachers use digital serious games as an innovative approach to teach students with ADHD. Therefore, as a result, the study's findings may give teachers and administrators the knowledge and leverage they need to understand the benefits and

challenges of using digital serious games when teaching students with ADHD so the support and professional development could improve student success.

Chapter 1 begins with a review of the background literature informing the problem statement, purpose of the study, and research questions. Next, I will identify and justify the conceptual framework for this study. In the next sections, I will review the nature of the study and establish important definitions from the literature. Finally, the chapter will conclude with the assumptions, scope and delimitations, limitations, and the significance of the study through potential contributions.

Background

Children with ADHD suffer a variety of scholastic issues, including inability to do assignments independently, inability to concentrate in class, and a high likelihood of dropping out (Zheng et al., 2021). Children with ADHD are unable to concentrate, have short attention spans, and are susceptible to external interference due to attention deficits. Children with ADHD have poor inhibition, difficulty controlling their emotions and behaviors, and are easily impulsive (Zheng et al., 2021). These ADHD symptoms put these children at a disadvantage in many aspects of daily life.

Digital serious games are a group of computer games used in various settings for instructional purposes. While digital serious games share much of their technologies with conventional video games, their goals and uses are result-driven. It is important to identify the goals, content, abilities, and behaviors to be established without ignoring the esthetic, storytelling, and technological tools required to promote interaction and playability, which are essential elements of a video game (García-Redondo et al., 2019).

Digital serious games include the following elements: a storyline, goals, feedback and rewards, and individualization and increasing levels of difficulty (Politis et al., 2017). Digital serious games have been shown to not only improve attention and suppress impulses, but to also exercise daily life skills and social skills in students with ADHD (Zheng et al., 2021).

Children with intellectual disabilities can require assistance with motor skills such as improving balance, cognitive skills such as vocabulary learning, or social skills such as an effective understanding of emotional expressions (Kokol et al., 2020). The traditional therapies could be supported by digital serious games. High quality computer games have been shown to increase concentration, improve the retention of information, facilitate deep learning, and bring about behavioral change (Fleming et al., 2017). With technological advancements, new approaches can be used to develop interactive experiences with visual effects. Studies suggest that secondary students learn relevant academic knowledge and skills as they reap the motivational and emotional benefits of learning games (Camilleri & Camilleri, 2019).

Digital serious games can be used as a supplementary tool to not only alleviate the symptoms of students with ADHD, but also to improve executive function and conduct cognitive training (Zheng et al., 2021). In this study, I extended what is understood about middle school teachers via digital serious game usage to support student learning for students with ADHD. In terms of the conceptual framework, no research studies focused on Sherry's model of game engagement to support a research study in its entirety; furthermore, no researchers have examined the perspectives of teachers through the

model's three constructs: development factors, gameplay motivations, and game attributes. This identified gap was the lens I used to look at teachers' use of digital serious games to support students with ADHD. The results of this study may be used to develop a new understanding of the perspectives of teachers who use digital serious games to support student learning, while filling in the gap of the benefits and challenges of using digital serious games in the classroom to aid student learning particularly students with ADHD.

Problem Statement

The increase of digital resources in this generation has led to the emergence of new ways of thinking, learning, and interacting with each other (García-Redondo et al., 2019). Videogames have been used as instructional tools in classrooms and have been shown to capture students' attention while keeping students in the zone of optimal flow for knowledge creation (Mancera et al., 2017). Using videogames as an alternative pedagogy could support different students' needs and expectations, which could enhance students' learning (Garneli et al., 2017). Digital serious games are games that have both entertainment and pedagogical value (McColgan et al.,2018) and can assist learning by merging both real-world and nonreal scenarios as an additional means of instruction. While research has shown promise that digital serious games can increase student interest and motivation, enhancing the efficacy of learning (Assaf et al., 2019), barriers related to school curriculum and teacher pedagogy have been shown to be a challenge to the successful integration of game-based technologies (Garneli et al., 2017). Teachers are a fundamental part of the successful implementation of classroom innovations, such as

digital serious games, and play crucial roles in technology integration in schools (Rocha & Escudeiro, 2018).

Educational computer games for students with learning disabilities and attention disorders could provide a viable means for motivating students and helping them obtain their academic goals (Heath et al., 2019). The reason for implementing game-based learning is to capitalize on the game's ability to capture a player's attention therefore it is important to analyze player's engagement for students with attention disorders (Heath et al., 2019, p. 243). In a recent study, researchers focused on the perceptions of secondary education teachers, who are using digital games in their classrooms to evaluate the value of digital games for learning (Huizenga et al., 2017). However, Huizenga et al., 2017 focused on general education and vocational education and not on the needs of student with learning disabilities such as student with ADHD. The perceptions of speech and language therapists has been explored related to the use of serious games with kindergarteners with special needs (Stankova et al., 2018); however, perceptions of classroom teachers of students with developmental issues such as attention disorders have not been explored. Therefore, the problem that I addressed in this study is the gap in understanding regarding the perceptions of middle school teachers' use of digital serious games for students with ADHD.

Purpose of the Study

The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. To fulfill this purpose, I developed research questions to focus on exploring the

perspectives of middle school teachers on the use of digital serious games to support learning for students with ADHD. Expanding on teacher perceptions has increased understanding of the use of digital serious games to support students with ADHD. Results may include insight into how digital serious game implementation benefited learning for students with ADHD, as well as what challenges may stifle effective learning during digital serious game implementation.

Research Questions

The research questions for this study were as follows:

Research Question 1 (RQ1): What are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD?

Research Question 2 (RQ2): What are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD?

Conceptual Framework for the Study

The conceptual framework for this study was Sherry's (2013) model for game engagement. This model has three constructs: development factors, gameplay motivations, and game attributes. I used these constructs to explore the perceptions of middle school teachers related to the use of games for students with ADHD. The first construct of development factors includes social demands, and emotional and cognitive stages. The construct of gameplay motivation includes social, emotional, and intellectual components. The construct of game attributes includes the various genres of games and

elements such as coplay, demands, and challenges. The model was a good choice for this study because of the inclusion of the construct development. I used this concept to determine if teachers consider developmental issues related to their students with ADHD when using serious games in the classroom. I used Sherry's model for game engagement to develop the interview questions, and used them for coding during data analysis. Table 1 describes how the framework factors aligned with the research questions by defining the data needs and data source to answer RQ1 and RQ2. To establish a clear pathway to what is required to collect data, the table shows each construct together with the specific factors that support that construct. In Chapter 2, I provide a more in-depth discussion of the framework.

Table 1

Framework Factors Aligned to Research Questions and Data Source

Sherry's Model for Game Engagement	RQ	Factors	Data Needs	Data Source
Developmental Factors	RQ1: benefits	Social demands	Participant perceptions of the social demands of gameplay benefiting students with ADHD	IQ #1
		Emotional demands	Participant perceptions of positive emotion management (hormonal changes) of students with ADHD during gameplay	IQ #1
		Cognitive stages	Participant perceptions of how gameplay engages/benefits students with ADHD at appropriate cognitive stages; working memory, reaction inhibition, and executive functions	IQ #1
Developmental Factors	RQ2: challenges	Social demands	Participant perceptions of social demands of gameplay being challenging for students with ADHD	IQ #2
		Emotional demands	Participant perceptions of negative emotion management (hormonal changes) of students with ADHD during gameplay	IQ #2

Sherry's Model for Game Engagement	RQ	Factors	Data Needs	Data Source
		Cognitive stages	Participant perception of how gameplay challenges students with ADHD at appropriate cognitive stages; working memory, reaction inhibition, and executive functions	IQ #2
Game Play Motivations	RQ1: benefits	Social motivation	Participant perceptions of the social motivations (games' social context) that benefit students with ADHD to play serious games	IQ #1
		Emotional motivation	Participant perceptions of the emotional motivations (autonomy, competence, and relatedness) that benefit students with ADHD during gameplay	IQ #1
		Intellectual motivation	Participant perceptions of the intellectual motivations (memory, attention, or problem-solving)that benefit students with ADHD during gameplay	IQ #1
Game Play Motivations	RQ2: challenges	Social motivation	Participant perceptions of the social motivations(games' social context)that challenge students with ADHD during gameplay	IQ #2
		Emotional motivation	Participant perceptions of the emotional motivations (autonomy, competence, and relatedness) that may negatively affect students with ADHD during gameplay	IQ #2
		Intellectual motivation	Participant perceptions of the intellectual motivations (memory, attention, or problem-solving)that negatively affect students with ADHD during gameplay	IQ #2
Game/Genre Attributes	RQ1: benefits	Coplay	Participant perceptions of coplay (peer interaction/competing) that benefit students with ADHD during gameplay	IQ #1
		Demands	Participant perceptions of the demands (game design/content) that benefit students with ADHD during gameplay	IQ #1
		Challenges	Participant perceptions of the challenges (students' experience) that benefit students with ADHD during gameplay	IQ #1
Game/Genre Attributes	RQ2: challenges	Coplay	Participant perceptions of coplay (peer interaction/competing) that challenge students with ADHD during gameplay	IQ #2

Sherry's Model for Game Engagement	RQ	Factors	Data Needs	Data Source
		Demands	Participant perceptions of the demands (game design/game content) that negatively affect students with ADHD during gameplay	IQ #2
		Challenges	Participant perceptions of the challenges (students' experience) that hinder students with ADHD during gameplay	IQ #2

Note: RQ = research question; IQ = Interview Question

Nature of the Study

In this basic qualitative study, I applied a generic qualitative interview methodology to explore the perceptions of middle school teachers, including seven general education teachers, two special education teachers, and one technology teacher related to the use of digital serious games for students with ADHD. Basic qualitative research refers to an approach in which researchers are interested in solving a problem, effecting a change, or identifying relevant themes (Mihas, 2019). I used a basic qualitative inquiry to investigate teacher opinions, attitudes, and experiences with the use of digital serious games. Percy et al. (2015) recommended that basic qualitative inquiry be used when the researcher has prior knowledge about the topic to describe it more fully from the perspective of the participants. My study fit the description provided by Percy et al. because I focused on exploring teacher perceptions, including their subjective opinions, attitudes, and beliefs of their experiences. I used purposeful sampling to study teachers who actively used digital serious games with their students. I used the three constructs from my conceptual framework: development factors, gameplay motivations,

and game attributes to develop data collection tools and provide insight into coding during data analysis (see Table 1).

I used purposive sampling to choose specific teachers to use for this particular study. The sample size included seven general education teachers, two special education teachers, and one technology teacher who each supported students with ADHD who were formally diagnosed as well as students who exhibit ADHD symptoms.

Definitions

Attention Deficit Hyperactivity Disorder (ADHD): also known as hyperactivity, is mainly manifested as symptoms of inattention, impulsivity and hyperactivity (Zheng et al., 2021).

Cognitive Training Paradigms: is a form of guided practice treatment that focuses on tasks that target specific cognitive functions, such as memory, attention, or problem-solving, have started to integrate serious game techniques to enhance motivation to train students (Boendermaker et al., 2018).

Executive Function (EF): Executive function is a type of natural cognitive function in humans that includes planning and organization, time management, working memory, and reaction inhibition (Zheng et al., 2021) and is frequently associated with the frontal lobes with high-level cognitive processes that control lower-level processes in the service of goal-directed behavior (Friedman & Miyake, 2017).

Extrinsic Motivation: refers to performing an activity, not for the pleasure gained from the activity (Osman & Cirak, 2020).

Game Attributes: are features and characteristics in the game structure that are likely to initiate and maintain interest in gaming activities and game elements as a set of tools shared by games (Nadolny et al., 2017).

Game Immersion: is as a pleasurable experience of being transported to a simulated place with the thought of being surrounded by a completely other reality that takes over students' attention (Zhang et al., 2017).

Intrinsic Motivation: is undertaking an activity done for fun, pleasure, and satisfaction (Osman & Cirak, 2020).

Serious Games (SG): are games that have both entertainment and pedagogical value (McColgan et al., 2018).

Assumptions

This study was based on a few assumptions. I assumed that the interview questions I devised would accurately assess the perspectives of middle school teachers and capture the experiences of the study's defined purpose. The interview questions were created using my conceptual framework, literature, and understanding of the phenomenon. Second, I expected all my interviewees to be open and honest in their responses to the interview questions.

Scope and Delimitations

The scope of this study was based on certain boundaries. The purpose of the study, was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD, was one of the boundaries. The empirical literature on digital serious game use helped me to determine the participant

demographics. Although research has explored elementary teachers' perceptions of the value of technology in teaching and learning (O'Neal et al., 2017) as well as high school teachers' perceptions of the use of game-based learning strategies to increase student motivation and achievement (Nadolny et al., 2017), there is limited research that specifically focuses on middle school teachers in Grades 6 through 8. As a result, there was a gap in the literature indicating that the perspectives of middle school teachers in Grades 6 through 8 were missing. Therefore, elementary and secondary teachers were not within the scope of the study, and my study only included middle school teachers.

Limitations

A study's research design frequently results in limitations. Because a basic qualitative research approach was used in this study, one limitation may be my own perspectives and biases as a researcher (see Merriam & Tisdell, 2016). Another limitation of the study was the collecting of teachers' perspectives on using digital serious games rather than documenting their actual use of digital serious games. In Chapter 3, I will explain how I increased the study's credibility by being open about the research findings, the recruitment process, and the demographics and settings of the participants, as well as clearly stating personal and professional ties to the research study. In addition, to manage my bias in this study, I conducted member checks (see Carlson, 2010), engaged in researcher reflective journaling (see Slevin & Sines, 2000), and made transcripts available to participants for review.

The length of time that the participants have used serious games to support students with ADHD was a second limitation of the study. Inclusion criteria included

participants who used serious games for at least 1 academic school year, but how often and the number of years they have implemented serious games varied. The use of virtual interviews to capture the perspectives of middle school teachers was a third limitation of the study. Conducting the interviews virtually may have impacted data analysis because it can be difficult to capture the participant's full descriptive experience (see Merriam & Tisdell, 2016). The last limitation was the transferability of the findings gathered through this study, as I looked for specific types of teachers, made it difficult to generalize the results of the study.

Significance

This study is significant for several reasons. First, results from this research may provide a deeper understanding of how middle school teachers perceive game use with students with ADHD, which may provide contributions to advance innovative practices, like serious gaming, to support learning implementation in middle school classrooms. Little is known about middle school teachers' perceptions of using serious games for students with ADHD. In this study, I addressed a gap in the literature in the discipline of educational technology by providing the perspectives of middle school teachers of the benefits and challenges of using digital serious games in the classroom to aid student learning particularly students with ADHD. In relation to positive social change, school administrators or technology support faculty may use data from this study to better understand the needs of middle school teachers serving students with ADHD, to create professional development opportunities.

In relation to improving innovative practices, educational stakeholders (including district officials, administrators, teachers, and instructional coaches) may use results from this study as a means to examine how digital serious games may enhance learning for students with ADHD and what teachers need to support these students. Another potential social change could be that administrators will be able to maximize resources while giving their middle school teachers an alternative way to access and implement innovative practices such as digital serious games to support effective learning for all students particularly those students with ADHD.

Summary

In Chapter 1, I introduced my qualitative study by describing the components of my conceptual framework, Sherry's (2013) model for game engagement, and how those components may affect teacher perceptions of the use of digital serious games to support middle school students with ADHD and why there is a need for this study to be conducted. In the background section, I summarized the research literature and identified gaps in knowledge of the pedagogical efficacy of serious games, to help teachers understand how to use or not use digital serious games to support students with ADHD. I provided evidence of the relevancy and significance of the phenomenon of interest. The questions outlined in the research question section framed the boundaries of the study through my conceptual framework, Sherry's (2013) model for game engagement (see Table 1).

Chapter 2: Literature Review

The problem that I addressed in this study is the gap in understanding regarding the perceptions of middle school teachers' use of digital serious games for students with ADHD. The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. Current literature establishes the benefits of using videogames as an alternative pedagogy that has both entertainment and pedagogical value (McColgan et al, 2018). These games can be used for learning because they incorporate real-world and non-real situations as an alternative form of instruction, therefore possibly meeting the needs and demands of various students and improving their learning (Garneli et al., 2017). Though studies have shown that serious games can increase student engagement and motivation while also improving learning effectiveness (Assaf et al., 2019), challenges related to the school curriculum and teacher pedagogy are an obstacle to the effective integration of game-based technologies (Garneli et al., 2017). My goal for this study was to gain middle school teacher perceptions related to the use of digital serious games with students with ADHD. The information that I gathered from this research study may result in increased awareness of middle school teachers' perspectives of digital serious games for students with developmental issues and attention disorders such as ADHD.

Chapter 2 begins with reviewing my literature search strategy and an overview of the conceptual framework for this study, Sherry's (2013) model for game engagement. In the literature review section, I provide an overview of factors that support digital serious gaming for middle school students through developmental factors, gameplay motivation, and game and genre attributes. Next, I review digital serious games to support students with ADHD via social, emotional, and cognitive demands. Finally, I review teacher perspectives of digital serious game usage for students with ADHD, which revealed perceived benefits and challenges of digital serious game use.

Literature Search Strategy

For this study, I used scholarly sources from published reports and peer-reviewed journal articles. The scholarly publications were accessed through databases Academic Search Complete, Education Source, ERIC, Google Scholar, ProQuest, and SAGE Journals. I used filters: peer-reviewed, academic journals, and set date limits. The keywords used in various combinations in the search for this literature were: *digital serious games* AND *teacher perceptions, digital serious games* AND *middle-schoolers, digital serious games* AND *attention, digital serious games, game-based learning, technology-based learning, digital serious games,* AND *implementation strategies, digital serious games,* AND *design process*. Articles related to the study were saved and categorized in four places after being examined in each search: the Walden Library, a literature review matrix, a folder on a computer laptop, and Zotero. For this study, the literature review matrix allowed categorization based on methodology, research findings, and relevance to level two headings. In addition, publications for this research were

found using the reference section of the articles. The prevalence of recurring themes in the literature and the inclusion of the same authors' names in publications contributed to the belief that saturation had been achieved.

Conceptual Framework

The conceptual framework for this study was Sherry's (2013) model for game engagement. This model helped me study the phenomena of middle school teachers' perceptions of using digital serious games for students with ADHD. The model has three constructs: development factors, gameplay motivations, and game attributes. One crucial factor Sherry's (2013) research recognizes is the effect of a student's development on gameplay, which is an important element of my research study.

Figure 1

Model for Game Engagement

Note. From New Directions for Child and Adolescent Development, by JL. Sherry, 2013, *Journal of Academic Optimism*, *98*, p. 11 (https://doi.org/10.1002/cad.20027). Copyright 2020 by Academic Publishing Consortium. Reprinted with permission (see Appendix F).

Developmental Factors

Sherry (2013) described three elements that make up the construct of developmental factors: a mixture of social, emotional, and cognitive elements that

influence a student's ability to play games. The first is related to social influences. Social motivations change as peer-to-peer influence increases, reflecting competition and encouragement to perform at the highest levels. However, the possibility of lost interest in the game may occur due to poor performance. Sherry (2013) claimed that previous research has shown that learning occurs predominantly in a social context, which can provide varying degrees of support as an individual progress through the lifespan. Another developmental element is a student's emotional influences while gaming. A student's mood can affect emotional motivations, particularly as they move through puberty (Sherry, 2013). Sherry described cognitive influences based on intellectual abilities that can drive a shift in genre preference from simple children's games to complex intellectual challenges (Sherry, 2013). Game engagement facilitates the right type of game for the target audience's changing developmental needs (Sherry, 2013). In the context of my study, developmental factors referred to how teachers described the benefits and challenges of ADHD students' ability to play educational games.

Game Play Motivations

I used gameplay motivations were used to describe why students play games. Sherry (2013) reported that social, emotional, and intellectual influences are part of gameplay motivation. The first is related to social motivation. Social gameplay motivation is when students are competing with each other while hanging out and making friends. This interaction may provide an opportunity for leadership or teaching moments amongst students through gameplay. Sherry stated that emotional motivation allows students to experience a highly intrinsic focused state called flow through playing games

to manage moods such as arousal or excitement. Intellectual motivation brings on a level of curiosity or discovery while allowing students to play for the challenge, experience creativity, and the opportunity to experiment with different identities. I used gameplay motivations in my study to focus on teacher's perceptions of student motivation levels to play serious games as a learning tool.

Game or Genre Attributes

Game or genre attributes are part of this framework so that what students play can be examined as part of the game engagement. The constructs of genre attributes include coplay, demands, and challenges (Sherry, 2013). Coplay is the aspect of playing games with peer groups and competing with others to maintain relationships. Peer influences increase motivations to play games that others are playing while keeping up with the latest popular games as a means of social bonding (Sherry, 2013). The next element, demands, refers to the game design related to graphics, how students move and interact within the game, content, or other players. Various game genres, such as highly graphic and complex, simple, clear objectives and patterns, extensive puzzle-solving, simulation, and greater social interactions like multiplayer games play a role in engaging learners' attention at different times in their lifespan (Sherry, 2013). The last element, challenges, involves students' experience, the problem they have to solve as part of the gameplay. Sherry suggested that students who prefer more of a challenge will likely continue with gameplay no matter the difficulty and may prefer more complex gameplay.

In contrast, students with low motivation or no interest in gameplay are more likely to play less challenging games or none at all (Sherry, 2013). As students' interests

change during their lifespan, they learn which genres are useful to satisfy their changing psychological needs and what which genres contribute best to their learning. Game or genre attributes in my study referred to when teachers describe students' interest in the gameplay environment related to how the game was designed and the game's challenge itself.

Model Justification

Other Models

One model that may have worked for this study is game flow: A model for evaluating player enjoyment in games (Sweetser & Wyeth, 2005). The game flow model is a generic model of player enjoyment that incorporates 38 criteria from the literature on game user experience and is divided into eight elements that conceptually correlate to Csikszentmihalyi's concept of flow (Sweetser & Wyeth, 2005). The eight elements include concentration, challenge, skills, control, clear goals, feedback, immersion, and social interaction. As an evaluation tool, the game flow model gives a deeper understanding of enjoyment in real-time strategy games (Sweetser & Wyeth, 2005). I did not choose this model because it focuses on the player's engagement and flow. I used Sherry's game engagement model to evaluate the influence of development and motivations for gameplay, which helped me to gather middle school teachers' perceptions of middle school students' developmental issues with ADHD.

Another model I considered was the technology acceptance model (TAM; Davis, 1989). TAM is a theoretical model used to describe teachers' acceptance of technology to support learning with technology implementation. TAM has two constructs, perceived

usefulness and perceived ease of use. The model also has three elements: attitude toward using, behavioral intention to use, and actual system use (Davis, 1989), which can be used to understand the acceptance of the technology. This model did not fully support my study because it focused on the perceived usefulness and ease of use for a teacher. In contrast, I explored the perceptions of middle school teachers related to the use of digital serious games for students with ADHD to support learning.

Justification for the Model for Game Engagement

Sherry's game engagement model (2013) has been used as a point of reference for many articles, but the model had not yet been cited as the only framework to support a research study. Sherry's game model was a good choice for my study for several reasons. Using Sherry's game engagement model helped me explore teachers' perceptions of how student developmental issues, student motivations, and genre attributes contribute to the benefits or challenges of having their students with ADHD play serious games. This model was a great fit for this study because I used the constructs of developmental factors, gameplay motivations, and game or genre attributes to develop the interview questions, as well as for coding during data analysis.

Sherry's game engagement model (2013) framework is aligned with the purpose of this research study which was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. Although it has not been employed as the primary framework in prior research studies, the game engagement model is frequently used as a point of reference when discussing the effect of child development on game play and student motivation (Sherry, 2013). Sherry's model of

game engagement provided me with an innovative lens for investigating middle school teachers' perspectives on the usage of serious games for children with ADHD, as I used the model's constructs to provide insight into how games may be chosen to enhance student learning.

Sherry's (2013) model of game engagement provided me with a way to explore teacher's perceptions of using serious games. Sherry's model of game engagement fit the needs of this study because it provided a way to categorize middle school teachers' perceptions of game use in order to identify common perspectives and discrepant data that could emerge from interviews. I used Sherry's model of game engagement during data analysis to determine digital serious game use of middle school teachers within the three constructs of the model to support students with ADHD. Additionally, I used the constructs of the model to gain a clear understanding of the role serious game implementation may or may not play in middle school teachers' classroom to support learning.

Serious Gaming and Middle School

In this section of the literature review, I review how developmental factors such as a student's executive function, a student's ability to regulate thoughts, emotions, and behaviors as well as physical, social, and emotional changes that middle school students experience during gaming. Next, I discuss the impact of game play motivations and how cognitive training paradigms are integrated in serious games to enhance motivation, how digital serious games can facilitate intrinsic and extrinsic motivation, and gameplay satisfaction. Lastly, I discuss game and genre attributes which are features and

characteristics in the game structure, games elements such as points, badges, and leaderboards along with game immersion and how the different forms of immersion impact game play to support learning.

