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

About the Author(s)

Motivational speaker and servant leader with 16 years of experience in public school education. Six years as a math teacher, five years as an at-risk coordinator, and five years as an educational administrator. Community college lecturer and owner of Write 2 the Point Coaching, an educational consulting company. Consulted on and edited five Ph.D. dissertations, two MA theses, and one BA theses. Currently, completing a teacher's guidebook to develop effective teachers.

Keywords

Attention Deficit Hyperactivity Disorder (ADHD), Cognitive Training Paradigms, Executive Function (EF), Extrinsic Motivation, Game Attributes, Game Immersion, Intrinsic Motivation, Serious Games (SG)

Cover Page Footnote

To my incredible Walden team, Dr. Harland and Dr. Courduff, for their direction and patience throughout this journey to successfully complete the study. Thank you.



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

LaToyia R. Stewart, *Walden University*

Abstract

Attention deficient hyperactivity disorder (ADHD) is the most common childhood neurodevelopment disorder, and severe digital 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. This study aimed to explore middle school teachers' perceptions of the use of digital severe 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. Semi-structured interviews were conducted with ten 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, frustration caused by not understanding the game concepts, and time constraints that influence a student's performance within a game. The 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.

Keywords: Attention Deficit Hyperactivity Disorder (ADHD), cognitive training paradigms, executive function (EF), extrinsic motivation, game attributes, game immersion, intrinsic motivation, serious games (SG)

Introduction

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 outstanding potential for adoption in this psychotherapeutic area (Fleming et al., 2017). Digital serious games are applied games not necessarily geared towards entertainment but teach specific skills and combine learning strategies using game components (Lameras et al., 2017). As a result, serious digital games are becoming more prevalent in the educational setting in the 21st-century classroom structure.

This basic qualitative study aimed to explore the perceptions of middle school teachers related to using digital serious games for students with ADHD. This study contributed knowledge to educational technology by sharing the experiences of middle school teachers using games to support student learning, particularly with students with ADHD. The researcher 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 provided insights and challenges into how teachers use digital serious games as an innovative approach to teaching 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 serious digital games when teaching students with ADHD so that support and professional development could improve student success.

Research Method/Study Design

This basic qualitative study aimed to explore middle school teachers' perceptions of using serious games for students with ADHD. To fulfill that purpose, the researcher explored the perspectives of middle school teachers through the lens of Sherry's (2013) model for game engagement.

The RQs for this study were:

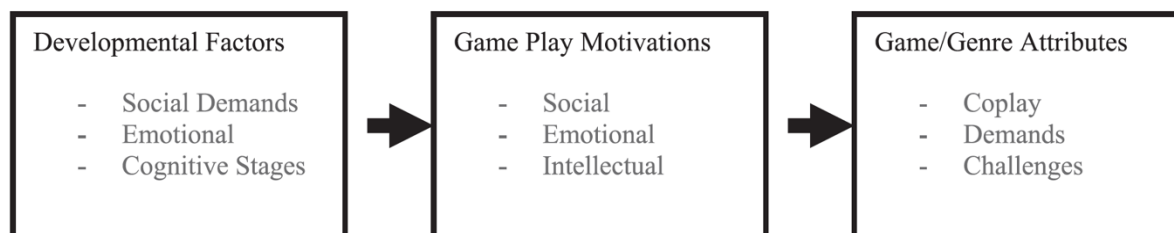
RQ1: What are middle school teachers’ perceptions regarding the benefits related to the use of digital serious games for students with ADHD?

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

In this basic qualitative research study, the researcher applied a semi-structured design to explore middle school teachers' perceptions. The researcher used purposeful sampling to study teachers actively using serious games with their students. The researcher used the three constructs from Sherry's model (2013): development factors, gameplay motivations, and game attributes for coding during data analysis. One crucial factor Sherry's (2013) research recognizes is the effect of a student's development on gameplay, an essential element of the research study. The researcher received IRB approval for this study (#02-07-22-0724944) on February 7, 2022.

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.