Developmental Factors

Children's cognitive stages play an integral role in learning as a child evolves through each step. Adolescence marks a period of critical social, cognitive, and physiological change. Inhibition and impulse control during adolescence have been associated with essential biological changes in the brain, particularly in the prefrontal cortex (Homer et al., 2019). Unique developmental factors come into play with adolescences or middle school students and, therefore, must be considered when examining using digital serious games with this group of students.

In a field study, Garneli et al. (2017) compared groups of 13-year-old students. One group played math games using a storytelling game, one group with the same game without the story, another group played the storytelling game engaged with changing the game code, and the last group learned math traditionally by solving exercises on paper. Although Garneli et al. identified minor differences in learning performance, significant differences were found in student attitudes toward learning. Students who are not motivated by conventional paper-based assignments might be engaged better with the use of a video game. The findings suggested that video game pedagogy could provide flexible learning for different groups of students using methods that move beyond the conventional tool-based approach (Garneli et al., 2017, p. 1). Even though only minor differences in learning performance were identified when using different approaches to

digital serious games, Garneli et al. (2017) insisted on the positive impact of video game pedagogy. This research must be expanded, namely, in terms of the game design.

For adolescents to enjoy digital serious games, designers should understand the developmental trajectory of executive function (EF), including relevant neurophysiological changes (Homer et al., 2019). EFs are a type of natural cognitive function in humans that includes planning and organization, time management, working memory, and reaction inhibition (Zheng et al., 2021) and is frequently associated with the frontal lobes with high-level cognitive processes that control lower-level processes in the service of goal-directed behavior (Friedman & Miyake, 2017).Homer et al. used an emotional design approach to study *hot* EF (with emotional design) and *cool* EF (with more emotionally neutral design) in a digital game to explore EF of adolescents (aged 12–16). Results showed that higher emotional arousal during hot EF was more effective for enhancing EF skills appropriate for adolescents' development. Homer et al. (2019) concluded that well-thought-out digital games could improve EF skills for adolescents, which may mean that middle school teachers might have more success if they develop learning and training that account for developmental changes the growth of hot EF that emotionally involves the students. Previous research (Parong et al., 2017) confirmed that playing a custom-made game that focuses on a specific executive function skill for sufficient time at an appropriate level of challenge helps students improve EF skills of shifting between competing tasks. Therefore, collectively research shows that digital games that consider the neurocognitive development of adolescents are more effective.

During adolescent development, a challenge to consider is a student's ability to regulate thoughts, emotions, and behaviors, which can arguably link to their task-specific motivational goals and dispositions during gaming (Dang & Koedinger, 2019). In a suburban middle school in a mid-Atlantic state, 189 students across seven pre-algebra classes and five geometry classes, Dang and Koedinger explored how student behavior on differentially gamed learning material related to student motivational goals and dispositions. Results indicated that gaming on more challenging materials is less influenced by student motivations and potentially resulting from adaptive learning behaviors in a naturalist setting. Whereas non-highly gamed material is significantly related to all targeted motivation measures. Adolescence is known for being a challenging time, so focusing on middle school students' developmental factors in implementing serious games is essential. Middle school students' developmental factors such as EF skills, are important during gameplay, namely self-control, interference control, working memory, and set-shifting (Friedman & Miyake, 2017, p. 186). Thus, students must be aware of temptations originating from within themselves (the sense of thirst or hunger, for example) and the ability to suppress those feelings to win the game.

The physical, social, and emotional changes that middle school students experience has significant influences on their development and, therefore, how they experience gaming. Hormonal changes play a role in behavioral changes, along with cognitive and socioemotional changes. In a study of 79 adolescents age 10 to 13, a novel reward cue (circuit) processing task was assessed using sex-specific standardized composite measures based on Tanner staging (self-report and clinical assessment) and

scores from the pubertal development scale to review pubertal maturation (Ladouceur et al., 2019). The brain's reward circuit mediates different aspects of incentive learning, leading to adaptive behaviors and good decision-making. Poehner and Brown (2019) state that the hormone dopamine naturally increases the value of rewards in adolescents. The reward cue can be essential for students as they are playing serious games. Findings indicated that reward cue vs. no reward cue shows greater striatal activation, demonstrates multiple aspects of cognition, motor and action planning, decision-making, motivation, reinforcement, and reward perception and functional connectivity between brain regions that share functional properties. Hormonal challenges during puberty development may include self-esteem with gaming. This can be positive or negative, the hormone Terrahydropregnanolone, which controls anxiety as a response to stress, and sleep patterns where melatonin can be delayed during puberty (Poehner & Brown, 2019). These challenges can play a role in how middle school students approach serious games for learning.

Game Play Motivations

Adolescents spend a great deal of their leisure time online. These developments have led to a new educational shift, learning via serious games. Cognitive training paradigms, which are a form of guided practice treatment that focuses on tasks that target specific cognitive functions, such as memory, attention, or problem-solving, have started to integrate serious game techniques to enhance motivation to train students (Boendermaker et al., 2018). The gamer is in control of their actions and aims to accomplish both motivational and satisfying results (Calinoiu, 2019).

Digital serious games can facilitate intrinsic and extrinsic motivation. The self-determination theory differentiates between motivation types and explains motivational behavior that offers high-quality learning predictors (Bovermann et al., 2018). The different types of motivation play an integral role in how students react to digital serious game use for learning. Intrinsic motivation is undertaking an activity done for fun, pleasure, and satisfaction, whereas extrinsic motivation refers to performing an activity, not for the pleasure gained from the activity (Osman & Cirak, 2020). The student who has intrinsic motivation strives to enjoy and want to develop their skill level. Extrinsic motivation is especially important in cases where students lack personal interest; using extrinsic incentives to increase participation can help promote learning interest (Sun & Hsieh, 2018). However, Hope et al., 2019, stated that intrinsic aspirations should be a priority over extrinsic aspirations as intrinsic aspirations lead to enhanced well-being through greater satisfaction of basic psychological needs and more autonomous self-regulation.

In a quasiexperimental research study, 144 seventh-grade middle schoolers were placed into three groups to examine how combining a game approach to an interactive response activity in an English class would affect intrinsic and extrinsic motivation, engagement, and attention (Sun & Hsieh, 2018). Results showed that the clickers used for polling activities, instead of whiteboards in the classroom, to initiate fun, interactive, competitive, and novel nature helped improve the students' intrinsic motivation levels, overall engagement, emotional engagement, and focused attention (Sun & Hsieh, 2018). This study suggested integrating the gamification element within a classroom makes

classes more interesting and attractive to learners, suggesting that highly interactive, challenging, and competitive motivation makes students pay more attention. Although, in an experimental design study with participants (age 13 to 17), the authors sought to figure out whether or not it is necessary to indicate an educational game as a learning material (in contrast to pure entertainment) to facilitate learning relevant for school (Hawlitschek & Joeckel, 2017). Results showed that learning instruction increased a loss of interest for students and decreased learning outcomes, showing that learning instruction as an extrinsic incentive might negatively influence intrinsic motivation (Hawlitschek & Joeckel, 2017). Collectively, these results show that playing games just for fun enhances the effectiveness of a learning environment and requiring games to meet learning outcomes can influence students' overall motivation.

The effectiveness of serious games must focus on students' intrinsic motivation to play. Many factors contribute to this, but three basic psychological needs are essential to increase a student's drive to play. The self-determination theory suggests the three basic psychological needs affect a student's motivation level, suggesting that a students' perception of the three basic needs is positively associated with academic well-being and school engagement (Zhen et al., 2017). Osman and Cirak (2020) stated that a student's psychological needs: autonomy, competence, and relatedness, can explain a student's motivation level and develop intrinsic motivation towards gaming. Serious games can help students with special education needs, such as students with ADHD, stay interested in their studies by increasing motivation, independence, autonomy, and, as a result, self-esteem (Papanastasiou et al., 2022). Autonomy refers to the student's sense of being in

control of the situation. In other words, the student is more likely to feel autonomous if they understand the game's goal, the rules, and the reward (Garneli et al., 2017). Competence refers to the ability that a student feels during the in-game performance. It is about the perception of a student's need to have challenges and feel the competence to overcome such challenges (Osman & Cirak, 2020). Relatedness refers to the student's desire to feel oneself a part of the team. Relatedness is about the virtual relationships within the gaming environment. When individuals connect with others, they experience a sense of connecting with others while engaging in the game or activity (Osman & Cirak, 2020). Therefore, relatedness describes the need for students wanting to enter supportive social relationships during gaming. It is believed that the more an activity engagement fulfills these needs, the stronger the intrinsic motivation that occurs.

A cross-sectional design study was conducted with 605 junior high students in China using a Basic Psychological Needs Satisfaction Scale, an Academic Self-Efficacy Scale, an academic emotions scale, and a Learning Engagement Scale to explore the relations among competence, autonomy, and relatedness satisfaction to evaluate student learning (Zhen et al., 2017). Results showed that competence and relatedness satisfaction with learning engagement were important, but autonomy satisfaction was not. Therefore, implying that students may be more concerned with the challenge and connection with others during gameplay than with game control. In another study, academic self-efficacy and positive academic emotions promoted relationships between competence and relatedness satisfaction with learning engagement (Zhen et al., 2017). Negative academic emotions could only facilitate relatedness satisfaction, but not the satisfaction of

competence, to learning engagement. Detailing that during gameplay, the students desired to be a part of a team and experience the sense of connecting with others but not the challenge that comes with competence during gameplay. Competence and satisfaction of relatedness had positive predictions of learning engagement through academic self-efficacy through positive/negative academic emotions in multiple mediating ways (Zhen et al., 2017). Studies show the importance of the three basic psychological needs in satisfying students' learning motivation through academics to support learning engagement.

Another aspect of gameplay motivation and satisfaction is related to why people choose to continue playing a game. The motivation to play games might be affected by a person's prior game experience or prior gameplay intensity (Touati & Baek, 2017). Game satisfaction is the degree where the player feels content with their experience while playing a video game. Players continue playing a game if they have higher satisfaction and enjoyment and have disconfirmation of expectations (Patzer et al., 2020). Unpredictable elements of games, such as player traits (persistence, finding novelty, and reward dependency), correlate with increased player ability, difficulty, and flow, resulting in increased intention to play a game repeatedly (Huang et al., 2017). In particular, players with higher persistence and novelty tended to be more skilled. Players with higher novelty and reward dependence tended to feel more challenged. Players who were more cooperative felt more interdependent with other players. Players with higher skill, challenge, interdependence, and flow were more likely to play a game repeatedly (Patzer et al., 2020). Therefore, teachers must consider students' ability to persist while playing

because motivation influences the length of time the students play. Motivation is something teachers need to consider when selecting serious games to use with their students.

Game and Genre Attributes

Game attributes are features and characteristics in the game structure that are likely to initiate and maintain interest in gaming activities and game elements as a set of tools shared by games (Nadolny et al., 2017). One game attribute that has shown to be important with students is that the game contains some storytelling aspect, revealing an interesting story to the students, enriching their imagination visually and via sound effects (Garneli et al., 2017). The narrative context of a game can embed activities and characters in the game and gives them meaning towards real, non-game contexts or act as analogies of real-world settings, which can enrich boring, barely stimulating contexts and, consequently, inspire and motivate players (Sailer et al., 2017). Game design should also consider future users' interests; game mechanics should be based on cognitive exercises; and therapeutic mechanisms should include difficulty control, engagement, motivation, time constraints, and reinforcement (Súja r et al., 2022). To form a balance between the fun and learning features, the pedagogy and story should be aligned together with distinctive features of an educational game, thereby spurring motivation and engagement in-game learning activities, content acquisition, feedback, assessment, and reflection in a particular academic domain (Lameras et al., 2017). Garneli et al. (2017) highlight the importance of the story aspect with middle school students finding that the storytelling element in an educational game does not seem to affect students'

performance suggesting that the plot and the story are effective only evolving. The storytelling element might have a negative influence on the repetition of the practice.

Another important game attribute for digital serious game design is game elements such as points, badges, leaderboards, performance gaps, and instant feedback to enhance learning. *Points* are basic elements and are typically rewarded for successful accomplishment. They serve to numerically represent a player's progress, which can be experience points, redeemable points, or reputation points, with the most important purpose of providing continuous and immediate feedback as a reward (Sailer et al., 2017). *Badges* are visual indicators of achievements won and received throughout the game, which affirm the players' achievements, symbolize their merits, and visually show their achievement levels or goals (Sailer et al., 2017). Badges reflect a player's desires and expertise, as they are awarded for completing different game activities (Goh et al., 2017). Badges can provide input; although collecting them is not compulsory, they may influence players' actions, causing them to select certain routes and challenge badges that exert social control on players, particularly if they are uncommon or difficult to win (Sailer et al., 2017). Middle school students, in particular, are motivated by badges and other methods of recognition within a game (Sailer et al., 2017).

Leaderboards rank players according to their relative success, measuring them against a certain success criterion that can help determine who performs best in a certain activity, which leads to competitive indicators of progress that rates oneself to other players (Sailer et al., 2017). The competition caused by leaderboards can create social pressure to increase the player's engagement level, positively affecting participation and

learning (Sailer et al., 2017). *Performance graphs* are used to provide information about the players' performance and instead evaluate the player's performance over time, thus allowing the student to focus on improvements by graphically displaying the player's performance over a fixed period, that fosters mastery orientation, which is beneficial to learning and gives recurring feedback (Sailer et al., 2017). The game elements all play a significant role, thus wrapping up the learning process in the games' structure to help visualize the goal, a set of rules, and a clear reward system for the students (Calinoiu, 2019, p. 69).

Game immersion is a game attribute that also plays a role in educational games for learning. Immersion can be defined as a pleasurable experience of being transported to a simulated place with the thought of being surrounded by a completely other reality that takes over students' attention (Zhang et al., 2017). Immersion is a characterization that has been deemed suitable for video game playing, which interplays between flow and presence. Presence is prompted when the player feels as being in the game, and flow is the sensation of influencing the activity in the virtual world (Michailidis et al., 2018). Three stages of immersion are engagement, engrossment, and total immersion, however, total immersion is not likely be achieved (Michailidis et al., 2018). A player must be satisfied with the game features, feel control over the game, and be willing to invest time and effort into the game to reach the first stage, engagement. As players become more involved in the game, they enter the second stage, the engrossment in which their perceptions of their surroundings and physical needs decrease and their emotions are highly attached to the game (Cheng et al., 2017). During the last stage, total immersion,

individuals may feel that they are actually avatars and thus empathize with their situations. When they have reached the stage of total immersion, players are completely cut off from reality, and the game is all that matters to them.

Consequently, with different barriers existing between the stages, a gamer may have difficulty progressing from one stage to the next until certain barriers are overcome (Cheng et al., 2017). In a mixed methods study, the effects of immersion on augmented reality (AR) activity were reviewed. The study examined the hypothesis that a greater link between physical space and AR activity narrative leads to increased immersion and learning. Forty-five middle school students participated in this study: students at Condition1 (n=22) participated in an AR activity with a strong link between narrative and physical space. In contrast, students at Condition2 (n=23) participated in a loose coupling version of the activity. Data collection included baseline data, immersion survey questionnaires, and learning gains, as well as post-activity interviews. Findings showed higher learning gains and increased immersion for strong coupling conditions than for the students in the loose coupling condition (Georgiou & Kyza, 2018). Possible incorporating of the stages of immersion suggests that the story (narrative) aspect should increase motivation, learning, and continuance to play for the student to have immersion effects. This study showed that immersion plays a significant role in game mechanisms to align game activity and assessment.

Serious Gaming and Attention Deficient Hyperactivity Disorder

Research related on the implementation of digital serious games for students with ADHD often focuses on the social, emotional, and cognitive demands to support student

learning. In Zheng et al.'s (2021) literature review they identified research that examined digital serious games for use by individuals with ADHD. They categorized games by console games, computer games, or mobile games and identified a number of purposes, including: improving attention, suppressing impulse, improving memory, improving social skills, improving time management or task prioritization skills or promoting emotional regulation. In this section of the literature review, I review the effects of social, emotional, and cognitive demands through game play for students with ADHD.

Social Demands

Playing serious games has been used to help improve the social skills of students with ADHD. Social learning theories and situated learning theories claim that learning occurs within a social context, implying that the social context may provide structure, motivation, behavioral models, and support to varying degrees as individuals develop across their lifetime (Sherry, 2013). Many children and adolescents with ADHD struggle with social skills and peer relationships. It is critical to address this major impairment since social issues promote later maladjustment in ADHD populations (Mikami et al., 2017). Social Skills Training (SST) is a common intervention technique that can be utilized to help students with ADHD by using game-based innovations rather than standard SST approaches, which may potentially improve efficacy (Mikami et al., 2017).

A randomized-control approach was used in a study of 29 fifth and Grade 6 students to investigate the efficacy and acceptability of the Hall of Heroes game for SST. The study design was to compare students who interacted with Hall of Heroes with students who did not complete the game in relation to social, emotional, and behavioral

outcomes (DeRosier & Thomas, 2019).When compared to children who did not complete the SST intervention, students who completed Hall of Heroes dramatically improved in their capacity to relate to others (including peers and family members), accept affection, and share feelings with others (DeRosier & Thomas, 2019). Furthermore, adolescents in the treatment condition saw a considerably higher decrease in anxiety, sadness, and hopelessness than adolescents in the control condition (DeRosier & Thomas, 2019). Effective SST can safeguard students by teaching and practicing social skills that improve prosocial and/or inhibit maladaptive behaviors while enhancing social problem-solving skills (DeRosier & Thomas, 2019). SST therapies have been shown consistently to significantly enhance social skills, conduct, and interpersonal connections in students of all backgrounds, not just those with ADHD.

Children with ADHD have problems with the regulation of emotions and social skills. The adolescent-specific psychosocial factors make social dysfunction a significant negative risk factor for poor reactions as peer relationships are the primary environments for improving dispute resolution, negotiation, and communication skills necessary for competent lifelong social functioning (Morris et al., 2020).

A systematic review of nonpharmacological therapies for ADHD (10–18 years) found 11 trials addressing social functioning, eight of which were included in meta-analyses (Morris et al., 2020). The outcomes of four randomized trials' random effects meta-analyses indicated no differences in social functioning between treatment and control groups (Morris et al., 2020). Only parent-report, but not teacher- or self-report, showed that adolescents' social functioning increased from baseline to postintervention in

meta-analyses of nonrandomized research (Morris et al., 2020). These findings emphasized the lack of research in this age range. As a result, there is no evidence in this study that showed existing therapies increased peer social functioning. Clearer conceptualizations of developmentally relevant remediation aims may result in more effective social interventions (Morris et al., 2020). Children with ADHD often have many social problems, such as social exclusion and interpersonal relationship issues and the literature is mixed on whether nonpharmacological therapies work for adolescents with ADHD.

Most children with ADHD are impaired in social functions such as waiting, responding to nonverbal signals, understanding others' feelings, and participating in social situations requiring restraint and involvement (Hakimirad et al., 2019). These children tend to show several aggressive behaviors towards others, making it difficult for them to establish and maintain friendly relationships (LaCount et al., 2018). In a mixed methods study, of 12 children, Socialdrome, a social problem-solving game, was created and evaluated. The game was created with the goal of providing an interesting and pedagogically sound learning environment for school-aged children in Singapore to improve their social problem-solving skills (Ang et al., 2017). The game was designed to educate children how to detect and manage their emotions, exercise self-control, address social problems, and negotiate conflict situations (Ang et al., 2017). Results showed that a game-based approach gives children many opportunities to develop and exercise social skills before being tested in real-life environments (Ang et al., 2017). Social skills include

teamwork, commitment, self-control, assertiveness, and sub-scale behavioral disorders involving intrinsic, extrinsic, and hyperactivity (Hakimirad et al., 2019).

Research has been done to explore the effectiveness of using video games as an alternative way to support adolescents with ADHD. A study was conducted to investigate the efficacy of video games in children's social skills with ADHD. Hakimirad et al. (2019) used the game EmoGalaxy to carry out a semi-experimental method for two pre-test and post-test control groups to study the effectiveness of EmoGalaxy with 20 boys age 7 to age 12years' old who were divided into an experimental and control group. The study group had fifteen 45-minute intervention sessions using EmoGalaxy. No particular intervention was provided for the control group. The Gresham and Elliott Social Ability Rating Scale (1990) for parents was used to test the students' social skills. Results showed significant differences between the experimental and control groups, showing that the EmoGalaxy video game had successfully developed social skills in children with ADHD (Hakimirad et al., 2019). EmoGalaxy was also discussed in Zheng et al.'s (2021) literature review and was described as a game that focuses on emotional regulation and social skills improvement. It is primarily used to complete the training of the three aspects of emotion recognition, expression, and regulation (Zheng et al., 2021). To advance to the next level, players must express the correct emotions on the planets representing different emotions, and emotion recognition is accomplished through the use of facial recognition technology (Zheng et al., 2021).

In a quasiexperimental research study, the EmoGalaxy video game was used to help children with intellectual disabilities in practicing their emotion recognition and

regulation in response to their social skill development (Kashani-Vahid et al., 2018). A pretest-posttest evaluation and a control group were used in study. The study included 20 students, with 10 randomly selected to receive the intervention and the remainder, i.e., the control group, receiving no intervention. To assess their social skills before and after intervention, the teacher version of the Social Skills Rating Scale (Gresham & Elliott, 1990) was used. The results revealed significant differences in social skills between the experimental and control groups, which were consistent with the findings of the Hakimirad et al., (2019) study. The results showed that computer cognitive games greatly boosted the scores of social skills and their components in children (Kashani-Vahid et al., 2018). As a result, both studies suggested that using computer cognitive games centered on the educational needs of young children is one of the greatest strategies for the long-term improvement of social skills (Kashani-Vahid et al., 2018). According to researchers, using pre-planned educational games, particularly for strengthening children's social skills, will have better educational and social results (Kashani-Vahid et al., 2018).

Emotional Demands

Regulation of emotion is the ability to produce and sustain an emotion and the ability to decrease the intensity or frequency of an emotion (Tarle et al., 2019). Current research confirms that using innovative approaches, such as serious games, for supporting students with ADHD includes both novel and consumer off-the-shelf technologies to support emotional and behavioral self-regulation. (Cibrian et al., 2022). Gaming has been used as a way to help improve the regulation of emotions of students with ADHD. It is argued that games are well suited to induce emotionally stimulating

experiences and have become increasingly common in education to enhance learning (Ninaus et al., 2019). Children with ADHD have major disabilities in their self-regulation functions, and they have significant problems with understanding and controlling their emotions and feelings during gameplay (Hakimirad et al., 2019). Children use inhibition in their lives to down-regulate their emotions based on social expectations and use working memory to perceive co-existing or complex feelings by identifying emotional signals, understanding the meaning of a situation, and determining how to modulate their responses (Tarle et al., 2019).

Using emotional design in digital learning has been investigated with middle school students aged 13 to 16 on learning and how this relationship is moderated by previous learner experiences, using a computer-based lesson on lightning formation (Shangguan et al., 2020). Participants were randomly assigned to one of two training design conditions: positive emotional design (colorful and anthropomorphic features) and neutral emotional design (grey and non-anthropomorphic features). They were split into high-level learners and low-level learners (Shangguan et al., 2020). The results showed that positive emotional design, operated via visual elements, did not induce more positive emotions than the neutral design group. However, there was a tendency to facilitate more learning transfer and increase students' mental effort with low prior knowledge (Shangguan et al., 2020). Therefore, constructive emotional architecture should be implemented with caution in digital learning, and individual differences in educational design in a multimedia learning environment must be considered (Shangguan et al., 2020). Studies based on the delay aversion have shown that video games lead

significantly to the neutralization of some of the ADHD's inattentive symptoms and that games may serve as a potential therapeutic choice for individuals with ADHD (Ströberg, 2018). Game mechanics, events, and triggers (i.e., lightning) lead to the possible neutralization of ADHD's inattentive symptoms while playing video games, which may be due to the amount of stimulation present in video games (Ströberg, 2018).

Cognitive Demands

ADHD is one of the most common cognitive disorders characterized by a lack of attention and focus (Eddin Alchalabi et al., 2017), and shifting from childhood to adolescence brings increased cognitive load capacity, along with increased cognitive demands (Ovadya, 2020). Gaming has been used as a way to help improve the cognitive function of students with ADHD. Some studies focus on improving students' working memory. Working memory deficits are related to student difficulties in reading, reading comprehension, mathematics, writing, language acquisition, and attention (Ovadya, 2020). With increasing awareness of ADHD diversity, multiple existing models of working memory training can be used for school intervention, including classroom instruction and computer-based instruction (Ovadya, 2020). Cognitive control and motivational states help with decision-making for individuals with ADHD (Ma et al., 2017). According to current research, serious games increase learning engagement and motivation, as well as improve competence or performance in domains such as language learning and numeracy (Koh, 2022).

A qualitative case study was conducted with 27 children, ages 3–14, diagnosed with ADHD. The study involved an intuitive system, the tabletop, that allows children to

interact with familiar objects and play and communication opportunities (Coma-Rosellé et al., 2020).The study results showed the usefulness of mediation recommendations in game design and improving game adaptability to help children with ADHD to meditate, plan, and maintain their focus (Coma-Rosellé et al., 2020).The mediating function of learning games is applicable in developing the executive functions vital to learning with facilitator help. Children face problems at school attributed to weak executive functions causing lack of concentration, ineffectiveness, and irresponsibility, which causes difficulty in problem-solving (Barkley, 2015).

Other studies focus on cognitive training games. A study included 32 children who were tested for the neurofeedback (NF) effect and game-based cognitive training on children with ADHD (Rajabi et al., 2020). Students were assigned to NF (N=16; Mage=10.20; SD=1.03) and waiting list control (N=16; Mage=10.05; SD=0.83) in a randomized double-blind trial. The children in the quantitative electroencephalography - based NF group attended 30 three-time weekly sessions. The children were tested with EEG, Integrated Visual and Auditory Continuous Performance, Conners Parent, and Teacher Rating Scales-Revised in pretest and post-test. All the symptom variables were found to be significant, except for attention deficit and response control (Rajabi et al., 2020). Advances in technology provide an important platform for treatments. Integrating NF and game-based cognitive training may have significant therapeutic effects on brainwaves and symptoms of ADHD (Rajabi et al., 2020). Many educational games include the type of “cognitive training” this game used.

Current research validates that strong predictors of ADHD include cognitive dysfunctions in attention and planning processes. When players interact with video games, they are provided with information through pictures and noises, increasing multisensory depiction of knowledge. Attractive game designs are an important factor in children's activity quality (Crescenzi-Lanna & Grané-Oro, 2016). Liu et al. (2018) explain that using brainwaves to control integrated and interesting game applications for concentration training may effectively improve students' learning outcomes. The brainwaves can verify whether different game control effects can effectively improve the results of concentration and observe students' increased interest as different applications are used to improve their concentration level (Liu et al., 2018). Games achieve positive results when game content designers consider which perceptive and cognitive abilities are used and how social and affective skills are improved (Connolly et al., 2012).

Teacher Perceptions of Game Usage for Students

Despite the research on the learning and motivational impact of digital games, the teaching of digital games in secondary education is not yet widespread (Huizenga et al., 2017). Teacher perceptions of game usage as instructional support are important to explore, particularly related to how teachers use games to support students' academic goals. In this section, I will describe teachers' perceived benefits and challenges of serious games.

Teacher Perceived Benefits

Teacher perceptions of benefits and usefulness of digital games can be used to inform how to best use digital games in education. Huizenga et al. (2017) explored the

practice-based perceptions of teachers who do teach by playing or creating digital games for use in the classroom. Forty-three secondary education teachers participated in semistructured interviews. The findings showed that the majority of teachers who use games in class perceived student engagement with a game and cognitive learning outcome as benefits of using games in formal teaching settings (Huizenga et al., 2017). The findings also showed that teachers believed that teaching with games (a) engaged their students, (b) motivated students to learn, (c) influenced learning outcomes, and (d) used the competition to promote engagement (Huizenga et al., 2017).

In order to use technological advances, such as games, in the teaching process, some teachers recognized the importance of social influence, as it influences students' decisions to participate in serious games (Malaquias et al., 2018). Aside from topic content, using games for learning teaches students a variety of real-life skills such as emotion management, independence, self-regulation, and abstract and critical thinking (Jesmin & Ley, 2020). Games as a method of instruction are appealing and motivating for students, and teachers can observe them using a variety of skills in an informal setting (Jesmin & Ley, 2020). Using more interactive, immersive digital games in schools appears to be intermittent, depending on individual teachers' excitement and creativity (Stieler-Hunt & Jones, 2018).

Reasons teachers use serious games may vary from design principles such as the use of fantasy and narration to involve students in learning to timely feedback mechanisms focusing on progress. According to recent research, students enjoy games much more when they stimulate their creativity, set specific goals to achieve, provide a

feedback mechanism that fosters motivation, and provide measurable results (Doulou & Drigas, 2022). In a qualitative case study, 13 perspectives of middle school teachers were captured using digital gaming in the middle school classroom to examine 21st-century student learning skills (Omegna, 2020). In the study, teachers' perspectives were explored to understand better how 21st-century skills, such as collaboration, cooperation, and critical thinking, are perceived and assessed by teachers using classroom learning gaming (Omegna, 2020). Many of the teachers interviewed stated that students showed a high degree of interest in gaming. Teachers observed a high degree of constructivist elements to the learning process about 21st-century thinking, which may be why they use games with middle school students. Teachers also noticed that the quality of feedback before and after these higher-order games was remarkable when addressing the cyclical nature of interaction and critical thinking (Omegna, 2020). Teachers shared the importance they saw in higher-level or serious games in encouraging critical thought, teamwork, and cooperation to come to an objective resolution (Omegna, 2020). Teachers observed a high degree of dedication to buy-in for the completion of the mission. However, teachers shared the importance of including checkpoints when using games to verify that students were learning course content goals and concepts (Omegna, 2020). While teachers validated learning, they recognized students' desire for continuous interaction within the game through immediate feedback.

Based on survey data from 1258 Estonian teachers, Jesmin and Ley (2020) identified a number of perceived benefits of gaming. Teachers reported that serious games capture and hold students' attention, and there is more active participation,

(Jesmin & Ley, 2020). According to teachers, serious games make studies more interesting and varied, as well as create positive feelings toward the subject being taught. The teachers believed that game play allowed students to put their skills into practice while also improving their analyzing skills and broadening their vocabulary (Jesmin & Ley, 2020). The teachers also shared that using serious games makes teaching to special needs children possible while giving students the opportunity for both cooperation and working on their own (Jesmin & Ley, 2020).

Teacher Perceived Challenges

Research shows that teachers have several perceived challenges when considering using serious games with students. These include systemic and pedagogical challenges.

Systemic Challenges

Systemic challenges teachers face when deciding to implement serious games are often related to technical contexts such as the systems, devices, and services that the users have available, including technology availability, usability, and budget. This may lead teachers to have various concerns in their choice of serious games, including platforms, connectivity infrastructure, and experience in the school to promote serious game use and content development, all part of the technical context when implementing serious games (Southgate et al., 2017).

Important systemic challenges teachers perceived were the lack of technical support and lack of strong technology leadership. Teachers and school leaders did not believe that digital games could improve student learning due to a lack of awareness (Alsuhaymi & Alzebidi, 2019). Teachers reported that external barriers influenced how

they integrate technology, which also correlates to the implementation of serious games as a learning tool. As part of a focus group, teachers recognized the benefit of integrating technology into teaching and learning. However, challenges such as a lack of working equipment, insufficient technology resources, a lack of preparation, and a lack of time-limited ability to do so (O'Neal et al., 2017). Several teachers stated that they often lacked access to equipment or that their equipment was often damaged. Another concern was that there was no access to school computer tools for teachers (O'Neal et al., 2017). Teachers noted that, even though students enjoy digital games, most schools did not have computers (An et al., 2016). There may be only one lab for each grade level, and booking a lab is nearly impossible. Teachers spoke about the concerns that arise when administrative activities from before centralizing computing in daily life clash with the advent of technology-driven instruction. Teachers argued that school administrators restrict teachers' access to working equipment by restricting their use of available resources (O'Neal et al., 2017). Jesmin and Ley (2020)'s study corroborated these findings, as teachers identified technical and resources a barrier to the implementation of games.

Another external barrier to implementing games was the issue of time. In interviews, 47 middle school teachers expressed disappointment with the amount of time needed to use technology. Teachers said the technology was inadequate or that there were problems with connectivity (Regan et al., 2019). Teachers thought that technical glitches did not make their time worth it. The teachers needed technology that was "reasonably simple to use." With time being such a precious asset, ineffective or malfunctioning

equipment is said to have hindered classroom technology use (Regan et al., 2019). Teachers often pointed to time demands as a key problem that hindered them from effectively incorporating technology into daily teaching. Teachers have also spent a great deal of their professional and personal time outside the classroom planning for teaching, which interferes with their ability to learn and implement new technical classroom resources (O'Neal et al., 2017). Teachers believed that if they had more time searching for and analyzing computer games for use in the classroom, game integration could be a strong tool for student learning. Lack of time, ideas and skills were also mentioned by the teachers in Jesmin and Ley's study (2020).

Budget and the teachers' ability to use technology was another barrier that affects the effective implementation of serious games. In a qualitative web survey of 109 teachers, all of those polled believed that a lack of funding was a major barrier. Teachers stated that some schools do not have the funds to buy games, particularly games that meet teachers' needs (Watson & Yang, 2016). Due to a lack of funds for purchasing games, participating teachers who had previously used games for instruction most often used free web-based games and computer games that accompanied the textbook (Watson & Yang, 2016). As a result, providing better technical assistance to teachers and financial support for the purchase of computers and appropriate games could go a long way toward promoting the effective implementation of game-based learning.

Pedagogical Challenges

Teachers also perceived pedagogical challenges to implementing serious games. The first challenge is that the use of games often requires a pedagogical shift in how they

teach, particularly since teachers must use educational technologies effectively in several different academic fields, including reading, writing, mathematics, and science (Regan et al., 2019). The slow adoption of technology in the classroom is often because pedagogy relies heavily on teachers' acceptance of the technology in question and how they view and appreciate it as a learning tool (Prestridge, 2017). Effective teachers consider students' cognitive abilities and learning styles and may worry about meeting strict curriculum standards. Insufficient resources for professional growth have been shown to influence classroom technology use frequency and content (O'Neal et al., 2017).

Pedagogically, teachers indicated that they were overwhelmed with information about the use of technology in subject teaching and expressed a strong preference for incorporating technology into lessons rather than holding special sessions in the computer room (Prestridge, 2017).These challenges are influenced by a teacher's understanding of the developmental differences of the individual learners in their classrooms and, for example, how other related games or activities outside the game could lead students to deeper learning (Southgate et al., 2017).

Another challenge that teachers faced was ensuring curriculum alignment and standards. Teachers considered games' weak alignment with curriculum and state standards as a huge barrier (Watson & Yang, 2016). Teachers have identified the inflexibility of certain subjects or curricula as a key problem. A qualitative approach was used to shed light on teachers' perceptions of video games and the obstacles to incorporating these games into their teaching (Alsuhaymi & Alzebidi, 2019). Data from 22 Saudi teachers in the Eastern Province of Saudi Arabia were gathered using face-to-

face interviews. The results show that teachers have a positive attitude toward adopting video games. The most perceived challenge was a lack of video games tailored to Saudi peculiarities and curricula (Alsuhaymi & Alzebidi, 2019). The authors suggested that it is hard to find a game suited to the curriculum objectives to support game pedagogy usage (Alsuhaymi & Alzebidi, 2019). Teachers noted that many digital games are popular among students, but they may not serve the curriculum in any way (Alsuhaymi & Alzebidi, 2019). Teachers claimed that there are difficulties related to the games themselves in terms of their relevance to the existence and criteria of education and their compliance with education policy and standards (Alsuhaymi & Alzebidi, 2019).

Teachers have also shared that another challenge was the lack of preparation or training to use interactive educational games. Teachers believed that providing workshops and training for teachers would increase video game usage in the classroom (Alsuhaymi & Alzebidi, 2019). Teachers were concerned that some teachers who are computer illiterate and do not know how to operate computers will struggle to incorporate video games which shows that the most significant barrier preventing teachers from using video games was a lack of professional development (Alsuhaymi & Alzebidi, 2019). Teachers said that by offering clear guides on using video games, the number of teachers who used digital games in classrooms would certainly increase (Alsuhaymi & Alzebidi, 2019). Teachers expressed disappointment with having access to a multitude of computer programs and tools but a disjointed training experience if any at all. As a result, teachers stressed it would be important for schools to improve their technology adoption by combining the introduction of emerging technologies with

intensive teacher preparation (O'Neal et al., 2017). Teachers shared the importance of discovering ways to incorporate technology training when teachers have enough time to learn and prepare to integrate technology into their curriculum (O'Neal et al., 2017).

Summary and Conclusions

Sherry's (2013) model for game engagement framework provided a lens for examining literature related to middle school teachers' perspectives implementing serious games to support students with ADHD. A review of the literature surfaced three themes. The emerging themes consisted of (a) serious gaming for middle school students, (b) serious games to support students with ADHD, and (c) teacher perspectives on serious games, which include the systemic and pedagogical benefits and challenges encountered during the implementation of serious games. The gathered themes from the literature review served as the basis of examining the perspectives of middle school teachers implementing serious games to support students who have ADHD in the current study.

The first theme, factors that support serious gaming for middle school students, revealed that developmental factors, gameplay motivation, along game and genre attributes play a critical role in implementing serious games to support student learning effectively. Concerning the developmental factors required for middle school students to enjoy serious games (or any games), EF skills, specifically self-control, interference control, working memory, and set-shifting, are critical (Friedman & Miyake, 2017, p. 186). Also, a student's ability to regulate thoughts, emotions, and behaviors during adolescent development is a challenge to consider, as it can arguably link to their task-specific motivational goals and dispositions during gaming (Dang & Koedinger, 2019).

Each of these difficulties may influence how middle school students approach serious games for learning. Gameplay motivation can facilitate intrinsic and extrinsic motivation. Cognitive training paradigms, a type of guided practice therapy that focuses on tasks that target specific cognitive functions such as memory, attention, or problem-solving, have begun to incorporate serious game strategies to increase motivation to train students (Boendermaker et al., 2018). The gamer has complete control over their actions and strives to complete missions that are both motivating and satisfying (Calinoiu, 2019). Game and genre attribute strike a balance between fun and learning features. The pedagogy and story should be aligned with distinguishing features of an educational game, thus encouraging motivation and engagement in-game learning activities, content acquisition, feedback, evaluation, and reflection in a specific academic domain (Lameras et al., 2017). Another important game attribute for serious game design is game elements such as points, badges, leaderboards, performance gaps, and instant feedback to enhance learning (Sailer et al., 2017). Although research has looked at developmental factors, gameplay motivation, and game and genre attributes, a gap based on game attributes for implementing serious games to support student learning effectively existed through the lens of Sherry's (2013) model for game engagement framework.

The second theme in the literature review was the use of serious games to support students with ADHD. This theme supported the second component of Sherry's (2013) model for game engagement framework, including social, emotional, and cognitive demands. The literature revealed that a game-based approach allows children to develop and practice social skills like teamwork and self-control before putting them to the test in

real-life situations (Ang et al., 2017). Emotionally, gaming has been used to help improve the regulation of emotions of students with ADHD. Literature showed that games are well suited to induce emotionally stimulating experiences and have become increasingly common in education to enhance learning (Ninaus et al., 2019). Gaming has been used to help students with ADHD increase their cognitive function. ADHD is a prevalent cognitive disorder characterized by a lack of attention and focus (Eddin Alchalabi et al., 2017). The transition from childhood to adolescence provides increased cognitive load capacity and increased cognitive demands (Ovadya, 2020). Although the methodologies of these studies were quantitative, there was a strong emphasis on data collection for social, emotional, and cognitive demands as they relate to game-based interventions to support students with ADHD. However, no data shared teacher perspectives on how these demands play a role in supporting middle school students with ADHD, which is the focus of this study.

The final theme of the literature review focused on teacher perspectives of serious games usage for students. In this section, I discussed teacher perceived benefits and teacher perceived challenges. Teachers perceived benefits in the literature review found that the use of more interactive, immersive digital games in classrooms appears to be sporadic, relying on individual teachers' enthusiasm and imagination (Stieler-Hunt & Jones, 2018). Therefore, the reasons teachers use serious games to support students with ADHD include design principles such as the use of fantasy and storytelling to engage students in learning; visual and aural stimulation through interactive elements; simple and concrete objectives with requiring and escalating levels of difficulty; and the introduction

of learning to timely feedback mechanisms with a focus on progress (Southgate et al., 2017). Teacher perceived challenges revolved around systemic and pedagogical issues. Systemic challenges revealed that serious game implementation could be stifled when technical support and leadership are not effective. Another systemic challenge was the lack of efficient equipment to support digital game learning. Problems with connectivity and technical glitches were also issues, and teachers thought it was not worth their time to implement educational games. Budget and the teachers' ability to use technology played a huge role ineffective implementation as well. Pedagogical challenges exposed in the literature review were cognitive skills and learning styles and concerns about meeting strict curriculum standards and inadequate resources for professional development all influenced the frequency and content of classroom technology use. Although much qualitative research has been conducted on teachers' perspectives of serious game implementation, few studies have looked at middle school teachers' perspectives only. Little to no studies have specifically focused on middle school teachers implementing serious games, particularly to support a student with ADHD, which is the focus of my proposed study.

Chapter 3 will include the research design and rationale, and the roles of the researcher. I will review the participation selection logic and instrumentation I will use in the study and provide my proposed recruitment, participation, and data collection procedures. Lastly, I will discuss the data analysis plan along with the issues of trustworthiness in the study.

Chapter 3: Research Method

Introduction

The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of serious games for students with ADHD. To fulfill that purpose, I explored the perspectives of middle school teachers through the lens of Sherry's (2013) model for game engagement. In Chapter 3, I describe the research design and rationale and discuss my role as the researcher. In the methodology section, I discuss participant selection, instrumentation, recruitment, data collection and analysis. Lastly, I discuss issues of trustworthiness and ethical considerations to be considered in this study.

Research Design and Rationale

RQ1: What are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD?

RQ2: What are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD?

Rationale for Research Design

In this basic qualitative research study, I applied a semistructured design was applied to explore the perceptions of middle school teachers which included, seven general education teachers, two special education teachers, and one technology teachers related to the use of serious games for students with ADHD. Basic qualitative research refers to an approach in which researchers are interested in solving a problem, effecting a change, or identifying relevant themes (Mihas, 2019). Using a basic qualitative approach

allows the researcher to investigate teacher opinions, attitudes, and experiences (see Percy et al., 2015), and in context of my study, teacher opinions about the use of serious games. Percy et al. (2015) recommended that when the researcher has prior knowledge about the issue, a basic qualitative inquiry should be used to describe it more thoroughly from the participants' perspective. As a classroom teacher, I used serious gaming to enhance my lessons and to assist with closing educational gaps. My study fits the description provided by Percy et al. because the research questions focused on exploring teacher perceptions, which included their subjective opinions, attitudes, and beliefs of their experiences. I used purposeful sampling to study teachers who are actively using serious games with their students. I used the three constructs from Sherry's model (2013): development factors, gameplay motivations, and game attributes for coding during data analysis.

Other Qualitative Designs Considered

For this research study, I considered four qualitative designs: phenomenology, ethnography, grounded theory, and case study. Phenomenology is the study of how people make sense of their experiences and translate them into consciousness, both individually and collectively (Patton, 2015). A phenomenology research design was not suited for this study because the goal was not to examine the essence or structure of digital serious games, but explored the perspectives of middle school teachers usage of digital serious games for students with ADHD.

In addition to a phenomenology study, grounded theory was also considered for this study. Grounded theory is a research theory that researchers use to focus on

developing theory while focusing on procedures through action (Patton, 2015). Grounded theory was not an appropriate methodology for this study because the data from the participant interviews were not used to develop a theory about digital serious game use (see Merriam & Tisdell, 2016). In this study, the conceptual framework, I used Sherry's model of game engagement to explore the perspectives of middle school teachers who use digital serious games to support learning for students with ADHD.

For this study, ethnography was considered as a research design. Ethnography is a methodology that researchers use to seek understanding of individuals' interactions not only with others, but also with the culture of the society in which they live (Merriam & Tisdell, 2016). Because the use of digital serious games by middle school teachers is not culturally connected, ethnography as a research design was not appropriate for this study. In contrast to the research design of ethnography, I selected participants for this study based on their use of digital serious games using Sherry's game of engagement model (2013).

The last qualitative design that I considered for this study was a case study. A case study is an empirical inquiry that investigates a contemporary phenomenon in depth and within its real context (Yin, 2014). In addition, a case study is a detailed rich study about a person, organization, event, campaign, or program that stands on its own (Patton, 2015). Through this study, I investigated a contemporary phenomenon, that was not focused on collecting in-depth information about individual experiences through multiple data sources. In this study, I focused on capturing the perspectives of middle school teachers on the usefulness of serious games to support learning across middle school

grade levels, Grade 6 through 8, and various contexts (see Merriam & Tisdell, 2016; Percy et al., 2015).

Role of the Researcher

For this basic qualitative study, I served as the primary investigator and observer. I used Sherry's (2013) game of engagement model served as my conceptual framework and a lens for data collection and data analysis in my position as primary investigator. As the primary investigator, I selected the research design, decided the conditions for participant participation, determined the types of data sources, and developed the data collection instruments. I also established protocols for participant recruitment, data collection and analysis, and worked to maintain trustworthiness through the use of qualitative research strategies. As an observer in this study, I collected data, maintained a researcher journal, and interpret the data during data analysis. My current job as an assistant principal of a middle school campus did not interfere with my work as a researcher. Despite the fact that I have worked with middle school teachers on a daily basis, none of the participants in this study were from my campus. Furthermore, because many schools use serious game implementation in a number of ways, I studied middle school teachers within the United States who actually used serious games to support learning to reduce researcher bias. My campus and district currently do not use serious game platforms or games as a part of the learning structure, although some teachers are becoming more aware of the use of games to support learning. To minimize my bias in the research, I performed member checks (see Carlson, 2010), used reflective journaling, acknowledged study limitations, and provided transcripts from participant interviews.

Methodology

In this section, I provide details on the methodology of the proposed research study. This section includes participant selection logic, instrumentation, an interview guide, procedures for recruitment, participation, data collection, and a data analysis plan. Additionally, I discuss issues of trustworthiness like credibility, transferability, dependability, confirmability, and ethical considerations for the study.

Participant Selection Logic

The inclusion criteria for this study were that participants (a) were a Grade 6 through 8 general education teacher, special education teacher, or technology teacher, (b) taught in the United States, (c) had at least 1 year of experience implementing digital serious games in their classroom, and (d) had implemented digital serious games with students with ADHD. Purposeful sampling was used to select individual teachers for this study, focusing on teachers with specific characteristics that were best able to assist with the related research by contacting individuals in my social networks. The purposeful sampling strategy was chosen as the sampling technique because it focused on information-rich cases, which meant using specific cases, such as digital serious games usage, to collect data that were essential to the qualitative research goal (see Patton, 2015). Purposeful sampling is described as a strategic method for identifying participants whose experiences are aligned with the study's purpose and the RQs being explored (Merriam & Tisdell, 2016). When information needs to come from a subset of participants who can share important information about the experience while the researcher looks through a specific lens, Merriam and Tisdell (2016) recommended

purposeful sampling. Purposeful sampling, according to Patton (2015), should be used where relevant information can be gathered from participants and used to obtain a better understanding of the inquiry's purpose.

After receiving approval from the Walden University Institutional Review Board (IRB), participants were identified through a recruiting email (see Appendix A) to teacher school email addresses obtained from a public website in a number of districts in the southern United States, and eight participants responded. After failing to attract the required number of participants during Phase 1 of recruitment strategy, I moved on to Phase 2, my personal learning network on social media, Facebook, where I posted my publicly available infographic (see Appendix E). I was able to recruit two more participants from online forums where teachers discuss gaming in education during Phase 2.

The sample size of a study was determined by a number of factors, including the depth and breadth of the RQs, the number of interviews conducted, and the purpose of the study (see Merriam & Tisdell, 2016; Patton, 2015). According to Guest et al. (2006) a sample size leading to 12 interviews would most likely be sufficient in meeting data saturation. When this point is reached, it is referred to as the stopping point by researchers (Francis et al., 2010; Sim et al., 2018). Using emergent themes as a determinant of sample size by collecting redundant and repetitive data (Francis et al., 2010; Sim et al., 2018) I decided on an interview size of 10 participants as I believed that data saturation occurred within the 10 interviews who specialized in game usage in different areas of education to support students with ADHD.