Participants

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 one year of experience implementing digital serious games in their classroom, and (d) had implemented digital serious games with students with ADHD.

The 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 over a year and various games to support student learning for all students, including students with ADHD.

Instrumentation

The researcher created an interview guide for this study while conducting semi-structured interviews. The interview guide is used to conduct compelling interviews for qualitative research (Castillo-Montoya, 2016). The researcher interviewed participants using the questions in Table 1; 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, the researcher aligned the interview questions to the RQs, as shown in Table 1. Table 1 displays each research question, interview question, and prompt that focuses on each construct as it relates to its subtopics. Based on Sherry's model of game engagement's three constructs: developmental factors, gameplay motivations, and game/genre attributes, the interview questions provided data to answer RQ1 and RQ2. To check for content validity for the interview protocol, the researcher polled subject matter experts on how valuable each question was and made suggested edits to the questions.

Table 1
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?

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?	<p>IQ #4: What motivational challenges do you notice from students with ADHD when playing a serious digital game?</p> <p>Prompt J: What are some of the social motivations that students with ADHD face while playing video games?</p> <p>Prompt K: How might emotional motivations have a negative impact on ADHD students during gameplay?</p> <p>Prompt L: What are some of the intellectual motivations that may have a negative impact on ADHD students during gameplay?</p>
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?	<p>IQ #5: What specific game elements have you found to be particularly successful with students with ADHD?</p> <p>Prompt M: How does coplay (peer interaction/competing) benefit students with ADHD during gameplay?</p> <p>Prompt N: What demands such as game design or game content that benefit students with ADHD during gameplay?</p> <p>Prompt O: In what ways do challenges, such as a student's experience, benefit students with ADHD during gameplay?</p>
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?	<p>IQ #6 Which specific game elements or designs are challenging for your students with ADHD?</p> <p>Prompt P: What coplay (peer interaction/competing) elements challenge students with ADHD during gameplay?</p>

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?

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?

Data Analysis

The researcher used an inductive analysis approach to analyze data (see Saldaña, 2015). Each interview was individually coded after it was transcribed. The researcher developed a codebook to aid with the coding process, as described by DeCuir-Gunby et al. (2011). Data gathered from the participant interviews and the researcher's reflections were used during the data analysis. The researcher conducted data analysis at two levels. At the first level, the researcher began by reading through the data, allowing codes to emerge, and assigning specific text segment codes that described or summarized their meaning. For the second level of data analysis, the researcher grouped emergent codes into similar groups based on the initial themes and then determined how the themes grouped into categories aligned with the conceptual framework. Finally, the researcher determined keywords and factors. As a result of these analyses, the researcher determined some factors to be at saturation, while others were repeated to support the category and initial theme.

Through the data analysis process, the researcher developed 15 factors that correlated to the categories, subcategories, and initial themes from Sherry's model of game engagement. Some factors were repeated based on the category and initial theme. Appendix F shows categories,

subcategories, initial themes, factors, and an exemplar quote that best describes the data coded under that particular theme. There was no discrepant data, which did not impact data analysis.

The first category was titled developmental factors and included three subcategories, social, emotional, and cognitive components, about Sherry's (2013) model of game engagement. This category produced three themes: social influences, emotional influences, and execution function, according to 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 social influences and included two repeated factors supporting 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 emotional influences and included two repeated factors supporting 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 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 gameplay.

The second category was titled gameplay motivations and included three subcategories, social, emotional, and intellectual components, about 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 gameplay motivations. P2 and P7 quote embody the importance of peer influences in the social subcategory of gameplay motivations. The theme of peer influences includes two factors; the competition factor will be repeated in category 3, which the researcher described in detail in the results section. The second theme was titled intrinsic motivation and included two factors. This theme was applied

to data that teachers perceived as intrinsic motivation, contributing to the emotional subcategory of gameplay motivations. To support the two factors, P8's quote supported the first factor, and P6's quote supported the second factor, which the researcher described in detail in the results section. The third theme, titled extrinsic motivation, included three factors. This theme applied to the data teachers perceived as extrinsic motivation contributing to the emotional subcategory of gameplay motivations. P3, P8, and P4 quotes supported each factor and the importance of extrinsic motivation to the emotional subcategory of gameplay motivations. The theme of extrinsic motivation included a total of three factors. The factor of cognitive ability will be repeated in category 3, which the researcher described 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 gameplay motivation. P4's quote exemplified the importance of cognitive paradigm training to the intellectual subcategory, which the researcher detailed in the results section.