Instrumentation

For this study, I created an interview guide for use while conducting semistructured interviews. The interview guide is a tool used to conduct effective interviews for qualitative research (Castillo-Montoya, 2016). According to Merriam and Tisdell (2016), interviews provide the study with nonobservable insights on a given phenomenon that they may not be able to capture on their own. As I interviewed participants using the interview questions listed in Table 2, content validity evolved through the constant comparison of the interview data. According to Merriam and Tisdell, validity "must be assessed in relation to the purposes and circumstances of the research" (p. 243). To understand the sufficiency of the data to answer the RQs, I aligned the interview questions to the RQs as shown in Table 2. Table 2 displays each research question, as well as each interview question and prompts that focuses on each construct as it relates to the construct's individual subtopics. Social demands, emotional, and cognitive stages support developmental factors. Social, emotional, and intellectual motives all play a role in game play. Finally, there are game/genre attributes such as coplay, demands, and challenges. Based on Sherry's model of game engagement's three constructs: developmental factors, game play motivations, and game/genre attributes, the interview questions provided data to answer RQ1 and RQ2 (see Table 1). To check for content validity for my interview protocol, I polled subject matter experts on how useful each question was and made suggested edits to the questions. These questions helped me gather information about teachers' perspectives on the use of digital serious games in their classrooms to support students with ADHD.

Table 2

Alignment of Framework to Research and Interview Questions

Sherry's model for game engagement	Research questions	Interview questions
Developmental Factors	RQ: 1 What are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD?	IQ#1: In what ways have you noticed developmental factors such as social, emotional or intellectual demands benefiting students with ADHD when playing serious games? Prompt A: How do social elements, such as peer influence, or preference to play alone, benefit a student with ADHD to play serious games? Prompt B: How about emotional elements, such as mood? Do you see these benefiting a student with ADHD when playing serious games? Prompt C: How about cognitive elements or a student's intellectual ability? Do you see these benefiting a student with ADHD when playing serious games?
Developmental Factors	RQ: 2 What are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD?	IQ #2: In what ways have you noticed developmental factors such as social, emotional, or intellectual demands being challenging to students with ADHD when playing serious games? Prompt D: How are social elements, such as peer influence, or preference to play alone, challenging for a student with ADHD when playing serious games? Prompt E: How are emotional elements such as mood challenging with ADHD when playing serious games? Prompt F: How do cognitive elements such as attention or a student's intellectual ability, challenge a student with ADHD when playing serious games?
Game Play Motivations	RQ 1: What are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD?	IQ #3: What types of motivation do you notice from students with ADHD when playing a serious digital game? Prompt: G: How do social motivations, such as, the games' social context benefit students with ADHD during gameplay? Prompt H: In what ways do emotional motives such as autonomy, competence, and relatedness aid students with ADHD during gameplay? Prompt I: How are the intellectual motivations such as memory, attention, or problem-solving benefit students with ADHD during gameplay?

Sherry's model for game engagement	Research questions	Interview questions
Game Play Motivations	RQ 2: What are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD?	IQ #4: What motivational challenges do you notice from students with ADHD when playing a serious digital game? Prompt: J: What are some of the social motivations that students with ADHD face while playing video games? Prompt K: How might emotional motivations have a negative impact on ADHD students during gameplay? Prompt L: What are some of the intellectual motivations that may have a negative impact on ADHD students during gameplay?
Game/Genre Attributes	RQ 1: What are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD?	IQ #5: What specific game elements have you found to be particularly successful with students with ADHD? Prompt: M: How does coplay (peer interaction/competing) benefit students with ADHD during gameplay? Prompt N: What demands such as game design or game content that benefit students with ADHD during gameplay? Prompt O: In what ways do challenges, such as a students' experience, benefit students with ADHD during gameplay?
Game/Genre Attributes	RQ 2: What are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD?	IQ #6 Which specific game elements or game designs that are challenging for your students with ADHD? Prompt: P: What coplay (peer interaction/competing) elements challenge students with ADHD during gameplay? Prompt Q: What aspects of the demands, such as game design or game content, have a negative impact on students with ADHD during gameplay? Prompt R: How do challenges based on students' experiences hinder ADHD students during gameplay?

Procedures for Recruitment

In Phase1 I obtained publicly available teacher email addresses from southern U.S. school districts. During Phase 2 I used my personal learning network on social media to recruit participants. Once I gained IRB approval, I contacted the middle school teachers, special education teachers, and technology teachers using their school email addresses. I sent individual emails to each teacher to introduce myself and my study,

explained the inclusion criteria, and invited them to learn more, with the option of receiving a $10 Amazon gift card when they chose to participate in the study (See Appendix A).

For Phase 2 of recruitment, I used my personal learning network on social media. I used hashtags identified that are related to my participants group, gaming, and educational technology, (see Table 3). I constructed microblogging tweets using these hashtags. I published the tweet with an infographic for more visibility (see Appendix D).

Table 3

Hashtags to Reach Teachers who use Digital Serious Games

Hashtag	
#SeriousGames	#gbl
#games4ed	#digitalpedagogy
#gamification	#middleschoolteachers
#edtech	#ADHD

Additionally, I identified online spaces where teachers discuss gaming in education, (see Table 4). I used these social media spaces to direct message invitations, or publicly post an infographic with the details of my study along with the option of receiving a $10 Amazon gift card for participating in the study (see Appendix F).

Table 4

Professional Learning Network Facebook Groups

Facebook	Number of members on 09/21/2021
Game-based Learning, Gamification, and Games in Education	3.5K members
Gamification for Education	4.5K members
Digital Technologies or Education	1.5K members
Technology Teacher Talk with Brittany Washburn	27K members
Instructional Technology for Teachers	2.4K members
ActivatED: Education, Technology, and Society	3.4K members

Before posting my invitation to participate to private groups, I obtained permission from any page administrator to post an invitation to my study.

Procedures for Participation and Data Collection

After I received contact information from consenting participants, I contacted them to set up a time for virtual interviews via the virtual platform Zoom. Each interview lasted about 45-60 minutes. The interviews were audio recorded by the virtual platform and saved. To assure the accuracy of the interviews, I used a voice recording program called Voice Recorder as a backup. I used the software Temi to obtain a transcription. I then further edited the transcription by listening to the interviews and fixed all errors to add formatting and proper punctuation. Once the interviews were transcribed and analyzed, I emailed each participant a two-to-three-page summary of my interpretation of what they shared to provide any clarifications.

Data Analysis Plan

Data collection included my recorded reflections of the interviews, including overall impressions as well as the codes in a reflective research journal as suggested by Ortlipp (2008). I uploaded the transcripts to Temi, a data management system, to begin the data analysis. I conducted inductive analysis through two levels. During the first level of coding, I read through the data which allowed the codes to emerge and assigned specific text segments codes that described or summarized their meaning. I began using Dedoose, a qualitative management software to track the codes names. Dedoose has a feature where I added definitions of the codes as I developed them. I gradually stopped using Dedoose and began taking jotted notes about preliminary patterns, participant quotes that seemed quite vivid, data anomalies, and so on (see Saldaña, 2015). These notes were put into a PowerPoint by interview question to help disaggregate the data and find common themes. This became my codebook for level 1 coding which made it efficient for me to identify patterns and to apply new codes to future text segments (see DeCuir-Gunby et al., 2011). When I developed a new code, I recorded it and put a brief definition in my codebook and referred to it often during the coding process. The codebook ensured that during the constant-comparative method of data analysis that I applied the codes consistently and were aware when codes should be combined or split into more codes. Identifying emergent codes, allowed me to find common trends and concepts that led to the development of patterns and themes in the data (Saldaña, 2015).

During the second level of data collection, I grouped emergent codes into similar themes, and then grouped the themes into categories aligned to the conceptual

framework. Table 5 shows the theoretical categories and initial theme codes I developed to align with Sherry's (2013) model of game engagement. Table 5 shows RQ1 and RQ2 through the initial themes by adding indicators (+,-) to the code so that the benefits and challenges can be organized by code. The initial theme codes are also defined to identify the code while supporting Sherry's (2013) model of game engagement three constructs and their subtopics.

Table 5

Theoretical Categories and Initial Theme Codes

Theoretical categories	Definition	Initial themes	Definition
DevSoc	Developmental-social	SI+ SI-	Social Influences: change as peer-to-peer influence increases, reflecting competition and encouragement to perform at the highest levels where learning occurs predominately in a social context that can provide support in varying degrees as an individual move through the lifespan (Sherry, 2013).
DevEmo	Developmental-emotional	EI+ EI-	Emotional Influences (ex. Puberty) A student's mood can affect emotional development, particularly as they move through puberty (Sherry, 2013).
DevCog	Developmental-cognitive	EF+ EF-	Executive Function: are a type of natural cognitive function in humans that includes planning and organization, time management, working memory, and reaction inhibition (Zheng et al., 2021) how well a game aligns with the cognitive needs of the player, not too easy, not too difficult.
GPMS	Game play motivation-social	PI+ PI-	Peer Influences: increase motivations to play games that others are playing while keeping up with the latest popular games as a means of social bonding (Sherry, 2013).

Theoretical categories	Definition	Initial themes	Definition
GPME	Game play motivation-emotional	EM/IM+ EM/IM-	Extrinsic/Intrinsic Motivation: Intrinsic motivation is undertaking an activity done for fun, pleasure, and satisfaction, whereas extrinsic motivation refers to performing an activity, not for the pleasure gained from the activity (Osman &Cirak, 2020).
GPMI	Game play motivation-intellectual	CTP+ CTP-	Cognitive Training Paradigms: are a form of guided practice treatment that focuses on tasks that target specific cognitive functions, such as memory, attention, or problem-solving, have started to integrate serious game techniques to enhance motivation to train students (Boendermaker et al., 2018). Motivated to keep playing due to successes and challenges within the game.
GACP	Game attributes-coplay	CP+ CP-	Coplay: is the aspect of playing games with peer groups and competing with others to maintain relationships. Peer influences increase motivations to play games that others are playing while keeping up with the latest popular games as a means of social bonding (Sherry, 2013).
GAD	Game attributes-demands	GD+ GD-	Game Design: is related to graphics, how students move and interact within the game, and what the game "demands" they do and learn.
GAC	Game Attributes-challenges	GA	Game attributes are features and characteristics in the game structure that are likely to initiate and maintain interest in gaming activities and game elements as a set of tools shared by games (Nadolny et al., 2017) such as the storytelling aspect, enriching their imagination visually and via sound effects (Garneli et al., 2017). Enjoying the game's attributes in how design challenges.

Patton (2015) shared the importance of seeking alternative explanations for data collected during a study in return increasing the credibility of the study. Although I used the codebook to code the data, I recognized that a priori coding is only a beginning point and that new codes would emerge that do not correspond with the existing codes (DeCuir-Gunby et al., 2011). This showed the importance of identifying discrepant data that does not conform to what is expected or anticipated by the researcher, particularly when using a priori codes (Merriam & Tisdell, 2016). It is important to identify discrepant data because all data during interviews should be openly shared. If data are omitted, the researcher has essentially impacted the validity and reliability of the study (Merriam & Tisdell, 2016). To increase trustworthiness of my study, I reported discrepant data in order to give other researchers and readers a full picture of my study.

Issues of Trustworthiness

Trustworthiness is important to qualitative research because it supports researchers in determining if the qualitative research is credible, transferable, dependable, and confirmable or objective. Trustworthiness of the study is no better than the individual conducting and analyzing the data (Merriam & Tisdell, 2016). As the researcher, to increase trustworthiness of the study was imperative to be transparent about the research findings, the recruitment process, and to clearly state personal and professional connections to the research study. One way to establish trustworthiness in a study is through the rigor of the research design and implementation (Merriam & Tisdell, 2016). When ethical practices are considered and implemented throughout the research process, trustworthiness is established in a study (Merriam & Tisdell, 2016). In this section, I

explained how I improve trustworthiness in this study by using practices that are credible, transferable, dependable, and confirmable.

Credibility

Merriam and Tisdell (2016) characterized credibility in qualitative research as how closely the research findings match fact. To strengthen the credibility of qualitative research, Merriam and Tisdell recommended that qualitative researchers use the following strategies: (a) triangulation, (b) member checks, (c) adequate engagement in data collection, (d) discrepant case analysis, and (e) peer review. Triangulation and member checks were the two methods used to strengthen the study's credibility. For this study, I used member checks to triangulate semistructured interview data and theoretical triangulation to validate emerging results, which served as a deeper analysis of the data (see Merriam & Tisdell, 2016). Member checking entails using interview participants as examiners of the data obtained during the analysis in order to prevent misinterpretations of the information exchanged during interviews (Merriam & Tisdell, 2016). For this analysis, participants checked and agreed that the transcriptions accurately represent their perspectives. For theoretical triangulation, I used Sherry's game engagement model to better understand the data analysis while looking at the data through the lens of the model.

Transferability

Transferability is known as the ability of a different researcher to replicate the study findings (Merriam & Tisdell, 2016). To assist other researchers in deciding whether the results of this study are transferable, I provided comprehensive and rich descriptions

of the participants (i.e., grade level taught) and their setting (i.e., public or private school, regional description) in my study on middle school teacher perceptions of the use of serious games for students with ADHD (see Merriam & Tisdell, 2016). Since I used purposeful sampling, all of the knowledge I needed to provide accurate explanations of the participants and their settings to the researchers was available.

Dependability

Ravitch and Carl (2016) described dependability as data that remains stable and consistent over time while answering RQs. The justification and rationale for the research methodology, as well as using the methodology systematically with participants in different environments, are two methods for ensuring the dependability and validity of the results (Ravitch & Carl, 2016). In this study, I explained why I chose basic qualitative research as my research design because it was relevant to serious game use and allowed for the collection of data on people's perspectives (see Merriam & Tisdell, 2016). Furthermore, I described how participants were recruited using specific inclusion criteria, collection of data during participant interviews using the same protocols, and interpreted data using codebooks developed from the conceptual framework. Since all of the participants came from different areas within the U. S., I made certain that I followed my approach with participants in a variety of settings to improve the dependability of my research.

Confirmability

According to Ravitch and Carl (2016), confirmability is the equivalence of objectivity. Confirmability necessitates that a qualitative researcher considers areas of

bias while keeping in mind that one cannot be fully impartial during the study process (Ravitch & Carl, 2016). I purposefully used the coding procedure in this study to ensure confirmability. I examined data through a single lens using my codebooks, which was derived from my conceptual framework. My personal lens was used as secondary to the knowledge and insights I acquired from the coding process as I examined my research through the conceptual framework. In order to ensure dependability and confirmability, I confirmed my results with the interview transcripts and data gathered during the coding process when I recorded the study's findings.

Ethical Procedures

Knowing that I, as the researcher, was used as an instrument in the research's data collection and analysis phases, it was critical that I followed ethical procedures. The researcher-participant relationship required a certain ethical consideration. The researcher-participant relationship, for example, can influence "how informed consent can be and how much privacy and protection from harm is afforded to the participants" (Merriam & Tisdell, 2016, p. 261). The researcher-participant relationship is also critical in establishing the credibility and reliability of data and findings (Merriam & Tisdell, 2016). It was imperative that the researcher be mindful of ethical procedures in order to ensure the participants of study are not harmed.

To comply with ethical procedures, I obtained permission from Walden University's IRB for this study. First, I addressed the ethical concern of doing a study within my work field of education on a middle school campus. In the role of the researcher section, I was transparent about my role as an assistant principal of a middle

school campus and that my role as an assistant principal did not interfere with my work as a researcher, as none of the participants in this study were from my campus. Additionally, for this study's recruitment, I concentrated on four general education instructors, four special education teachers, and four technology teachers. Next, ethical consideration of transparency was addressed by sending a friendly email or infographic invitation to potential participants who meet the inclusion criteria for the study along with a consent form. In the consent form, I explained my inclusion criteria and the purpose of the study. The consent form also outlined the risks and benefits of the study so the participants were able to make an informed decision about participating. In the consent form, the voluntary nature of the study was outlined which included how the participant could have opted out of the study at any time. No participants chose to opt out their decision to participate. I informed the participants about how privacy and protection of data would be kept for a period of five years in a password protected computer in a secured folder. A review of data collection methods and procedures of how member checks would be used to review findings was be included in the consent form. Participants who chose to participate also filled out a demographic questionnaire.

The ethical concern of confidentiality was addressed in multiple ways. During interviews, participants were audio-recorded using Zoom. When the audio-recordings were completed, they were deleted from the platform and downloaded to two locations, a secured folder on my password protected computer and an external password protected hard drive. I then masked the identities of participants by using a number and shared no identifying characteristics during the research process or findings. After the data were

collected from the interviews, I had the participants engage in a member check of the transcription and analysis. My committee and I are the only people with access to this raw data and the data will be kept for up to five years after the study is conducted. After five years, the data will be destroyed.

The ethical consideration of incentives was considered in this study. Once the study was completed, those who opted to participate in the study were sent a $10 gift card from Amazon. The gift card showed my appreciation to the participants, for completing a questionnaire, data obtained through the 45-60-minute interview, and for a completed member check of the transcripts for content accuracy. The reason for this incentive was to recognize the time participants took out of their day to participate in the study. To minimize or eliminate the appearance of coercion, in the consent form, I informed the participants that the study was completely voluntary, and they could opt out at any time. Offering the gift card helped me obtain the number of participants I needed to reach saturation and ensure reliability and validate my study.

Summary

In this chapter of the study, the areas discussed were research design and rationale, role of the researcher, methodology, and issues of trustworthiness. The research design was a basic qualitative inquiry, which allowed me to understand concepts, opinions, and experiences of middle school teacher perceptions of serious games to support students with ADHD. In the role of the researcher section, I shared my role as the primary investigator in determining the research design, recruiting participants, conducting interviews, and conducting the data analysis for the study. For the

methodology section, I outlined the selection of participants for the study, which included an interview guide that was used during the semistructured interviews, shared the steps for strengthening trustworthiness of the study, and described the ethical procedures for participants and data collection and reporting.

Chapter 4: Results

Introduction

The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. In this chapter I describe the setting, demographics, and data collection procedure used in this study. Next, I will discuss the research design and rationale for using basic qualitative methods. This is followed by a discussion of the data analysis, evidence of trustworthiness, and the results of the study including a description of the factors that emerged from the data. I will also discuss the 10 themes and 15 factors based on Sherry's (2013) model of game engagement.

The RQs for this study were:

RQ1: What are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD?

RQ2: What are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD?

Setting

For this basic qualitative study, I gathered participants from the southern region of the United States. The 10 teachers interviewed as part of this study were full-time employees teaching in Grade 6 through 8. I used semistructured interviews that were conducted via the virtual platform Zoom in the spring of 2022.

Several organizational conditions may have influenced the interpretation of the study results. As participants consented to participate in the study from five different

school districts in the Southern region of the United States, school factors such as adequate access to technology and campus approved digital games, to name a few, existed as hidden variables. Variables influencing the interpretation of the study results could have included each district's vision for the use of digital serious games to support learning, the expectations shared with participants about digital serious games, and the systemic and pedagogical benefits and challenges encountered during serious game implementation. As a result, participants may have had different experiences while using digital serious games.

Demographics

The participants for this study included 10 middle school teachers Grades 6 through 8 from five school districts in the United States. See Table 6. All of the participants were either a Grade 6 through 8 general education teacher, special education teacher, or technology teacher. The teachers taught in the United States and had at least 1 year of experience implementing digital serious games in their classroom. The teachers also had implemented digital serious games with students with ADHD. Participants were four math teachers, one English teacher, one science teacher, one history teacher, two special education teachers (one life skills and one adaptive behavior teacher), and one technology teacher. Six of the participants were female and four were male. All participants have used serious games for more than one year and have used various games to support student learning for all students including students with ADHD.

Table 6

Participant Demographics of Subject Taught, Gender, Experience, and Region

Participant pseudonym	Subject taught	Gender	# of years taught	Region
P1	Math Interventionist	Female	8	Southern
P2	History	Male	15	Southern
P3	Math	Male	4	Southern
P4	Technology	Female	13	Southwestern
P5	Math	Male	5	Southern
P6	Math	Male	10	Southern
P7	Special Education	Female	8	Southern
P8	Special Education	Female	22	Southern
P9	English	Female	8	Southern
P10	Science	Female	18	Southern

Data Collection

I received IRB approval for this study (#02-07-22-0724944) on February 7, 2022. The initial recruitment for this basic qualitative study occurred as described in Chapter 3. I sent a recruiting email (see Appendix A) to teacher school email addresses that I obtained from a public website in numerous districts in the southern region of the United States; this yielded eight of the ten participants. After not receiving the minimum number of participants needed during Phase 1 of my recruitment plan, I moved to Phase 2, my personal learning network on social media, Facebook, where I uploaded my publicly uploaded infographic (see Appendix E). From Phase 2, I was also able to gather two more participants from online spaces where teachers discuss gaming in education. No unusual circumstances were encountered during data collection. Interviews occurred between March 4, 2022 and April 11, 2022. Before the interviews were conducted participants were given the option to select a virtual platform such as Google Meets, Zoom, Skype, or by phone. All participants opted to be interviewed via Zoom. Each

participant participated in one round of semistructured individual interviews that lasted between 30 and 90 minutes.

I used various tools to record and transcribe the interviews. For recording I used the audio-recording feature built into the Zoom platform and backed up with a voice recorder app on my phone. After each interview, I saved the digital files to a password protected hard drive. To transcribe the interviews, I used Walden's capture recording tool Kaltura to transcribe the first three interviews and Temi for the last seven interviews. Next, I listened to the audio files and edited the transcripts to delineate speakers and fix grammatical or spelling errors. When the interviews were completed, I emailed participants a copy of their transcripts for member checking. I asked each participant to review their transcript checking for accuracy or clarifications that they wanted to make. None of the transcripts were returned with revisions. Finally, in preparation for data analysis, I uploaded the transcripts to Dedoose. I gradually stopped using Dedoose and began taking jotted notes about preliminary patterns, participant quotes that seemed quite vivid, data anomalies, and so on (see Saldaña, 2015. These notes were put into a PowerPoint by interview question to help disaggregate the data and find common themes. Additionally, I used reflective journaling to write my reactions to interviews and to note initial thoughts about connections to the literature.

Data Analysis

I used an inductive analysis approach to analyze data (see Saldaña, 2015). Each interview was individually coded after it was transcribed. To aid with the coding process, I developed a codebook, as described by DeCuir-Gunby et al. (2011). Data gathered from

the participant interviews along with my reflections were used during the data analysis process. I conducted data analysis at two levels. At the first level, I began by reading through the data allowing codes to emerge and assigning specific text segments codes that described or summarized their meaning. I initially started off using Dedoose a, qualitative management software to track the codes names as stated in Chapter 3. I uploaded my initial themes from the literature into Dedoose which had a feature where I added definitions of the codes as I developed them. The use of this feature became my codebook for level 1 coding and made it efficient for me to identify patterns and to apply new codes to future text segments (see DeCuir-Gunby et al., 2011). I gradually stopped using Dedoose and began taking jotted notes about preliminary patterns, participant quotes that seemed quite vivid, data anomalies, and so on (see Saldaña, 2015). These notes were put into a PowerPoint by interview questions to help disaggregate the data and find common themes, and when I developed a new code, I recorded it with a brief definition in my codebook and referred to it often during the coding process. For the second level of data analysis, I grouped emergent codes into similar groups based on the initial themes, and then determined how the themes grouped into categories aligned to the conceptual framework. Finally, I determined keywords and factors. As a result of these analyses, I determined some factors to be at saturation, while others were repeated to support the category and initial theme.

Through the data analysis process, I developed a total of 15 factors that correlated to the categories, subcategories, and the initial themes from Sherry's model of game engagement. There were some factors that were repeated based on the category and initial

theme. Appendix F shows categories, subcategories, initial themes, and factors as well as an exemplar quote that best describes the data coded under that particular theme. There were no discrepant data; therefore, this did not impact data analysis.

The first category was titled developmental factors and included three subcategories social, emotional, and cognitive components in reference to Sherry's (2013) model of game engagement. This category produced three themes social influences, emotional influences, and execution function from Sherry's (2013) model of game engagement. This category also included three factors that were repeated to detail teacher perceived notions that supported the research questions.

The first theme was titled social influences and included two repeated factors to support RQ1 and RQ2. This theme applied to the data teachers perceived as social influences, contributing to the social subcategory of developmental factors. P3 and P5 quotes address the benefits and challenges related to the impact of social influences. The second theme was titled emotional influences and included two repeated factors to support RQ1 and RQ2. This theme applied to the data teachers perceived as emotional influences contributing to the emotional subcategory of developmental factors. P1 and P3 quotes support the benefits and challenges of emotional influences as they relate to emotional influences and how a student's mood can affect emotional development. The third theme was titled executive function and included two repeated factors to support RQ1 and RQ2. This theme applied to the data what teachers perceived as executive function contributing to the cognitive subcategory of developmental factors. Quotes from

P9 and P5 embody the benefits and challenges of executive function that relate to the cognitive needs of a student during game play.

The second category was titled game play motivations and included three subcategories; social, emotional, and intellectual components in reference to Sherry's (2013) model of game engagement. This category produced four themes; peer influences, intrinsic motivation, extrinsic motivation, and cognitive training paradigms from Sherry's (2013) model of game engagement.

The first theme was titled peer influences and included two factors. This theme applied to data what teachers perceived as peer influences contributing to the social subcategory of game play motivations. P2 and P7 quotes embodies the importance of peer influences of the social subcategory of game play motivations. The theme peer influences, includes a total of two factors, the factor competition will be repeated in category 3, which I will describe in detail in the results section. The second theme was titled intrinsic motivation and included two factors. This theme applied to data that teachers perceived as intrinsic motivation contributing to the emotional subcategory of game play motivations. To support the two factors P8's quote supported the first factor and P6's quote supported the second factor, which I will describe in detail in the results section. The third theme was titled extrinsic motivation included three factors. This theme applied to the data that teachers perceived as extrinsic motivation contributing to the emotional subcategory of game play motivations. P3, P8, and P4 quotes supported each factor and the importance of extrinsic motivation to the emotional subcategory of game play motivations. The theme extrinsic motivation, included a total of three factors, the

factor cognitive ability will be repeated in category 3, which I will describe in detail in the results section. The final theme cognitive paradigm training included one factor that targeted specific cognitive functions to enhance motivation to train students. This theme applied to data teachers perceived as cognitive paradigm training contributing to the intellectual subcategory of game play motivation. P4's quote exemplified the importance of cognitive paradigm training to the intellectual subcategory, which I will detail in the results section.

The final category was titled game attributes and included three subcategories; coplay, demands, and challenges in reference to Sherry's (2013) model of game engagement. This category produced three themes; coplay, game design, and game attributes from Sherry's (2013) model of game engagement. In this category the factor competition is repeated from category one to support a theme. Cognitive ability is also repeated from category two to support two different themes in this category, which I will describe in detail in the results section.

The first theme was titled coplay and included two factors. The factor competition used in category two was repeated to support this theme. This theme applied to data of how teachers perceived coplay contributing to the coplay subcategory of game attributes. P1 and P7 quotes represent the importance of coplay to support the coplay subcategory of game play motivations, which I will describe in detail in the results section. The second theme was titled game design and included one factor that represented the demands subcategory of game attributes. This theme applied to data on what teachers perceived about game design contributing to the demands subcategory of game attributes. A quote

from P9 gives insight to how the factor and subcategory support the theme, which I will describe in detail in the results section. The third theme was titled game attributes and included three factors. This theme applied to the data of how teachers perceived game attributes contributing to the challenges subcategory of game attributes. The factor cognitive ability was repeated for this theme as well. Quotes from P6, P8, and P6 supported each factor and the importance of game attributes in the challenges subcategory of game attributes, which I will describe in detail in the results section.

Evidence of Trustworthiness

Credibility

Merriam and Tisdell (2016) characterized credibility in qualitative research as how closely the research findings match facts. Merriam and Tisdell recommend using triangulation strategies, member checks, adequate engagement in data collection, discrepant case analysis, and peer review. There were no adjustments to the credibility strategies stated in Chapter 3. All interviews were recorded, and participants received verbatim transcripts as a member check. Triangulation was achieved by using reflective journaling and interviewing middle school teachers, special education teachers, and technology teachers in Grade 6 through 8 with different perspectives. The results section includes the description of the data. Throughout the interviews and transcribing, I maintain reflective journaling and began taking jotted notes in conjunction with the reflective notes. Reflective journaling was handwritten and included my thoughts on the interviews; development of descriptions to support themes to follow up on; and where participants put emphasis when describing their experiences with serious games to

support students with ADHD; along with jotted notes that were transferred over to a PowerPoint to help disaggregate the data in a visual format.

Transferability

There were no adjustments made to the transferability strategies stated in Chapter 3. Transferability is the ability of a different researcher to replicate the study findings (Merriam & Tisdell, 2016). During this stage I provided comprehensive and rich descriptions of the participants (i.e., grade level taught) and their setting (i.e., regional description) in my study on middle school teacher perceptions of the use of serious games for students with ADHD (see Merriam & Tisdell, 2016). Using purposeful sampling, I gathered all of the knowledge I needed to provide accurate explanations of the participants and their settings to the researchers reading my study.

Dependability

There were no adjustments made to the dependability strategies stated in Chapter 3. Ravitch and Carl (2016) described dependability as data that remains stable and consistent over time while answering RQs. Dependability is defined as data stability and is achieved through triangulation, detailed rationale for choices made, a sequencing of methods, and peer review (Ravitch & Carl, 2016). Triangulation occurred using multiple interviews. I recruited participants using specific inclusion criteria, collection of data during participant interviews using the same protocols and interpreted data through codebooks developed from the conceptual framework. Peer review of the interview questions occurred prior to interviews starting. I made certain that I followed my approach with participants in various settings to improve my research's dependability.

Confirmability

Confirmability necessitates that a qualitative researcher considers areas of bias while keeping in mind that one cannot be fully impartial during the study process (Ravitch & Carl, 2016). According to Ravitch and Carl (2016), confirmability is the equivalence of objectivity. I purposefully used the coding procedure in this study to ensure confirmability. I examined data through a single lens using my codebook derived from my conceptual framework. I used my personal lens as secondary to the knowledge and insights I acquired from coding as I examined my research through the conceptual framework. To ensure dependability and confirmability, I confirmed my results with the interview transcripts and data gathered during the coding process.

Results

In this section, I have organized the results by RQ based on Sherry's (2013) model of game engagement. For each RQ, I include the categories, the subcategories, the initial themes, and the factors that relate to the question. I will also include quotes from participants.

Research Question 1: Benefits

The first RQ was what are middle school teachers' perceptions regarding the benefits related to the use of digital serious games for students with ADHD? I asked teachers to reflect on using serious games to support students with ADHD. I used Sherry's (2013) model of game engagement to categorize the responses teachers shared during the semistructured interviews. There were three categories: developmental factors, game play motivations, and game/genre attributes, which included eight themes: social

influences, emotional influences, executive functions, peer influences, intrinsic motivation, cognitive training paradigms, coplay, and game design, which included a total of 11 factors (see Table 7).

Table 7

Initial Themes vs Factors (Benefits)

Theoretical category	Definition	Initial themes	Factors	# of participants	Participants who responded
DevSoc	Developmental (social)	Social influences	Social demands	8	P2, P3, P4, P6, P7, P8, P9, P10
DevEmo	Developmental (emotional)	Emotional influences	Emotional demands	8	P1, P3, P4, P5, P6, P7, P9, P10
DevCog	Developmental (cognitive)	Executive functions	Cognitive demands	8	P1, P2, P4, P5, P6, P7, P9, P10
GPMS	Game play motivation (social)	Peer influences	Competition	5	P1, P2, P4, P6, P8
			Camaraderie	4	P4, P5, P7, P9
GPME	Game play motivation (emotional)	Intrinsic motivation	Stimulation	6	P1, P3, P5, P6, P8, P9
			Confidence builder	5	P3, P4, P6, P7, P9
GPMI	Game play motivation (intellectual)	Cognitive training paradigms	Cognitive functions	8	P1, P3, P4, P6, P7, P8, P9, P10
GACP	Game attributes coplay	Coplay	Competition	4	P1, P4, P5, P8
			Motivation	4	P3, P6, P7, P9
GAD	Game attributes (demands)	Game design	Game elements	9	P2, P3, P4, P5, P6, P7, P8, P9, P10

Developmental Factors

The first category was titled developmental factors. Regarding the RQ, developmental factors are important because they give insight into the social, emotional, and cognitive elements that influence a student's ability to play games. For this category, there are three subcategories and three initial themes; social influences, emotional influences, and executive function that produced three factors (see Table 7).

Social Influences. Social influences included the factor social demands and showed how social motivations change as peer-to-peer influence increases, reflecting competition and encouragement to perform at the highest levels. However, the possibility of lost interest in the game may occur due to poor performance.

Social Demands. Social demands referred to learning occurring primarily in a social context, competition and motivation to perform at the greatest levels are encouraged. Teachers pointed out the importance of social context for serious games in the classroom and how these situations benefit students with ADHD. P4 stated that they observed students with ADHD, not necessarily wanting to play alone, but seeing the students wanting to play with other students. Teachers shared that students enjoyed games they can "win" as opposed to playing for the sake of playing. While, P9 stated "I've noticed with [students with] ADHD, I feel like the students want to play with others, but they also want to play by themselves because they want to be the winner." Both participants described the importance of winning and how the impact of social context of game play benefits students with ADHD, but whether the students play alone or together depends on the social demands of the student. P10 stated "if [the students] are

paired up, many of them prefer to work in pairs, although not too frequently." Teachers mentioned that students with ADHD enjoy working with other students and enjoy working in pairs which can be beneficial to the social aspect of gaming. P2 said "I've noticed that the kids show camaraderie, they show competitiveness but yet you'll also see levels of not self-sabotage, [but] levels of like defeat, if they don't get the correct answer." Whereas P3 also stated "the social aspect promotes teamwork, camaraderie, where they're not just sitting and listening to a direct or remote instruction. I think that benefits them and their communication aspects as well." P6 stated "I organize my students as a group so that they can work together to solve the problem...It encourages them to interact more with one another, ensuring that everyone receives the correct answer." P7 noticed that many times the students would gather and sit with one another to play games and work together which leads to the more advanced students assisting students who were less advanced than them. P8 mentioned that [the students] can pair and learn from each other successfully, although depending on the type of game will determine a student's peer or social level during gameplay. During some games, students with ADHD prefer to play alone, whereas some games require that they play with their peers. The participant responses showed that social context during game play benefits students socially, which can offer varying degrees of support for students with ADHD. However, the student's social demands are solely determined by their level of interaction as they progress through the game.

Emotional Influences. Emotional influences included the factor of emotional demands, which leads to a student's mood that can affect emotional development, particularly as they move through puberty (Sherry, 2013).

Emotional Demands. Emotional demands is the ability to produce and sustain an emotion as well as to reduce the intensity or frequency of an emotion (Tarle et al., 2019). Gaming has been used to help students with ADHD regulate their emotions. Teachers gave various examples of how emotional demands benefit students with ADHD. P1 stated that emotionally, serious games help to build student confidence and that playing helps the students with ADHD learn and strengthens their knowledge of the material because it is something they want to do. While P3 observed that in terms of emotions, students with ADHD tend to participate more when using serious games because it is a game and not the traditional form of learning. As a result, students are emotionally stimulated and more willing to complete the task, especially if they believe they have a chance of succeeding. Teachers shared that students are much more positive about the material they are learning and that this benefits students with ADHD. For example, P1 shared that games stimulate the students because it is something they enjoy. So, they enjoy playing, it makes them happy, and they want to do it. They want to learn which helps the students pay attention a little more than learning in a way that they do not quite like. P7 stated

> The [students] are actually excited, even more so when they get a correct answer. [The digital game] sends [the students] praise; you're awesome, and you're doing a good job. You can see the smiles on their faces, they're actually quiet during

> digital game time, and they're not being disruptive. They are happy and excited about getting on [the game], to learn, and also get a chance to enjoy themselves while playing the game.

P4 said "I find that [the students] are happier and that they tend to be more engaged in whatever the process is that we're doing." P6 shared "my [students] for the most part are highly engaged and they're into it, wanting to learn. Especially, the [students] with ADHD." P9 explained that students with ADHD are content when playing serious games, and that they are more focused on what they are doing within the game. Teachers believed this is why they do not really say much or show much emotion when they get the right answer, but more so when they get the wrong answer. The students tend to show more emotion when they get the wrong answer. P5 stated that the students are into the games and alluded to the student's excitement and how digital games ignite the lesson so much that the students with ADHD do not want to stop playing the game. As a result, the students' excitement to learn increased prompting engaged learning. Whereas P10 stated "overall a lot of [students] really enjoy [digital games]. [The students] like the challenge…the games are really stimulating and it almost over engages [students] in a way." The participant responses gave insight to how games are well suited to induce emotionally stimulating experiences and enhance learning to benefit students with ADHD during game play.

Executive Functions. Executive function included the factor cognitive demands based on intellectual abilities that can drive a shift in genre preference from simple children's games to complex intellectual challenges (Sherry, 2013).

Cognitive Demands. Cognitive demands include planning and organization, time management, working memory, and reaction inhibition which leads to how well a game aligns with the cognitive needs of the player, not too easy, not too difficult. Teachers provided a variety of examples of how cognitive demands benefit ADHD students. P6 stated that,

> depending on what they're working on, serious games help [the students] focus a little more. They are able to concentrate better than when working problems on a piece of paper because the game is moving and things are happening on the screen.

This benefits the students because it allows for the students to be more interactive with their learning. P1 stated that digital games

> allow for the words to be in front of them along with the audio. They can read it, they can pause it, they can do it on their own. [Most games] usually move at their own pace. So, the games help them learn because it goes at their own pace. It gives them time to think about the questions to work them out.

P4 stated that games are beneficial because the students

> …retain the content more, particularly if [the content] is boring, if it's vocabulary-based or something similar. I think that is when students play serious games, they are more likely to retain information, interact with the content more deeply, and possibly at a higher level.

P5 shared that serious games benefit students because

> They want to get to the next level and [serious games] will not let [the students] go on until they pass the current level. So, they end up having to solve the problems. They start having to think, and they have to do the work because they can't get back to the game without answering the questions.

P9 stated that "I believe that games give [the students] time to think. I believe they are more focused and more capable when they have time to themselves. I guess you could say they have more thinking time." While P7 mentioned that many students are at a lower level, but when they play games, the game sees them at their learning level. So, it gives the students a chance to feel like they own their learning, understand it, and know what they are doing when they play the game. P2 and P10 both referred to a tactile component to gaming that benefit students with ADHD cognitively. P2 stated that "I think it helps with their visual, I think it also helps with their tactile," whereas P10 stated that

> A lot of the ADHD students really benefit from using their hands. So, we try to include a hands-on tactile component to whatever games that we're using, where they'd have to put something together. I think it's important to find a game that allows you to have a balance between the two.

The participant responses showed that serious games benefit students with ADHD as gaming has been used to help improve the cognitive function of students with ADHD, but including a tactile component may also be beneficial to enhance student learning.

Game Play Motivations

The second category was titled game play motivations. In relation to the RQ, gameplay motivations are used to describe why students play games. Sherry (2013)

reported that social, emotional, and intellectual influences are part of gameplay motivation. For this category, there are three subcategories and three initial themes that support RQ; peer influences, intrinsic motivation, and cognitive training paradigms that produced five factors.

Peer Influences. Peer influences included the factors competition and camaraderie which is based on increased motivations to play games that others are playing while keeping up with the latest popular games as a means of social bonding (Sherry, 2013).

Competition. Teachers provided various examples of how competition is a motivational benefit for students with ADHD. P1 stated that,

> [If the students with ADHD] know that a friend or classmate is on a higher level within the game, they will want to get to the same level. [They think], 'I need to hurry and get to that level. I have to do this to get there.' And these are students that usually don't focus much. So, because they're challenged by their classmates on levels where the other one isn't, they may put a little bit more work into it. They want to strive to do the same thing.

P2, P4, and P6 observed an increase in student competitiveness during game play. As a result, the ADHD students' classmates motivated them to focus and progress to higher levels; the students were appreciative and happier when they felt confident in their understanding of the material; and the competition motivated students to want to play in order to learn. P8 stated,

> When students with ADHD compete, it helps them focus during game play, which socially motivates them to get the work done, and at the end of the week, I can tally up the modules completed to see who has the best scores, which motivates the students to play the games and learn at the same time.

Teachers discussed how competition in game play benefits students with ADHD because gaming progressively motivates students to want to be successful within the game while social bonding through friendly competition enables them to progress and learn in a creative manner.

Camaraderie. Teachers provided insight into how camaraderie, which fosters a sense of trust and goodwill among people who are closely associated with an activity or endeavor, can benefit students with ADHD in terms of motivation. P4 stated students with ADHD feel a lot more confident when they are really comfortable with the subject, and if they are the person everyone is turning to for the answer and people want them to be on their team, this gives them a sense of positivity. P5 stated,

> Students may be in the same world or level within the game where they play for points in order to win together. So, the students work collaboratively to find the answers, and they will wait until everyone is finished before proceeding. The students become connected to one another, and you'll notice them communicating throughout the room as they take part on their adventures together, building avatars, fighting monsters, and answering questions.

P7 and P9 shared that social motivation benefited students during game play by giving them a chance to sit with a friend, pair with friend, and get help by working together, even if they are working on an individual game that requires them to work or answer independently, and that gaming motivates students; when playing in a group, the game could help them focus more because they are able to be in a group environment. Teachers reported that camaraderie amongst students within game play demonstrated how students with ADHD collaborate with their peers and feel supported, as well as how camaraderie benefited students as they progressed through game play, allowing the students to learn and succeed.

Intrinsic Motivation. Intrinsic motivation included the factors stimulation and confidence builder, which detailed how intrinsic motivation is doing an activity for fun, pleasure, and satisfaction.

Stimulation. Teachers provided multiple references to stimulation in relation to intrinsic motivation which allows for action of arousing interest, enthusiasm, or excitement. P1 shared that it is their classmates who motivate the students with ADHD, and this stimulates them to focus a little bit more and be successful during game play, as well as move up to higher levels within the game. P3 mentioned that students perked up while playing games. When a game is introduced, the students become even more excited because they immediately think that they are not learning, so they will want to play again. The students believe they are not actually required to do any work because they are playing a game. So, the motivation increases because gaming is something that the students are interested in. P6 stated,

> The stimulation level is high because the students are given the opportunity to try again based on the games. The students have the opportunity to play the game over and over again. As a result, the level of confidence is very high. I believe it is higher during game play than on a test.

P8 shared that when the students can relate the digital game to the games that they play at home, such as Minecraft, the games seem to stimulate the students to want to play and therefore learn in a fun and innovative way. As a result, stimulating students with ADHD to play serious digital games. Whereas P9 explained that some students relate to the game and that the stimulation to play is dependent on the game's text or subject matter, some students are more motivated to play certain games based on these circumstances. Teachers shared giving the students the option to choose during game play can stimulate students to play. P5 stated,

> When [the student] can choose whatever level [they] want to go to; [the student] can go to whatever land [they] want to go to with whatever avatar [they] want to choose. The student can choose to work alone or play with other players. They can spend their points on whatever they want to improve their skill levels, get weapons, and win powerups. When the students have the autonomy to choose they become motivated to play.

This gives them the autonomy needed to stimulate them to play the games, which is important.

Confidence Builder. As students make progress through gameplay in digital serious games, teachers provided insight into how intrinsic motivation builds confidence and a feeling of self-assurance from an appreciation of their abilities or qualities. P3 explained that once a student understands what they are doing, they become fully engaged in the game. The students take on the game, the challenge, and say, "Okay, I got this." The students will play the game till it becomes second nature. So, the mechanics of the game will probably become second nature which builds confidence for the students to want to play. P4 also stated,

> The more confident [students] are about their understanding of the material, the more they're going to enjoy the game and the process. I think they're pretty motivated by any kind of game play. I think that it's intrinsically motivating for students.

P6 noticed that during serious digital gaming, students feel emotionally confident and good about themselves because, in a sense, gaming is unreal, which means they can try over and over without getting discouraged, and if the student gets the answer wrong, it's okay because they can always try again. P7 believed game play instilled confidence in the students, as evidenced by the smiles on their faces and the words, "Yes, I got it right." Especially when a notification arrives stating that the students have mastered the objective. The praise given during game play motivates students to keep going as they accomplish their goals. As a result, the game continues to motivate, encourage, and reassure them that they are doing well. P9 stated "I believe game play gives [students] the confidence they need to complete the work and focus more as they move through the

game. I also believe it's boosting their confidence and showing the students that they can do it." Teachers provided numerous examples of how game play intrinsically motivates and builds students' confidence as they progress through the game to learn. According to participant responses, praise within the game as well as from peers and teachers motivates them to continue playing and learning which builds confidence.

Cognitive Training Paradigms. Cognitive training paradigms are a form of guided practice treatment that focus on tasks that target specific cognitive functions, such as memory, attention, or problem-solving, which have started to integrate serious game techniques to enhance motivation to train students (Boendermaker et al., 2018). There was only one factor in this section, cognitive functions that benefit students with ADHD which may increase learning through gaming.

Cognitive Functions. Teachers provided various examples of how cognitive functions benefit students with ADHD through game play motivations. P1 shared that because students want to play, they will focus more so that they can advance a level. In terms of reading, memory, and attention, as well as problem-solving, the game assists students as it reads to them, it is flashy, brightly colored, and the music assists them with their attention to keep them focused as well as retain information to be able to problem solve to get the correct answers as they play. P3 stated,

> I believe that with more repetition, because this isn't just notes, it's actually playing a game and doing an activity with an objective with a goal in mind, they have to focus on a task and they're more likely to hone in on the objective if there is an endgame. I think that the repetition is

> going to help with their memory as well, because now they know that [they're] playing a game, but to be successful within the game [they] have to work the problems.

P4 believed that students simply retained the material better through gameplay, which resulted in better retention. P6 mentioned that as far as attention, game play is going to keep them focused. Game play keeps the students engaged as far as memory and retaining information, although gaming can seem to be a quick fix to learning. P7 stated,

> I've noticed that when they're doing something enjoyable, such as playing a game, they seem to retain or remember the information. As a result, even during our regular class time, I try to incorporate new activities to keep them interested.

So, teachers reported that when students are gaming, they appear to be having fun and playing games, but that they feel that students are actually learning. P8 explained that students with ADHD have busy minds. However, when they are playing games, their memory is good because they are doing something they enjoy and feel like they are playing a regular game rather than a serious game. As a result, the students remember because they know they need to learn the concept in order to proceed to the next level of the game. Basically, in order for students to be successful during game play, they must understand the content. It is not enough to be focused; you must also understand the material. P9 stated that "game play benefits [students] in my opinion because it demonstrates that they remember more than they think and know more about the subject

than they thought. The students began to retain a lot of information as they play." P10 stated,

> I believe that learning through game play has great potential. I believe the games benefit all of the [students]. However, you know, it can't be used all of the time. There must be some level of direct instruction to provide context for the lesson.

Teachers acknowledged that the gaming component could be used to supplement their learning. Perhaps not as much as an engaged part where they're discovering, which can cause the students to stay engaged throughout a long lesson and provide opportunities for them to be challenged with possibly more complicated material rather than just a worksheet. Teachers also shared that although gaming supports cognitive function the students still need to learn the material in class in order to be successful within the game.

Game/Genre Attributes

The third category was titled game/genre attributes. Concerning the RQ, game/genre attributes are part of the framework that shows *what* students play can benefit or be examined as part of the game engagement. For this category, there are three subcategories and two initial themes that support RQ; coplay and game design that produced three factors.

Coplay. Coplay is the aspect of playing games with peer groups and competing with others to maintain relationships. In this section there are two factors that benefit coplay in relation to game/genre attributes.

Competition. The teachers provided insight on how the competition elements within the game benefit students during game play to help maintain relationships and learning. P1 shared that when students can play with their classmates, I believe this is the most beneficial game element that supports learning in digital serious games. When students have the option to battle their classmates while maintaining relationships, they are more likely to learn. P4 stated,

> I'd like [the students] to do the team [games] because, even if they're not super confident, there's that sort of peer pressure to answer the question, and there's usually someone in the group who can help keep everybody on track and make sure everybody's paying attention to when they have the right answer

P5 explained when students are in the game and are all in the same universe working together, students who would never even talk to each other start working together as they progressed through the game. P5 said they can hear the students discussing which level they are own and then engaging with each other in the game, whether they are on the same team or competing to win the level. Teachers observed students interacting socially through game play, which could lead to improved learning through friendly competition. P8 mentioned competition as the most specific game element that has shown to be particularly effective with students with ADHD. The element of competition in the game keeps them coming back.

Motivation. Teachers provided insight into how motivation determined if a player will continue playing. Teachers shared that computer-based games were found to be

particularly successful with students with ADHD, because they can focus on a screen with a visual that is clear cut and set up for success. P3 stated,

> One important tool within game play is the element of instant feedback to let them know how well they're doing. I believe that identifier is very useful and motivating for students to know, 'OK, I'm doing well here. If I make a mistake, it's not the end of the world.

Whereas P7 stated that "the most important game element that I find beneficial is the engaging lessons that allow students to have fun while playing games while still learning." The benefit is that the student gets to play a game based on what they learned. P6 mentioned that game play helps students to slow down and really learn to concentrate, which motivates them to stop depending on the fact that they have ADHD and that they can get the work done just like the other students in the class which benefits students and helps build their confidence. P9 stated "I feel like a lot of the games are really competitive and the students like to win. So, when they see their scores as they play the game, it motivates the students to want to continue to play." Teachers shared that during game play, students may say, "If I just go a little bit further, or if I just get one more question, I can win." Therefore, motivating the students and helping them to focus more on the questions.

Game Design. Game design relates to graphics, how students move and interact within the game, content, or other players. In this section, there is one factor: game elements. Where the game attributes and student engagement show how these elements benefit student learning.

Game Elements. Game elements, such as points, badges, leaderboards, performance gaps, and instant feedback, are important game attributes for digital serious game design. P7 stated that the game elements that benefit students with ADHD included "the animation, the different colors, and the excitement as they progress through the levels. Most importantly the game begins with the students at their current level of learning and progresses with them as they play." Meanwhile P3 shared that game elements such as time where games are quick to win, have a social aspect where they can communicate and chat, and give instant feedback, or if you can combine any of these things, the students will be more invested in the game.

Teachers believed that when students can easily obtain instant feedback and communicate with one another, it is beneficial during game play, especially if the game's goal is clear, the instructions are clear and concise, and they can communicate with one another. P4 stated "the game element of repeating the concept over and over again throughout the game gives the students a lot of confidence." P5 mentioned that the game's points, graphics, characters, and sense of teamwork correspond to elements of video games that the students primarily play at home, and that they are relatable. As a result, the game elements give students a sense of progress and rewards as they advance, to which they can relate. P6 stated that

> To keep them interested, the questions must be brief. There can be a lot of movement within the game, but it's not overly complicated, and everything on the screen makes sense. Those are the things that I believe are beneficial.

Teachers reported that students would benefit from short questions followed by not much happening on the screen but just enough to keep their minds occupied. P8 shared that the points, colors, and characters within the game make the game enjoyable for students. The students can buy levels, create characters, and progress through the game to learn. P2 stated that

> Learning through games is highly beneficial for [students with ADHD] because, from what I've seen, the majority of these students are kinesthetic and tactile learners. As a result, the game's visual aspect usually aids their visual learning, allowing the student to focus more on the content.

P9 stated that "I feel like game play benefits them because…they're able to have some brain time to think as the students' progress through the game." P10 stated that

> Game elements such as visual preferences should be nothing too busy for students with ADHD. If there's too much going on the screen, it's not helpful at all, but it can't be drab either. So, the game definitely has to be well designed and aesthetically pleasing, but not just a bunch of random stuff being displayed on the screen.

The game elements that the participants presented indicated that in order for students with ADHD to learn effectively, both the game's design and its component parts must be beneficial to the students.

Research Question 2: Challenges

The second RQ was what are middle school teachers' perceptions regarding the challenges related to the use of digital serious games for students with ADHD? I asked teachers to reflect on their challenges when using serious games to support students with ADHD. I used Sherry's (2013) model of game engagement to categorize the responses teachers shared during the semistructured interviews. There were three categories: developmental factors, game play motivations, and game/genre attributes, which included five themes: social influences, emotional influences, cognitive influences, extrinsic motivation, and game attributes, which included a total of nine factors. See Table 8.

Table 8

Initial Themes vs Factors (Challenges)

Theoretical category	Definition	Initial themes	Factors	# of participants	Participant who responded
DevSoc	Developmental (social)	Social influences	Social demands	5	P1, P4, P5, P6, P8
DevEmo	Developmental (emotional)	Emotional influences	Emotional demands	7	P2, P3, P4, P5, P6, P7, P10
DevCog	Developmental (cognitive)	Executive functions	Cognitive demands	6	P1, P3, P5, P6, P7, P10
GPME	Game play motivation (emotional)	External motivation	Lack of engagement	5	P1, P3, P4, P5, P6
			Lack of stimulation	5	P2, P4, P6, P8, P10
			Cognitive ability	5	P4, P5, P7, P8, P10 *P9-No known challenges
GAC	Game attributes (challenges)	Game attributes	Cognitive ability	5	P1, P3, P4, P6, P9
			Game attributes	8	P1, P2, P3, P4, P5, P8, P9, P10
			Unengaged	5	P1, P4, P6, P9, P10 *P7-No known challenges

Developmental Factors

The first category was titled developmental factors. In relation to the RQ, developmental factors give insight to the mixture of challenges that social, emotional, and cognitive elements influence a student's ability to play games. For this category, there are

three subcategories and three initial themes; social influences, emotional influences, and executive function that produced three factors. See Table 8.

Social Influences. Despite the fact that social influences included the factor social demands and demonstrated how social motivations change as peer-to-peer influence grows, reflecting competition and encouragement to perform at the highest levels, challenges due to poor performance may provide a loss of interest in playing the game.

Social Demands. Social demands refer to learning that takes place primarily in a social setting, where competition and motivation to perform at the highest levels are encouraged. Teachers, on the other hand, provided a variety of examples of how challenges affect the social climate in their classrooms in relation to serious game use for students with ADHD. P6 stated that,

> When working in groups, one challenge I've observed is that if students are not asked to participate in the group, they will become distracted from time to time. They'll get off track. Especially if you don't have a system in place, they can get distracted and start doing something completely different.

P1 indicated that if there are any peer distractions within the classroom during gameplay, the students cannot focus on what they are supposed to be doing in front of them and they get off task. Teachers stated that in this situation, the student with ADHD will be doing something completely different and unfocused, so you must find a way to keep them engaged with the group. P5 stated that,

> The majority of serious games are independent-focused, so if [the students] are stuck in the game alone and haven't progressed past the initial levels or sections and keep receiving low scores, they lose interest because there isn't any enjoyable peer interaction.

It is challenging because no one is available to assist them, and a teacher may be unavailable to approach each individual and help. P4 stated that socially, "I think the biggest challenge is to transition from gameplay to returning to a more traditional learning environment." Teachers shared that students tend to struggle when games are very high-energy, a little chaotic, and super exciting while playing with their peers, and then having to come back down and play something unrelated to games. As a result, the high energy of the digital games makes it hard for the students to return to learning activities that are not related to games. Whereas P8 stated that some students with ADHD "just don't want to play with each other during gameplay activities. The students may have 'bad energy' with each other—if you will—so that can be challenging leading the students to become apprehensive about playing." The participant responses shed light on how a student with ADHD may find it difficult to adjust to the social demands of a serious game's social context.

Emotional Influences. In this section, the emotional influences challenges included the factor of emotional demands, which leads to a student's mood that can affect emotional development, particularly as they progress through puberty (Sherry, 2013).

Emotional Demands. Emotion regulation is the capacity to elicit and maintain an emotion as well as to lessen its intensity or frequency. This section addresses the

challenges of emotional demands. Teachers provided a variety of examples from their classrooms of the difficulties associated with the emotional demands of serious games and how emotion regulation affects their classrooms. P2 stated that "once you get [students] moving and involved in the game, their self-esteem increases, but they will not get involved at first," whereas P4 stated that "once you get [students] moving, transitioning back to traditional learning after the end of gameplay can also cause students to become stressed, anxious, or angry." Teachers also reported there could be shutdowns when there is frustration from that point, which sometimes leads to a student not participating because they do not understand. For example, P3 shared there could be frustrations with not being able to follow the instructions of the game, not being able to complete the task at hand because the students are focused on the game part, not the learning part. Students with ADHD tend to shut down while playing if they do not understand the concepts in the game. According to P5,

> Students with ADHD shutdown because they didn't want to be embarrassed to ask questions as they progressed through the game. They get very emotional about it. As a result, if you do not assist the students or their peers, they will not complete the levels in the game because they do not want to be embarrassed.

While P6 stated that "by not knowing what to do, struggling to get it right, and not being engaged, frustration is probably the only thing I've noticed." Teachers have stated that this could result in them having temper tantrums because they are frustrated because the

students do not understand the subject matter in the game. Some teachers addressed issues around cheating being an emotionally challenging element of using serious games with students with ADHD. P4 stated "the only time I've ever seen something that I would consider negative is if they suspected someone of cheating. If [the students] witness someone cheating, it stresses them out." P10 also stated what I've observed is that a lot of them will try to cheat to beat someone." Teachers stated that cheating causes the students to become angry or anxious during gameplay because they are trying to beat their peers. This can be a challenge within itself because the students are trying to find the answer without comprehending the actual content material. P7 stated that,

> You can tell in their faces if they don't get the question correct. You see disappointment, but it is only because they didn't get the question right and although you can see the disappointment in their faces, they continue to go. They never complain and never give up. They continue to work on the program.

The participant responses gave insight into the emotion regulation of students with ADHD and the challenges they have witnessed during gameplay.

Executive Functions. Executive function challenges, which include cognitive demands, will have an impact on intellectual abilities, potentially leading to a shift in genre preference from simple children's games to complex intellectual challenges (Sherry, 2013).

Cognitive Demands. In this section, cognitive demands are discussed, which include the challenges that affect planning and organization, time management, working

memory, and reaction inhibition, which lead to how well a game aligns with the cognitive needs of the player; not too easy, not too difficult. P1 shared students with ADHD are prone to becoming distracted while playing serious digital games. The students still want to know what is going on in class, or a noise or something catches their attention, and they cannot focus on the concept in front of them. The participant also mentioned that depending on the program and how it operates, the students might not be able to sit still long enough before becoming antsy. They will become distracted unless something within the game grabs their attention. Teachers also stated another challenge would be for teachers to select focused topics that support students' learning rather than simply allowing students to play at lower levels of the game. P3 stated that,

> The challenge I see is actually following the instructions. Being able to follow the instructions is going to affect their cognitive ability to execute the task within the game. They're excited about playing a game, but cognitively, if they cannot get past the instructions, then they are not going to be able to perform the activities at hand. So, I think that would affect their cognitive ability, with their attention and focus.

P5 and P7, on the other hand, stated that students begin to shut down when they do not understand the game's content or learning objective. The game is moving so fast that the students are struggling to keep up. The students do not comprehend enough of the game's content to be successful, and they struggle with the game's comprehension component. P6 stated that "the biggest problem I see is not retaining information. [Students with] ADHD have a hard time retaining information because it's more fun [for them], but they

don't really retain a lot of information." During gaming, the students are not always repeating concepts; it may be something different every time leading the students to not necessarily retain the information. P10 stated,

> Students with ADHD may have a lot of impulsive responses to the game while gaming, even if they are fully capable of doing whatever is required. If it requires a lot of executive function, they will resort to doing anything to get to the next step, such as using Google to find an answer.

If a student is having difficulty progressing to the next level, they may simply quit. According to participant responses, students with ADHD may face cognitive function challenges as they progress through gaming, affecting planning and organization, time management, working memory, and reaction inhibition.

Game Play Motivations

The second category was titled game play motivations. In relation to the RQ, gameplay motivations are used to describe why students play games. In this section, I will discuss the challenges of social, emotional, and intellectual influences that are part of gameplay motivation. For this category, there is one challenge with one subcategory and one initial theme that support the RQ; extrinsic motivation that produced three factors.

Extrinsic Motivation. Extrinsic motivation refers to performing an activity, not for the pleasure gained from the activity (Osman & Cirak, 2020). In this section, the participants give examples of how extrinsic motivation affects students with ADHD as they move through game play to learn. P9 had no known challenges in reference to extrinsic motivation to support this study.

Lack of Engagement. Lack of engagement in this section refers to students' not being immersed in game play and the challenges students with ADHD face during game play. P1 stated that,

> It can be challenging to keep these students entertained at times because they have ADHD. Additionally, students with ADHD often prefer to work alone or refuse to participate in the games. Some students dislike playing because it requires them to sit still. They do not want to sit and play the game. So that is one of the challenges I see with games.

Whereas P3 stated that "the most common challenge is that students with ADHD do not always get along during game play, which leads to students not being motivated enough to engage in the game to effectively learn." P4 mentioned that when students with ADHD are playing peer games such as Quizlet, where the game has a random selection of who is in what group, they feel as if that is unfair, but also if they do not answer the question quickly, or they did not get a chance to log in as fast as somebody else, or they were hitting their button and they did not feel like it was taking their response. All of these circumstances can be a challenge, especially when things are perceived as being unfair, which leads to a lack of engagement during game play. P5 reported that if the students keep getting the wrong answer, they will become frustrated and being to jump from concept to concept or world to world within the game. Teachers shared that the students become tired of getting the wrong answer, which shuts the students down, they lose interest, and are no longer engaged in the game. P6 stated that,

> A challenge you're going to face is the students getting bored. If there are two people playing and the game is repetitive, they'll lose focus and start to focus on something else. It depends on what [game] they're playing. If they're with their peers, you have to be very careful. Because if they have peers who aren't helping them work out, learn, and solve whatever problem they're working on in the game, they'll drift off into their own world and lose focus.

According to participants, learning can be challenging in different aspects during game play, resulting in a student's lack of engagement and enjoyment from gaming.

Lack of Stimulation. Lack of stimulation in this section relates to students having no arousing interest, enthusiasm, or excitement during game play. P2 and P6 shared that when students with ADHD get the wrong answer during a game, they isolate themselves once they realize they made a mistake, especially if they continue to get the wrong answer, which may lead to them wanting to quit playing, but the majority of students will continue to play; they will just lose interest in the game and will just go through the motions of playing. Leading students to possibly become disappointed in themselves rather than angry when they get the answer wrong during game play. P4stated "I believe their perception of things being unfair within the game is the most significant challenge I've noticed as a struggle with something not going as planned… [the students] become fixated on whatever they perceive to be unfair." Which also leads to students losing interest for the game. P8 mentioned that during game play, students with ADHD tend to give up easily when they are losing, they will just quit. P10 stated that,

> Stimulation during game play really depends on the level of the game and their interest in the subject and how long it takes to do it…because they get bored pretty easily, especially if it's kind of repetitive. If they believe they're capable, if the challenge is just right, they'll get bored with it and figure it out right away.

The participants gave examples of how students with ADHD experience a lack of stimulation and how these challenges arise during game play.

Cognitive Ability. Cognitive ability in this section evaluates the challenges teacher perceive to affect student learning in relation to game play motivations as a result of their reasoning or thinking, processing speeds, and one's ability to solve problems. P4 stated,

> I think if the game isn't going along fast enough or the questions are really wordy and they have to do a ton of reading. I think the students might lose a little bit of interest. I don't think they get the benefits of the game when it's too long, it's too complicated, or there are too many parts to a question. I think those are all times when students with ADHD struggle more.

While P5 felt that the time required to solve the problems is a challenge because [the students] want to get to the video game part, but would not put in the effort to do the work to solve the problem. So, the students need to work out the problems and do them on paper, but they feel that this process takes too long. Teachers believed that if students took the time to answer the questions correctly, they would be successful; however,

students would become stuck or trapped on the same question because they were trying to answer the questions in their heads rather than working the problem out on paper. The challenge for the teacher then becomes to push them cognitively to get them started. P7 stated that "the only challenge that I can think of is that some students' disabilities are more severe and they may not have the cognitive ability to understand the content within the game and struggle to process the information." P8 stated that,

> Students will not remember the information simply because they are repeating the same concept within the game. As a teacher, you must ask yourself whether the students are basically doing the work because they know what to do next or whether they are truly retaining the information.

Teachers stated they are often left wondering if the students learned anything after they stopped playing the game. Another issue that teachers reported was that most ADHD students preferred to complete their work quickly rather than reading the questions, using strategies, and taking their time. P10 stated that "if [the game] is too challenging cognitively, it will quickly shut them down. So, knowing your students and ensuring they understand the concepts is key, and there is no one-size-fits-all solution." As a result, the teacher's job becomes even more complicated when choosing games to support learning.

Game or Genre Attributes

The third category was titled game or genre attributes. In relation to the RQ, game or genre attribute challenges shows *what* students play can be examined as part of the game engagement. For this category, there is one challenge with one subcategory and one initial theme that support the RQ; extrinsic motivation that produced three factors.

Game Attributes. Game attributes are game structure features and characteristics that are likely to initiate and maintain interest in gaming activities, whereas game elements are a set of tools shared by games (Nadolny et al., 2017). Teachers discussed the challenges of the game attributes within game play in this section. P7 had no known challenges in terms of game attributes to support this study.

Cognitive Ability. Cognitive ability in this section referred to how game attributes challenge student learning in relation to the features and characteristics to initiate and maintain interest in gaming activities. According to P1, "when students are unfamiliar with the game or the material, they do not fully comprehend it, or perhaps they do not recall reviewing the material prior to playing the game becomes a huge challenge." P3 stated that,

> When students with ADHD have to rely on someone else to win, it can be a challenge, especially if they want to go at their own pace, which may be a million miles per hour, or if it takes them a little longer to solve the questions.

P4 mentioned that it can be difficult when there are multiple sections, the instructions are unclear, or there is more than one question on a page. Especially if there are multiple questions on a page that are paced by the teacher rather than the student. Teachers reported that when games are set up by time students struggle with having to reread the question multiple times because they just were not tracking it well. Teachers also shared that in this scenario the students get farther behind because they do not answer quite as quickly. Even if they knew the answer, the students may be under too much pressure to

answer the question on time. P6 stated that "students with ADHD tend to suffer during game play when the problems are too complicated and not simple enough for them to break down, because cognitively, they cannot successfully answer the questions as they progress through the game." P9 stated that,

> Everybody doesn't read or process information at the same speed. So, I try to give them time but I also feel like when we are playing the game, it does get intense. I feel like other students around students with ADHD could be a little distracting...which could interfere a lot, especially if their peers have already answered the question and they're still struggling to focus in on what the questions are asking in the game.

Teachers provided numerous examples of difficulties encountered in relation to game attributes and cognitive ability, as well as how the features and characteristics required to initiate and maintain interest in gaming activities can be difficult for students with ADHD and have an impact on their cognitive ability.

Game Attributes. Game attributes influence the features and characteristics of the game, which keep students interested. Although in this section teacher perceptions of the challenges that affect game play in reference to game attributes will be discussed. P1 reported that the game programs must include specific instructions for the students to understand; too much content at once without a break within the game can lose the students' interest; and too many questions can also lose the students' interest. As a result, game play should reflect how their brain works, such as small amounts of material followed by small amounts of play throughout

the game design. P2 and P4 agreed with P9 on the time component during gaming, sharing that the wording, answer, and time limit are all game attributes that affect a student's performance within a game, with time being a huge challenge for students with ADHD during game play. If the students do not respond to the question quickly enough during the game, they may fall further behind as the game progresses. Furthermore, because not everyone reads at the same pace, time constraints can be the most difficult challenge for students with ADHD.

Teachers mentioned that if you do not give students enough time to process the questions in their mind first and then look at the actual answers the students can struggle. So even if the students knew the answer by the time they processed the concept to answer, the game moves on leaving the student under too much pressure to answer. P3, on the other hand, mentioned that another challenge would be if it took a long time to get into the game. For example, before the students can play the game, teachers have found that students might be excited and ready to play, but their excitement is diminished if teachers spend too much time explaining the rules and concepts when all the students want to do is get in and play. P10 stated that,

> Another challenge with the design would be to ensure the students are not fixated on one spot for too long, but make sure the content is not so quick to the point where it just feels like the students click out of the room. So, I would say a 10- or 15-minute task would be ideal, but not too quick of a

> task, maybe not too challenging, or too long. If so, you'll lose their attention.

Whereas P5 stated that "when there is no video game element and it's more of an interactive worksheet, like Mathia or Edgenuity, and a speaker comes into the video to teach, it becomes more of a virtual classroom than a game." Teachers shared if the game does not allow for interactive independence, it can be a significant challenge for students with ADHD. While P8 stated that "I believe a lot of students with ADHD lose interest because they don't like a lot of busy stuff on the computer. If it's moving too much, the students will shut down and don't want to do it anymore because they can't focus." There's too much movement, which can be overstimulating. Teachers discussed the challenges that students with ADHD face in relation to game attributes and how these attributes affect their learning.

Unengaged. Unengaged refers to students who are not occupied or engaged during game play, and participants in this section provide insight into how this component affects student learning. P1 shared that some game features were not always self-explanatory, and students with ADHD do not have the patience to sit down and try to figure it out for long periods of time. So, the students would become frustrated because they did not understand how to play the game, and then they would shutdown because they did not understand the game itself. Teachers indicated that students would become frustrated and want to move on to something else after becoming frustrated. P4 stated that "I believe that if students with ADHD do not feel heard or matched with a good partner, they will become disengaged from the game, which can be a significant challenge." P6

indicated that "if the game is not quick and easy, you will see students with ADHD pull back and become unengaged during game play." P9 stated,

> Students with ADHD worry that the person next to them will get the answer faster, or they may be at the five-second mark with only have five seconds left, and they still have no answer. As a result, being unable to respond quickly may cause the student to become unengaged.

P10 mentioned the reading component as a major game element within the game that can cause an issue for students with ADHD during game play, which also could lead to wrong answers, which causes frustration and can turn the students off immediately. Teachers reported that students become disengaged during game play, but it is usually a game component that causes students to lose focus, become frustrated, and feel the need to quit the game.

Summary

In Chapter 4, I discussed the setting of the study and the demographics of interviewed participants, procedures for data collection, including issues of trustworthiness. This chapter focused on analyzing data and reporting results. Finally, I reported on the 15 factors derived from data based on the categories, subcategories, and the initial themes from Sherry's model of game engagement (2013). The key findings for the study were based on the two RQs and the categories, subcategories, and the initial themes from Sherry's model of game engagement (2013). Based on the data, the key findings for RQ1 were that middle school teachers found digital serious games to be beneficial for learning to support students with ADHD because:

1. the social aspect promotes teamwork and camaraderie
2. the emotional aspect helps build student confidence while retaining information
3. the competitive aspect improves student motivation
4. the game element aspect provides a safe place for repetition with instant feedback and progress that moves with their ability

Participants stated that the social aspect encourages teamwork and camaraderie in an environment where they are not just sitting and listening to direct or remote instruction. Participants stated that playing serious games helps students with ADHD learn and strengthen their knowledge of the material because it is something they want to do. Participants perceived students to be more likely to retain information, interact with the content more deeply, and possibly at a higher level. Participants thought that increased student competitiveness during game play was inevitable; that competition motivated students to want to play in order to learn; and that the gaming component could be used to supplement their learning. Participants stated that the game starts with the students at their current level of learning and progresses with them as they play, allowing them to receive instant feedback and communicate with one another.

Based on the data, the key findings for RQ2 were that middle school teachers found digital serious games to be challenging for students with ADHD because:

1. socially, students are distracted by their peers

2. emotionally, students have anxiety if they do not understand the concepts in the game and frustration causes them to shut down, or they have anger caused by cheating or feeling that things are not fair within the game
3. cognitively, students have difficulty reading instructions, and will lose motivation if they do not progress
4. game attribute related to complicated structure or inflexible time limits influence a student's performance and engagement with a game.

Participants stated that students with ADHD tend to shut down while playing if they do not understand the concepts in the game, resulting in the students searching for the answer without understanding the actual content material. Participants stated that students may lack the cognitive ability to comprehend the game's content and struggle to process the information. According to participants the time limit affects a student's performance within a game for students with ADHD during game play if there are multiple sections, the instructions are unclear, or there is more than one question on a page.

In Chapter 5, I will address the interpretation of the results, limitations of the study, recommendations for future research, and implications.

Chapter 5: Implications, Recommendations, and Conclusions

The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. I conducted this study due to limited research in the area of middle school teachers Grades 6 through 8 used digital serious games for students with ADHD.

The study results showed that teachers used digital serious games for diverse types of learners and felt that digital serious games both benefitted and posed challenges when implemented by middle school teachers to support students with ADHD. Based on the data, the key findings for RQ1 were that middle school teachers found digital serious games to be beneficial for learning to support students with ADHD because:

1. the social aspect promotes teamwork and camaraderie
2. the emotional aspect helps build student confidence while retaining information
3. the competitive aspect improves student motivation
4. the game element aspect provides a safe place for repetition with instant feedback and progress that moves with their ability

Based on the data, the key findings for RQ2 were that middle school teachers found digital serious games to be challenging for students with ADHD because:

1. socially, students are distracted by their peers
2. emotionally, students have anxiety if they do not understand the concepts in the game and frustration causes them to shut down, or they have anger caused by cheating or feeling that things are not fair within the game

3. cognitively, students have difficulty reading instructions, and will lose motivation if they do not progress
4. game attribute related to complicated structure or inflexible time limits influence a student's performance and engagement with a game.

Chapter 5 consists of an interpretation of the findings, limitations of the study, recommendation for practice, implications, and conclusion.

Interpretations of the Findings

Next, I will talk about how the study findings confirm, disconfirm, or extend what is known in the literature. I organized the discussion by the two research questions and the associated key findings which are described in context of the conceptual framework.

Research Question 1: Benefits

Teachers in this study reported that one benefit for students with ADHD playing serious games was that the social aspect promotes teamwork and camaraderie. The data in this study confirmed Hakimirad et al.'s (2019) findings in that social skills include teamwork, commitment, self-control, assertiveness, and sub-scale behavioral disorders involving intrinsic, extrinsic, and hyperactivity. The data also confirmed the studies completed by Mikami et al., (2017), Osman and Cirak (2020), and Zheng et al. (2021). The study was an extension of the results from Omegna (2020), where 13 middle school teachers shared the importance that higher-level or serious games encouraged critical thought, teamwork, and cooperation to come to an objective resolution. My study extended Ang et al.'s (2017) findings that a game-based approach gives children many

opportunities to develop and practice social skills before being tested in real-life situations. Teachers in my study reported that a second benefit for students with ADHD playing serious games was that the emotional aspect builds student confidence while retaining information. Results showed that teachers perceived that serious games create motivational and emotional benefits for students in middle school between the ages of 11 to 13 with ADHD, which confirms the findings from Camilleri and Camilleri (2019) and Osman and Cirak (2020). Fleming et al. (2017) found that high quality computer games have been shown to increase concentration and improve the retention of information while facilitating behavioral changes, which my study extended to apply to students with ADHD.

The data from my study showed that digital serious games help to build student confidence and emotionally stimulate students with ADHD to complete the task during gaming. That is an extension of Dang and Koedinger's (2019) study, in which they found that a student's ability to regulate thoughts, emotions, and behaviors link to their task-specific motivational goals and dispositions during gaming. Calinoiu (2019) reported similar findings that exploration of the gamer's control influenced their actions and aim to achieve both motivational and satisfying results during game play. Teachers in this study reported that a third benefit for students with ADHD playing serious games the competitive aspect improves student motivation. Similar results were reported by Huizenga et al. (2017) showing that teachers believed that teaching with games (a) engaged their students, (b) motivated students to learn, (c) influenced learning outcomes, and (d) used the competition to promote engagement. This study also confirmed Sailer et

al. (2017) that the competition caused by leaderboards can create social pressure to increase the player's engagement level, positively affecting participation and learning with students that have ADHD. The data within this study were an extension of Parong et al. (2017) which confirmed that playing a custom-made game that focuses on a specific executive function skill for sufficient time at an appropriate level of challenge helps students improve EF skills of shifting between competing tasks. The findings of this study backed up the importance of the competitive aspect improves student motivation, confirming the findings of Sun and Hsieh (2018), which showed that introducing fun, interactive, competitive, and novel elements helped improve students' intrinsic motivation levels, overall engagement, emotional engagement, and focused attention.

Teachers in this study also reported that a final benefit for students with ADHD playing serious games was that the game element aspect provides a safe place for repetition with instant feedback and progress that moves with their ability. Teachers in this study, similar to the findings of Lameras et al. (2017), felt that it was important that the pedagogy and story should be aligned with distinguishing features of an educational game, thus encouraging motivation and engagement in-game learning activities, content acquisition, feedback, evaluation, and reflection in a specific academic domain. Teachers in this study also found that another important game attribute for serious game design is game elements such as points, badges, leaderboards, performance gaps, and instant feedback to enhance learning, confirming the findings of Sailer et al. (2017). The data in this study demonstrated the importance of digital serious games having instant feedback and progress that moves with their ability extends the findings of Sun and Hsieh (2018),

that integrating the gamification element within a classroom makes classes more interesting and attractive to learners, suggesting that highly interactive, challenging, and competitive motivation makes students pay more attention. The data within this study extended the findings of Calinoiu (2019), demonstrating how game elements all play a significant role, thus wrapping up the learning process in the games' structure to help visualize the goal, a set of rules, and a clear reward system for the students.

Research Question 2: Challenges

Teachers in this study reported one challenge for students with ADHD playing serious games socially is that students are distracted by their peers. Morris et al. (2020) conducted a systematic review of nonpharmacological therapies for students with ADHD ages 10 to 18, demonstrating that adolescent-specific psychosocial factors make social dysfunction a significant negative risk factor for poor reactions through effecting skills required for competent lifelong social functioning which is an element confirmed by teachers this study. The findings of Hakimirad et al. (2019) used the game EmoGalaxy to review the efficacy of video games in children with ADHD's social skills, such as waiting, responding to nonverbal signals, and understanding others' feelings, which teachers confirmed in this study where students participated in social situations requiring restraint and involvement during gameplay. Although digital serious games have been shown to improve attention and social skills in students with ADHD (Zheng et al., 2021), teachers in this study reported that some students with ADHD are distracted by their peers. This study extends LaCount et al. (2018) in regard to student with ADHD and these children tend to show several aggressive behaviors towards others, making it

difficult for them to establish and maintain friendly relationships which could hinder effective game play.

The second challenge teachers in this study reported for students with ADHD playing serious games emotionally, is that students have anxiety if they do not understand the concepts in the game, are frustrated which can cause them to shut down, or they become angry when they see others cheating because they feel that the competion if not fair within the game. Teachers in this study described various emotional challenges during game play, correlating with the findings of Dang and Koedinger (2019) who reported that during adolescent development, a challenge to consider is a student's ability to regulate thoughts, emotions, and behaviors, which can arguably link to their task-specific motivational goals and dispositions during gaming. Hakimirad et al. (2019) found that children with ADHD have major disabilities in their self-regulation functions, and they have significant problems with understanding and controlling their emotions and feelings during gameplay which was confirmed by this study. However, teachers in this study disconfirmed Jesmin and Ley's (2020) findings that using serious games allows teachers to teach special needs children while also allowing students to work cooperatively and independently.

Teachers in this study reported a third challenge for students with ADHD playing serious games cognitively, students have difficulty reading instructions, and will lose motivation if they do not progress. This study confirmed Cheng et al.'s (2017) findings, demonstrating that, with different barriers between stages, a gamer may have difficulty progressing from one stage to the next until certain barriers are overcome. This study

may extend that the difficulty students with ADHD have with working memory, reading comprehension, and attention reported by Ovadya (2020), which may be the reason why some lack motivation when playing serious games. The importance of cognitive ability was an extension of the Barkley (2015) findings, where students with ADHD faced problems at school due to weak executive functions causing lack of concentration, ineffectiveness, and irresponsibility, which caused difficulty in problem-solving, which may be why students lose motivation during gaming if they do not progress. This study also extends the findings of Eddin Alchalabi et al. (2017) and Ovadya (2020) in that ADHD is one of the most common cognitive disorders characterized by a lack of attention and focus, and that transitioning from childhood to adolescence brings increased cognitive load capacity, as well as increased cognitive demands, which can affect students with ADHD motivation to progress during game play.

Teachers in this study reported a final challenge for students with ADHD playing serious games as a game attribute related to complicated structure or inflexible time limits influence a student's performance and engagement with a game. This study may confirm the difficulty students with ADHD have with inflexible time limits, extending the findings of Zheng et al. (2021), who discussed the struggles students with ADHD have with attention, suppressing impulse, memory, social skills, time management or task prioritization skills, and promoting emotional regulation which supports executive function. This study is also an extension of Huang et al.'s (2017) study, in which the authors discussed how unpredictable elements of games, such as player traits (persistence, finding novelty, and reward dependency), which can include inflexible time

limits, correlate with increased player ability, difficulty, and flow, resulting in increased intention to play a game repeatedly.

Limitations of the Study

All research studies have limitations related to research design and potential for research bias. First, in my study, the choice of the research design was a limitation. Because I limited my study to the perspectives of 10 teachers and one data source, the generalizability of the study results to other educational settings is restricted. I conducted the interviews virtually which was another limitation related to methodology. Although teachers, because of the pandemic, were more comfortable in online spaces then they once were (see Kobakhidze et al., 2021), being interviewed online, might still have limited the rapport I was able to build with participants, and therefore influenced how much they shared with me. Also related to methodology, there was a limitation associated with finding participants who fit the study criteria. Several participants did not meet the criteria to participate in the study which resulted in a change of the number of participants and the subject taught. This study was limited to Grades 6 through 8 middle school teachers who have used digital serious games for at least 1 year. This small range and specific teachers could have potentially produced different results than would be found for elementary or high school grade levels. Additionally, my recruitment was limited by time and to those who viewed my recruitment flyer, therefore study results do not represent the perspectives of the larger population of middle school teachers who use serious games with students for ADHD.

Other limitations of the study were related to the potential for researcher bias. I have been a middle school teacher in the past, and as an administrator have seen successful use of gaming with students with ADHD. However, as I described in Chapter 3, I had numerous ways in which I did my best to alleviate concerns with researcher bias, including researcher reflective journaling (see Slevin & Sines, 2000) and member checking (see Carlson, 2010).

Recommendations

Recommendations for future research are based on the limitations of the study and study results. The first recommendation is related to the limitations of this study. This study was conducted with 10 middle school teachers, seven who were general education teachers, two special education teachers, and one technology teacher in middle school in a number of districts in the southern United States. I recommend that this study be replicated with a larger participant pool of middle school teachers to determine whether results are similar or dissimilar. More research needs to be done to determine if teachers from multiple areas within the United States provide different perspectives on the use of digital serious games for students with ADHD.

The second recommendation is related to the study research finding, teachers shared that the game element aspect provides a safe place for repetition with instant feedback and progress that moves with their ability. I recommend that the study be replicated with elementary teachers to confirm, disconfirm, or extend findings. More research could be done using Sherry's model of game engagement (2013) as the model takes into account the social, emotional, and cognitive demands of how students learn.

Using the model to support learning through digital serious games for students with ADHD from elementary teacher perspectives will be beneficial as most schools are moving to a more tech savvy approach in education.

The final recommendation is based on the study finding that teachers perceived that cognitively, students have difficulty reading instructions, and will lose motivation if they do not progress. I recommend that studies be conducted to confirm or disconfirm how cognitive ability alone effects learning through game play. More research needs to be done with middle school students to determine their perceptions about how digital serious games contribute to students cognitive learning mechanisms during game play.

Implications

This study may contribute to positive social change in several ways. First at the individual level, teachers may show how digital serious games present an innovative approach to teach students with ADHD. For administrators, this study may show the knowledge and leverage needed to understand the benefits and challenges of using serious games to support teacher's implementation of digital serious games for students with ADHD, thereby improving student success through teacher support and professional development.

The positive implications at the organizational level could be professional development that might be provided within districts. At the district level, digital serious games are perceived as viable pedagogical tools for teaching and learning to encourage student success for students with ADHD. This study may encourage districts to provide

professional developments or specific games to provide support for teachers to support effective learning for students with ADHD at the middle school level.

Finally, a change in how teachers support and successfully teach students with ADHD may make a positive contribution to social change on a societal level. The study's teachers saw digital serious games to give students with ADHD the chance to use games as a learning tool to make the most of their resources while also giving them a different way to access and use cutting-edge strategies, like digital serious games, to support effective learning for those students. Digital serious games would benefit students with ADHD if more teachers used them. If more teachers employed this cutting-edge strategy, it might encourage students with ADHD to pay attention and be more engaged in their lessons.

Conclusion

The problem related to this study is the gap that little is understood about the perceptions of middle school teachers' use of digital serious games for students with ADHD. The purpose of this basic qualitative study was to explore the perceptions of middle school teachers related to the use of digital serious games for students with ADHD. In order to accomplish this purpose, I interviewed 10 middle school teachers Grade 6 through 8 who have used digital serious games to support students with ADHD.

The key findings for RQ1 were that middle school teachers found digital serious games to be beneficial for learning to support students with ADHD. Teachers stated that the social aspect encourages teamwork and camaraderie in an environment where they are not just sitting and listening to direct or remote instruction. Teachers felt that playing

serious games helps students with ADHD learn and strengthen their knowledge of the material because it is something they want to do. Teachers perceived students to be more likely to retain information, interact with the content more deeply, and possibly at a higher level. Teachers thought that increased student competitiveness during game play was inevitable; that competition motivated students to want to play to learn; and that the gaming component could be used to supplement their learning. The results showed that the game starts with the students at their current level of learning and progresses with them as they play, allowing them to receive instant feedback and communicate with one another.

The key findings for RQ2 were that middle school teachers found digital serious games to be challenging for students with ADHD. Teachers stated that students with ADHD tend to shut down while playing if they do not understand the concepts in the game, resulting in the students searching for the answer without understanding the actual content material. Results showed that students may lack the cognitive ability to comprehend the game's content and struggle to process the information. According to participants the time limit affects a student's performance within a game for students with ADHD during game play if there are multiple sections, the instructions are unclear, or there is more than one question on a page. By giving teachers and administrators the information and power, they need to comprehend the advantages and difficulties of using serious games when teaching students with ADHD, the findings may help bring about positive social change. This may improve student success through teacher support and professional development.

References

Alsuhaymi, D. & Alzebidi, A. (2019). Saudi teachers' perceptions regarding adopting digital games in teaching practice. *Turkish Online Journal of Educational Technology, 18*(4), 62–69.

An, Y. J., Haynes, L., D'Alba, A., & Chumney, F. (2016). Using educational computer games in the classroom: Science teachers' experiences, attitudes, perceptions, concerns, and support needs. *Contemporary Issues in Technology and Teacher Education*, *16*(4), 415–433.

Ang, R. P., Tan, J. L., Goh, D. H. L., Huan, V. S., Ooi, Y. P., Boon, J. S. T., & Fung, D. S. S. (2017). A game-based approach to teaching social problem-solving skills. *Advances in Game-Based Learning*, 168–195. https://doi.org/10.4018/978-1-5225-0513-6.ch008

Assaf, M., van Hillegersberg, J., Spil, T., & Arikat, N. (2019). Teachers' Perceptions about using serious games in formal education in Jordan: possibilities and limitations. *2019 IEEE Global Engineering Education Conference (EDUCON)*. https://doi.org/10.1109/educon.2019.8725193

Avila-Pesantez, D., Rivera, L. A., Vaca-Cardenas, L., Aguayo, S., & Zuniga, L. (2018). Towards the improvement of ADHD children through augmented reality serious games: Preliminary results. *2018 IEEE Global Engineering Education Conference (EDUCON)*. https://doi.org/10.1109/educon.2018.8363318

Barkley, R. A. (2015). Emotional dysregulation is a core component of ADHD.

Boendermaker, W. J., Gladwin, T. E., Peeters, M., Prins, P. J. M., & Wiers, R. W. (2018). Training working memory in adolescents using serious game elements: Pilot randomized controlled trial. *JMIR Serious Games*, *6*(2), e10. https://doi.org/10.2196/games.8364

Bovermann, K., Weidlich, J., & Bastiaens, T. (2018). Online learning readiness and attitudes towards gaming in gamified online learning–a mixed-methods case study. *International Journal of Educational Technology in Higher Education, 15*(1), 27. https://doi.org/10.1186/s41239-018-0107-0

Calinoiu, N. (2019). Learning enhancement through video games. *Central and Eastern European Online Library, 15*, 68–77.

Camilleri, M. A., & Camilleri, A. C. (2019). Student-centered learning through serious games. *INTED2019 Proceedings*. https://doi.org/10.21125/inted.2019.0578

Carlson, J. A. (2010). Avoiding traps in member checking. *Qualitative Report*, *15*(5), 1102–1113.https://doi.org/10.46743/2160-3715/2010.1332

Castillo-Montoya, M. (2016). Preparing for interview research: The interview protocol refinement framework. *The Qualitative Report, 21*(5), 811-831. https://doi.org/10.46743/2160-3715/2016.2337

Cheng, M., Lin, Y., She, H., & Kuo, P. (2017). Is immersion of any value? Whether, and to what extent, game immersion experience during serious gaming affects science learning. *British Journal of Educational Technology, 48*(2), 246–263. https://doi.org/10.1111/bjet.12386

Cibrian, F. L., Lakes, K. D., Schuck, S. E., & Hayes, G. R. (2022). The potential for emerging technologies to support self-regulation in children with ADHD: A literature review. *International Journal of Child-Computer Interaction*, *31*, 100421. https://doi.org/10.1016/j.ijcci.2021.100421

Coma-Rosellé, T., Blasco-Serrano, A. C., Garrido Laparte, M. Á., & Aguelo Arguis, A. (2020). Mediation criteria for interactive serious games aimed at improving learning in children with attention deficit hyperactivity disorder (ADHD). *Research and Practice in Technology Enhanced Learning, 15*(1). https://doi.org/10.1186/s41039-020-00144-6

Connolly, T. M., Boyle, E. A., MacArthur, E., Hainey, T., & Boyle, J. M. (2012). A systematic literature review of empirical evidence on computer games and serious games. *Computers &Education*, *59*(2), 661–686.

Crescenzi-Lanna, L., & Grané-Oró, M. (2016). An analysis of the interaction design of the best educational apps for children aged zero to eight. *Comunicar*, *24*(46), 77–85. https://doi.org/10.3916/c46-2016-08

Dang, S., & Koedinger, K. (2019). *Exploring the Link between motivations and gaming*. International Educational Data Mining Society. http://www.Educationaldatamining.org

Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 319–340.

DeCuir-Gunby, J. T., Marshall, P. L., & McCulloch, A. W. (2011). Developing and using a codebook for the analysis of interview data: An example from a professional

development research project. *Field methods*, *23*(2), 136-155. https://doi.org/10.1177/1525822x10388468

DeRosier, M. E., & Thomas, J. M. (2019). Hall of heroes: A digital game for social skills training with young adolescents. *International Journal of Computer Games Technology*, *2019*, 1–12. https://doi.org/10.1155/2019/6981698

Doulou, A., & Drigas, A. (2022). Virtual reality and electronic games for assessment in ADHD. *International Journal of Recent Contributions from Engineering, Science & IT (iJES)*, *10*, 4-15. https://doi.org/10.3991/ijes.v10i02.29735

Eddin Alchalabi, A., Elsharnouby, M., Shirmohammadi, S., & Nour Eddin, A. (2017). Feasibility of detecting ADHD patients' attention levels by classifying their EEG signals. *2017 IEEE International Symposium on Medical Measurements and Applications (MeMeA)*. https://doi.org/10.1109/memea.2017.7985895

Fleming, T. M., Bavin, L., Stasiak, K., Hermansson-Webb, E., Merry, S. N., Cheek, C., Lucassen, M., Lau, H. M., Pollmuller, B., & Hetrick, S. (2017). Serious games and gamification for mental health: Current status and promising directions. *Frontiers in Psychiatry*, *7*. https://doi.org/10.3389/fpsyt.2016.00215

Francis, J. J., Johnston, M., Robertson, C., Glidewell, L., Entwistle, V., Eccles, M. P., & Grimshaw, J. M. (2010). What is an adequate sample size? Operationalising data saturation for theory-based interview studies. *Psychology and Health*, *25*(10), 1229-1245.

Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, *86*, 186-204. https://doi.org/10.1016/j.cortex.2016.04.023

García-Redondo, P., García, T., Areces, D., Núñez, J. C., & Rodríguez, C. (2019). Serious games and their effect improving attention in students with learning disabilities. *International Journal of Environmental Research and Public Health*, *16*(14), 2480. https://doi.org/10.3390/ijerph16142480

Garneli, V., Giannakos, M., & Chorianopoulos, K. (2017). Serious games as a malleable learning medium: The effects of narrative, gameplay, and making on students' performance and attitudes. *British Journal of Educational Technology*, *48*(3), 842-859. https://doi.org/10.1111/bjet.12455

Georgiou, Y., & Kyza, E. A. (2018). Investigating the coupling of narrative and locality in augmented reality educational activities: Effects on students' immersion and learning gains. International Society of the Learning Sciences, Inc. [ISLS].

Goh, D. H.-L., Pe-Than, E. P. P., & Lee, C. S. (2017). Perceptions of virtual reward systems in crowdsourcing games. *Computers in Human Behavior*, *70*, 365–374. https://doi.org/10.1016/j.chb.2017.01.006

Gresham, F. M., & Elliott, S. N. (1990). *Social skills rating system: Manual*. American Guidance Service.

Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, *18*(1), 59–82. https://doi.org/10.1177/1525822x05279903

Hakimirad, E., Kashani-Vahid, L., Hosseini, M. S., Irani, A., & Moradi, H. (2019). Effectiveness of EmoGalaxy video game on social skills of children with ADHD. *2019 International Serious Games Symposium (ISGS)*. https://doi.org/10.1109/isgs49501.2019.9046992

Hawlitschek, A., & Joeckel, S. (2017). Increasing the effectiveness of digital educational games: The effects of a learning instruction on students' learning, motivation and cognitive load. *Computers in Human Behavior, 72*, 79–86. https://doi.org/10.1016/j.chb.2017.01.040

Heath, C. D., McDaniel, T., & Panchanathan, S. (2019). Examining motivational game features for students with learning disabilities or attention disorders. In *Handbook of Research on Immersive Digital Games in Educational Environments* (pp. 232-259). IGI Global.

Homer, B. D., Ober, T. M., Rose, M. C., MacNamara, A., Mayer, R. E., & Plass, J. L. (2019). Speed versus accuracy: Implications of adolescents' neurocognitive developments in a digital game to train executive functions. *Mind, Brain, and Education*, *13*(1), 41–52. https://doi.org/10.1111/mbe.12189

Hope, N. H., Holding, A. C., Verner-Filion, J., Sheldon, K. M., & Koestner, R. (2019). The path from intrinsic aspirations to subjective well-being is mediated by changes in basic psychological need satisfaction and autonomous motivation: A large prospective test. *Motivation & Emotion, 43*(2), 232–241. https://doi.org/10.1007/s11031-018-9733-z

Huang, H. C., Huang, L. S., Chou, Y. J., & Teng, C. I. (2017). Influence of temperament and character on online gamer loyalty: Perspectives from personality and flow theories. *Computers in Human Behavior*, *70*, 398–406. https://doi.org/10.1016/j.chb.2017.01.009

Huizenga, J. C., ten Dam, G. T. M., Voogt, J. M., & Admiraal, W. F. (2017). Teacher perceptions of the value of game-based learning in secondary education. *Computers & Education*, 110, 105–115. https://doi.org/10.1016/j.compedu.2017.03.008

Jesmin, T., & Ley, T. (2020). Giving teachers a voice: A study of actual game use in the classroom. *Information*, *11*(1), 55. https://doi.org/10.3390/info11010055

Kashani-Vahid, L., Mohajeri, M., Moradi, H., & Irani, A. (2018, November). Effectiveness of computer games of emotion regulation on social skills of children with intellectual disability. In *2018 2nd National and 1st International Digital Games Research Conference: Trends, Technologies, and Applications (DGRC)* (pp. 46-50). IEEE. https://doi-org/10.1109/DGRC.2018.8712024

Kobakhidze, M. N., Hui, J., Chui, J., & Gonzalez, A. (2021). Research disruptions, new opportunities: Re-imagining qualitative interview study during the COVID-19 pandemic. *International Journal of Qualitative Methods, 20*. https://doi.org/10.1177/16094069211051576

Koh, C. (2022). A qualitative meta-analysis on the use of serious games to support learners with intellectual and developmental disabilities: What we know, what we need to know and what we can do. *International Journal of Disability,*

Development and Education, *69*(3), 919–950. https://doi.org/10.1080/1034912X.2020.1746245

Kokol, P., Vošner, H. B., Završnik, J., Vermeulen, J., Shohieb, S., & Peinemann, F. (2020). Serious game-based intervention for children with developmental disabilities. *Current Pediatric Reviews*, *16*(1), 26–32. https://doi.org/10.2174/1573396315666190808115238

LaCount, P. A., Hartung, C. M., Canu, W. H., & Knouse, L. E. (2018). Interventions for transitioning adolescents with ADHD to emerging adulthood: Developmental context and empirically-supported treatment principles. *Evidence-Based Practice in Child and Adolescent Mental Health*, 1–17. https://doi.org/10.1080/23794925.2018.1518120

Ladouceur, C. D., Kerestes, R., Schlund, M. W., Shirtcliff, E. A., Lee, Y., & Dahl, R. E. (2019). Neural systems underlying reward cue processing in early adolescence: The role of puberty and pubertal hormones. *Psychoneuroendocrinology*, *102*, 281–291. https://doi.org/10.1016/j.psyneuen.2018.12.016

Lameras, P., Arnab, S., Dunwell, I., Stewart, C., Clarke, S., & Petridis, P. (2017). Essential features of serious games design in higher education: Linking learning attributes to game mechanics. *British Journal of Educational Technology*, *48*(4), 972–994. https://doi.org/10.1111/bjet.12467

Liu, C.-Y., Huang, Y.-K., Yu, H.-Y., & Tsai, I.-C. (2018). Verifying user concentration based on brainwave control applied to different game training methods. *2018*

IEEE International Conference on Teaching, Assessment, and Learning for Engineering (TALE). https://doi.org/10.1109/tale.2018.8615311

Ma, I., Lambregts-Rommelse, N. N. J., Buitelaar, J. K., Cillessen, A. H. N., & Scheres, A. P. J. (2017). Decision-making in social contexts in youth with ADHD. *European Child & Adolescent Psychiatry*, *26*(3), 335–344. https://doi.org/10.1007/s00787-016-0895-5

Malaquias, R. F., Malaquias, F. F. O., & Hwang, Y. (2018). Understanding technology acceptance features in learning through a serious game. *Computers in Human Behavior*, *87*, 395–402. https://doi.org/10.1016/j.chb.2018.06.008

Mancera, L., Baldiris, S., Fabregat, R., Gomez, S., & Mejia, C. (2017, July). aTenDerAH: A videogame to support e-Learning students with ADHD. In *2017 IEEE 17th International Conference on Advanced Learning Technologies (ICALT)* (pp. 438–440). IEEE.

McColgan, M., Colesante, R., & Andrade, A. (2018). Pre-service teachers learn to teach with serious games. *Journal of STEM Education*, *19*(2).

Merriam, S.B., & Tisdell, E.J. (2016) *Qualitative research: A guide to design and implementation* (4th ed.). Jossey-Bass.

Michailidis, L., Balaguer-Ballester, E., & He, X. (2018). Flow and immersion in video games: The aftermath of a conceptual challenge. *Frontiers in Psychology*, *9*. https://doi.org/10.3389/fpsyg.2018.01682

Mihas. (2019). *Learn to build a codebook for a generic qualitative study*. Sage Publications Ltd.

Mikami, A. Y., Smit, S., & Khalis, A. (2017). Social skills training and ADHD—What works? *Current Psychiatry Reports*, *19*(12). https://doi.org/10.1007/s11920-017-0850-2

Morris, S., Sheen, J., Ling, M., Foley, D., & Sciberras, E. (2020). Interventions for adolescents with ADHD to improve peer social functioning: A systematic review and meta-analysis. *Journal of Attention Disorders*, 108705472090651. https://doi.org/10.1177/1087054720906514

Nadolny, L., Alaswad, Z., Culver, D., & Wang, W. (2017). Designing with game-based learning: Game mechanics from middle school to higher education. *Simulation & Gaming, 48*(6), 814–831. https://doi.org/10.1177/1046878117736893

Ninaus, M., Greipl, S., Kiili, K., Lindstedt, A., Huber, S., Klein, E., Karnath, H.-O., & Moeller, K. (2019). Increased emotional engagement in game-based learning – A machine learning approach on facial emotion detection data. *Computers & Education*, *142*, 103641. https://doi.org/10.1016/j.compedu.2019.103641

Omegna, E. (2020). *Teachers perceptions of digital gaming and 21st century skills in the middle school classroom*. [Doctoral dissertation, Seton Hall University]. Seton Hall University Dissertations and Theses (ETDs). 2774. https://scholarship.shu.edu/dissertations/2774

O'Neal, L. J., Gibson, P., & Cotten, S. R. (2017). Elementary school teachers' beliefs about the role of technology in 21st-Century teaching and learning. *Computers in the Schools*,34(3), 192–206. https://doi.org/10.1080/07380569.2017.1347443

Ortlipp, M. (2008). Keeping and using reflective journals in the qualitative research process. *The Qualitative Report, 13*(4), 695-705. http://nsuworks.nova.edu/tqr/vol13/i

Osman, E. & Çirak, N. S. (2020). What are the factors that affect the motivation of digital gamers? *Participatory Educational Research*, *7*(1), 184-200. https://doi.org/10.17275/per.20.11.7.1

Ovadya, S. A. (2020). *Working memory among ADHD middle adolescent males and evidence-based school psychology practice* (Publication No. 27960431) [Doctoral dissertation, Alliant International University]. ProQuest Dissertations and Theses Global.

Papanastasiou, G., Drigas, A., & Skianis, C. (2022). Serious games: How do they impact special education needs children. *Technium Education and Humanities*, *2*(3), 41–58.

Parong, J., Mayer, R. E., Fiorella, L., MacNamara, A., Homer, B. D., & Plass, J. L. (2017). Learning executive function skills by playing focused video games. *Contemporary Educational Psychology*, *51*, 141–151. https://doi.org/10.1016/j.cedpsych.2017.07.002

Patton, M. Q. (2015). *Qualitative research & evaluation methods: Integrating theory and practice* (4th ed.): Sage.

Patzer, B., Chaparro, B., & Keebler, J. R. (2020). Developing a model of video gameplay: Motivations, satisfactions, and continuance intentions. *Simulation & Gaming, 51*(3), 287–309. https://doi:10.1177/1046878120903352

Percy, W. H., Kostere, K., & Kostere, S. (2015). Generic qualitative research in psychology. *The qualitative report*, *20*(2), 76–85.

Poehner, P. M., & Brown, D. F. (2019). The effects of contemporary technology on young adolescents' socioemotional behaviors and learning. In *International Handbook of Middle Level Education Theory, Research, and Policy* (pp. 116-130). Routledge.

Politis, Y., Robb, N., Yakkundi, A., Dillenburger, K., Herbertson, N., Charlesworth, B., & Goodman, L. (2017). People with disabilities leading the design of serious games and virtual worlds. *International Journal of Serious Games*, *4*(2), 63–73. https://doi.org/10.17083/ijsg.v4i2.160

Prestridge, S. (2017). Examining the shaping of teachers' pedagogical orientation for the use of technology. *Technology, Pedagogy and Education*, *26*(4), 367–381. https://doi.org/10.1080/1475939x.2016.1258369

Rajabi, S., Pakize, A., & Moradi, N. (2020). Effect of combined neurofeedback and game-based cognitive training on the treatment of ADHD: A randomized controlled study. *Applied Neuropsychology: Child*, *9*(3), 193–205. https://doi.org/10.1080/21622965.2018.1556101

Ravitch, S. M., & Carl, N. M. (2016). Validity: Process, strategies, and considerations. *Qualitative research: Bridging the conceptual, theoretical, and methodological*, 185–214.

Regan, K., Evmenova, A. S., Sacco, D., Schwartzer, J., Chirinos, D. S., & Hughes, M. D. (2019). Teacher perceptions of integrating technology in writing. *Technology,*

Pedagogy and Education, *28*(1), 1–19. https://doi.org/10.1080/1475939x.2018.1561507

Rocha, E., & Escudeiro, P. (2018, October). Meta-model of serious game mechanics for deaf and blind. In *European Conference on Games Based Learning* (pp. 907-XXIII). Academic Conferences International Limited.

Sailer, M., Hense, J. U., Mayr, S. K., & Mandl, H. (2017). How gamification motivates: An experimental study of the effects of specific game design elements on psychological need satisfaction. *Computers in Human Behavior*,*69*(69), 371–380. https://doi.org/10.1016/j.chb.2016.12.033

Saldaña, J. (2015). *The coding manual for qualitative researchers*: Sage.

Shangguan, C., Gong, S., Guo, Y., Wang, X., & Lu, J. (2020). The effects of emotional design on middle school students' multimedia learning: the role of learners' prior knowledge. *Educational Psychology*, 1–18. https://doi.org/10.1080/01443410.2020.1714548

Sherry, J. L. (2013). The challenge of audience reception: A developmental model for educational game engagement. *New Directions for Child and Adolescent Development*, *2013*(139), 11–20. https://doi.org/10.1002/cad.20027

Sim, J., Saunders, B., Waterfield, J., & Kingstone, T. (2018). Can sample size in qualitative research be determined a priori? *International Journal of Social Research Methodology*, *21*(5), 619–634.

Slevin, E., & Sines, D. (2000). Enhancing the truthfulness, consistency and transferability of a qualitative study: Utilising a manifold of approaches. *Nurse Researcher*, *7*(2), 79–98. https://doi.org/10.7748/nr2000.01.7.2.79.c6113

Southgate, E., Budd, J., & Smith, S. (2017). Press play for learning: A framework to guide serious computer game use in the classroom. *Australian Journal of Teacher Education*, *42*(7), 1–13. https://doi.org/10.14221/ajte.2017v42n7.1

Stankova, M., Ivanova, V., & Kamenski, T. (2018). Use of educational computer games in the initial assessment and therapy of children with special educational needs in Bulgaria. *TEM Journal*, *7*(3), 488.

Stieler-Hunt, C., & Jones, C. (2018). A professional development model to facilitate teacher adoption of interactive, immersive digital games for classroom learning. *British Journal of Educational Technology*, *50*(1), 264–279. https://doi.org/10.1111/bjet.12679

Ströberg, S. (2018). ADHD Through the lens of game design: How digital RPGs neutralize the symptoms of inattention amongst Swedish adults with ADHD. http://urn.kb.se/resolve?urn=urn:nbn:se:uu:diva-394208

Sújar, A., Martín-Moratinos, M., Rodrigo-Yanguas, M., Bella-Fernández, M., González-Tardón, C., Delgado-Gómez, D., & Blasco-Fontecilla, H. (2022). Developing serious video games to treat attention deficit hyperactivity disorder: Tutorial guide. *Journal of Medical Internet Research Serious Games*, *10*(3), e33884. https://doi.org/10.2196/33884

Sun, J. C.-Y., & Hsieh, P.-H. (2018). Application of a gamified interactive response system to enhance the intrinsic and extrinsic motivation, student engagement, and attention of English learners. *Educational Technology & Society, 21*(3), 104–116.

Sweetser, P., & Wyeth, P. (2005). GameFlow: A model for evaluating player enjoyment in games. *Computers in Entertainment (CIE)*, *3*(3), 3. https://doi.org/10.1145/1077246.1077253

Tarle, S. J., Alderson, R. M., Arrington, E. F., & Roberts, D. K. (2019). Emotion regulation and children with attention-deficit/hyperactivity disorder: The effect of varying phonological working memory demands. *Journal of Attention Disorders*, 108705471986463. https://doi.org/10.1177/1087054719864636

Touati, A., & Baek, Y. (2017). Collaboration, cooperation, and competition: Toward a better understanding of conceptual differences in a mobile learning games. *Game-based learning: Theory, strategies, and performance outcomes: Nova Science Publishers, Inc*, 213-237.

Watson, W., & Yang, S. (2016). Games in schools: Teachers' perceptions of barriers to game-based learning. *Journal of Interactive Learning Research*, *27*(2), 153-170.

Yin, R. K. (2014). *Case study research: Design and methods* (5th ed.). Sage.

Zhang, C., Perkis, A., & Arndt, S. (2017). Spatial immersion versus emotional immersion, which is more immersive? *2017 Ninth International Conference on Quality of Multimedia Experience (QoMEX)*. https://doi.org/10.1109/qomex.2017.7965655

Zheng, Y., Li, R., Li, S., Zhang, Y., Yang, S., & Ning, H. (2021). A review on serious games for ADHD. https://arxiv.org/pdf/2105.02970.pdf

Zhen, R., Liu, R.-D., Ding, Y., Wang, J., Liu, Y., & Xu, L. (2017). The mediating roles of academic self-efficacy and academic emotions in the relation between basic psychological needs satisfaction and learning engagement among Chinese adolescent students. *Learning and Individual Differences*, *54*, 210–216. https://doi:10.1016/j.lindif.2017.01.017

Appendix A: Email Recruitment

Subject line: Educational games & ADHD; research study; need your insight $10 Amazon Gift Card

Dear ,

My name is LaToyia Jones Stewart, I am a doctoral student at Walden University, and I am interested in hearing about experiences from middle school teachers who use educational or serious games in their classes to support students with ADHD.

I am looking for teachers in the U.S. who have used educational digital serious games with middle school students for at least a year, and have students with ADHD who have played these digital games. I hope to have classroom teachers, technology teachers and special education teachers all be part of the study. The first 12 teachers who fit the criteria and accept this invitation will be included in the study to be interviewed virtually. You will receive a $10 Amazon gift card in appreciation for your time.

If you would like more information about this study, please click this link:

http://www.XXXXXX

Sincerely,

LaToyia Jones Stewart
Doctoral Candidate-Walden University

Appendix B: Participant Recruitment Flow Chart

Section A: Inclusion Criteria

Do you teach middle school students (any grade 6-8)? Yes/no

Do you teach in the United States? Yes/no

Are you a general education teacher, special education teacher, or technology teacher? Yes/no

Do you use digital educational (serious) games with your middle school students? Yes/no

Have you used digital educational (serious) games for at least a year? Yes/no

Have you had students with ADHD in your classes when you implemented digital educational (serious) games? Yes/no

If they answer NO to any of the questions, they go to section B
If they answer YES to each of these questions, they go to section C

Section B

I'm sorry, based on your answers, you do not currently fit the inclusion criteria to be a participant in my doctoral research study. However, I want to thank you for your willingness.

Section C: Letter of Consent

The last few lines of the Letter of Consent read:

I have read the above information and I am willing to be a participant in this research study and give my informed consent.

If you consent, please click here to answer a few demographic questions and provide your contact information so I may reach out to set up a time for our virtual interview.
[Submit] – goes to page D.

Section D:

What is the name and location of the school where you teach middle school students? (This will remain confidential.)

Which educational (serious) digital games have you used with middle school students?

In your school, what policies are in place regarding informing teachers that they may be serving a student with ADHD? (How would you know whether you have a student with ADHD?)

What is your name?

How may I contact you to set up an interview? Please provide a cell phone number, email, or social media contact info.

Appendix C: Tweets to use for Twitter Recruitment

Are you a #middleschoolteacher who uses #SeriousGames with students with #ADHD? I'm a #PhDstudent searching for 12 teachers to interview about their use of games with students. For more information about being a participant in my research study, go here: LINK to GOOGLE FORM.

Do you use #seriousgames to support learning for students with #ADHD? I'm a #PhDstudent searching for 12 teachers to interview about using #seriousgames in the classroom. For more information about being a participant in my research study, go here: LINK to GOOGLE FORM.

Calling all #gamification #middleschoolteachers who use #seriousgames with students with #ADHD. I'm a #PhDstudent searching for 12 teachers to interview about their use of games with students. For more information about being a participant in my research study, go here: LINK to GOOGLE FORM.

#games4edu#middleschoolteachers who use #seriousgames to support learning for students with #ADHD I am looking for you! I'm a #PhDstudent searching for 12 teachers to interview about their use of games with students. For more information about being a participant in my research study, go here: LINK to GOOGLE FORM.

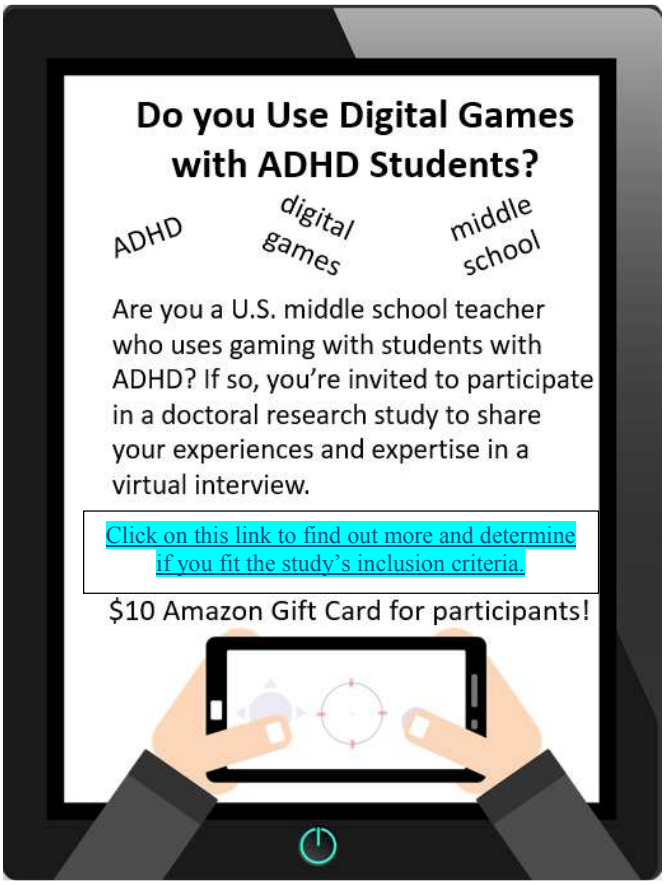
#edutech and #gbl followers are you a #middleschoolteacher who uses #seriousgames with students with #ADHD? I'm a #PhDstudent searching for 12 teachers to interview about their use of games with students. For more information about being a participant in my research study, go here: LINK to GOOGLE FORM.

#digitalpedagogy#digitallearning followers Do you use #seriousgames in your classroom? Are you a #middleschoolteacher? I'm a #PhDstudent searching for 12 teachers to interview about their use of games with students. For more information about my research study, go here: LINK to GOOGLE FORM.

Appendix D: Infographic for Recruitment on Social Media

Narrative to post with Infographic:

> Do you teach middle school students (any grade 6-8)? Do you teach in the United States? Are you a general education teacher, special education teacher, or technology teacher? Do you use digital educational (serious) games with your middle school students? Have you used digital educational (serious) games for at least a year? To the best of your knowledge, have you had students with ADHD in your classes when you implemented digital educational (serious) games? If you answered yes to these questions I'd love for you to be part of my research study. Click here for more details.



Appendix E: Consent to use Sherry's model of game engagement

Hi LaToyia!

Great to hear from you and of your interest in my article. Though I'm not what you call a 'gamer' (these games really didn't exist when I was in middle school), I have long been informally interested in how the education system deals with students who have ADHD. Mainly because I was ADHD before there was ADHD (and still am)! It really presents difficulties for students who are trying to navigate a system that is largely designed to maintain order, but it really doesn't have much effect on learning, per se. After all, I have a PhD despite a life of deficient attention!

My personal experience, and that of my adult daughter with ADHD, has been that we don't have a deficit in *attention*, but a deficit in *stimulation*. Our brains crave stimulation to the point that we create stimulation for our brains during uneventful classroom times. Sometimes this looks like daydreaming; sometimes it leads to 'great ideas' of which our teachers did not see the greatness! I was lucky to have lovely nuns as principals who understood my unrelenting curiosity and need for stimulation!

The paper on The Challenge of Audience Reception came after a conference on games for leaning at Fordham put on by Fran Blumberg (her work is great). I noticed that everyone simply assumed that the 'engaging nature of games' was automatic, as if you could drop any game in front of a kid and they would be engaged. But people your age know this isn't true. There were some games that you found highly engaging and enjoyed playing while there were many, many more you had no interest in playing. I think this one-size-fits-all approach to games for learning is one of the major reasons that so many 'educational game' companies went out of business in the 1990s.

I'm glad to see you taking up this idea. What are the unique developmental/educational challenges faced by children with ADHD? Like I said above, for me it was probably lack of stimulation. My Mom told me she was shocked that she never saw me bring a book home in 12 years of elementary-high school. The reason was that I always did my homework in class! I quickly understood the day's lesson and did the homework to avoid boredom. I'm sure there is a whole literature on the experiences of children with ADHD that points to other developmental challenges.

How might my need for stimulation have predicted motivations to play games? Just off the top of my head, I would have loved to have something like a GameBoy to satisfy my need for stimulation. Thinking about the six uses and gratifications of game play (challenge, competition, social interaction, fantasy, arousal, diversion), I would clearly hypothesize that I would have looked for games that emphasized challenge and diversion, and to a lesser extent fantasy and arousal.

I'm attaching a few articles I wrote about the uses and gratifications of games along with the scale we used.

RE: Permission to use my article—As you work on your PhD, you are making a major shift in your orientation to knowledge from being a consumer to being a producer. I find this is one of the toughest things about the PhD; leaving the community of learners and entering the community of knowledge producers. The producer community freely shares ideas via the journal publication process. So, you don't need anyone's permission to build upon an idea. However, we expect that you will tell us the ideas that you are building from and that is done via the references at the end of your dissertation. You'll notice that any good paper leaves a trail of the ideas that inspired the work: e.g., "Aristotle originally believed that people could fly thanks to the magic of the gods. Euclid came along later, and in a series of experiments in which his grad assistants propelled themselves off cliffs, demonstrated Aristotle was wrong. He instead hypothesized that people could fly if they had wings. DaVinci designed a set of wings for human flight, but met with the same fate as Euclid's grad students. It wasn't until the Wright Brothers demonstrated the fixed-wing airplane that humans flew. Drawing on the research of Euclid, DaVinci, and the Wright Brothers, this study tests hypothesizes that we can create flying cars by fixing 1000 sparrow wing replicas on a 2021 Tesla." And then we provide references to the works of Aristotle, Euclid, etc. No need to get permission from Aristotle and his friends in the theoretical flight world!

Let me know if you have any questions and good luck with your dissertation!

JS

John L Sherry PhD
Cognitive Science
Department of Communication
Michigan State University

Appendix F: Summary and Quotes for Data Analysis Themes

Theoretical category	Initial themes	Factors	Sample Quote
DevSoc Developmental (+social)	Social influences	Social demands	"The social aspect promotes teamwork, camaraderie, where they're not just sitting and listening to a direct or remote instruction. I think that benefits them and their communication aspects as well." (P3)
DevEmo Developmental (+emotional)	Emotional influences	Emotional demands	"Emotionally, serious games help to build student confidence and that playing helps the students with ADHD learn and strengthens their knowledge of the material because it is something they want to do." (P1)
DevCog Developmental (+cognitive)	Executive function	Cognitive demands	"I believe that games give [the students] time to think. I believe they are more focused and more capable when they have time to themselves. I guess you could say they have more thinking time." (P9)
DevSoc Developmental (-social)	Social influences	Social demands	"The majority of serious games are independent-focused, so if [the students] are stuck in the game alone and haven't progressed past the initial levels or sections and keep receiving low scores, they lose interest because there isn't any enjoyable peer interaction." (P5)
DevEmo Developmental (-emotional)	Emotional influences	Emotional demands	"There could be frustrations with not being able to follow the instructions of the game, not being able to complete the task at hand because they're focused on the game part, not the learning part…" (P3)
DevCog Developmental (-cognitive)	Cognitive influences	Cognitive demands	"[students]…They don't understand enough about the content within the game to be successful." (P5)

Theoretical category	Initial themes	Factors	Sample Quote
GPMS Game play motivations (social)	Peer influences	Competition	"I noticed is that the competitiveness has increased. The majority of the [students] with ADHD love to compete." (P2)
		Camaraderie	Students "have a chance to sit with a friend, pair with somebody, and they get help by working together, even if they are working on an individual game that requires them to work or answer independently." (P7)
GPME Game play motivations (+emotional)	Intrinsic motivation	Stimulation	"When the students can relate the digital game to the games that they play at home, such as Minecraft, the games seem to stimulate the students to want to play and therefore learn in a fun and innovative way." (P8)
		Confidence builder	"During serious digital gaming, students feel emotionally confident and good about themselves…(P6)
GPMI Game play motivations (intellectual)	Cognitive training paradigms	Cognitive functions	"I think [students] just retain the material or better through gameplay. That's the outcome that we tend to notice, just better retention." (P4)
GACP Game attributes (coplay)	Coplay	Competition	"When students have the option to battle their classmates while maintaining relationships, they are more likely to learn." (P1)
		Motivation	"The most important game element that I find beneficial is the engaging lessons that allow students to have fun while playing games while still learning." (P7)
GAD Game attributes (demands)	Game design	Game elements	"I feel like game play benefits them because…they're able to have some brain time to think as the students' progress through the game." (P9)
GPME Game play motivations (-emotional)	Extrinsic motivation	Lack of engagement	"The most common challenge is that students with ADHD do not always get along during game play, which leads to students not being motivated enough to engage in the game to effectively learn." (P3)

Theoretical category	Initial themes	Factors	Sample Quote
		Lack of stimulation	Students with ADHD tend to give up easily when they're losing; they'll just quit. (P8)
		Cognitive ability	I don't think they get the benefits of the game when it's too long, it's too complicated, or there are too many parts to a question. I think those are all times when students with ADHD struggle more. (P4)
GAC Game attributes (challenges)	Game attributes	Cognitive ability	"Students with ADHD tend to suffer during game play when the problems are too complicated and not simple enough for them to break down, because cognitively, they cannot successfully answer the questions as they progress through the game." (P6)
		Game attributes	"I believe a lot of students with ADHD lose interest because they don't like a lot of busy stuff on the computer. If it's moving too much, the students will shut down and don't want to do it anymore because they can't focus." (P8)
		Unengaged	"If the game is not quick and easy, you will see students with ADHD pull back and become unengaged during game play." (P6)