The final category was titled game attributes and included three subcategories: coplay, demands, and challenges, which are related 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 the researcher described 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 on how teachers perceived coplay contributing to the coplay subcategory of game attributes. P1 and P7 quotes represent the importance of coplay in supporting the coplay subcategory of gameplay motivations, which the researcher described in detail in the results section. The second theme was game design, which included one factor representing the demands subcategory of game attributes. This theme applied to data on what teachers perceived about game design contributing to the demand's subcategory of game attributes. A quote from P9 explains how the factor and subcategory support the theme, which the researcher described 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 challenge's subcategory of game attributes. The factor of 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 challenge's subcategory of game attributes, which the researcher described in detail in the results section.

Results

Research Question 1: Benefits

The first RQ was: What are middle school teachers' perceptions regarding the benefits related to the use of serious digital games for students with ADHD? The researcher asked teachers to reflect on using serious games to support students with ADHD. The researcher used Sherry's (2013) model of game engagement to categorize the responses teachers shared during the semi-structured interviews. There were three categories: developmental factors, gameplay 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 2).

Table 2

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	Gameplay motivation (social)	Peer influences	Competition	5	P1, P2, P4, P6, P8
			Camaraderie	4	P4, P5, P7, P9
GPME	Gameplay motivation (emotional)	Intrinsic motivation	Stimulation	6	P1, P3, P5, P6, P8, P9

			Confidence builder	5	P3, P4, P6, P7, P9
GPMI	Gameplay 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

Research Question 2: Challenges

The second RQ was: What are middle school teachers' perceptions regarding the challenges of using serious digital games for students with ADHD? The researcher asked teachers to reflect on their challenges when using serious games to support students with ADHD. The researcher used Sherry's (2013) model of game engagement to categorize the responses teachers shared during the semi-structured interviews. There were three categories: developmental factors, gameplay motivations, and game/genre attributes, which included five themes: social influences, emotional influences, cognitive influences, extrinsic motivation, and game attributes, which included nine factors (see Table 3).

Table 3

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		External motivation	Lack of engagement	5	P1, P3, P4, P5, P6

	Gameplay motivation (emotional)		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

The researcher reported on the 15 factors derived from data based on the categories, subcategories, and 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 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, and
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 as more likely to retain information, interact with the content more deeply, and possibly at a higher level.

Participants thought that increased student competitiveness during gameplay was inevitable, that competition motivated students to want to play 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 attributes 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 gameplay if there are multiple sections, the instructions are unclear, or there is more than one question on a page.

Interpretations of the Findings

In this section, the researcher discussed how the study findings confirm, disconfirm, or extend what is known in the literature. The researcher organized the discussion using the two research questions and the associated key findings, which are described in the 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 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). This study was an extension of the results from Omega (2020), where 13 middle school teachers shared the importance of higher-level or serious games encouraging critical thought, teamwork, and cooperation to come to an objective resolution. This 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 this 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 and 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 this study extended to apply to students with ADHD.

The data from this study showed that digital serious games help to build student confidence and emotionally stimulate students with ADHD to complete tasks during gaming. That is an extension of Dang and Koedinger's (2019) study, in which researchers found that students' ability to regulate thoughts, emotions, and behaviors links to their task-specific motivational goals and dispositions during gaming. Calinoiu (2019) reported similar findings that exploring the gamer's control influenced their actions and aim to achieve motivational and satisfying results during gameplay. Teachers in this study reported that a third benefit for students with ADHD playing serious games is that 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 by Sailer et al. (2017) that competition caused by leaderboards can create social pressure to increase player engagement, positively affecting participation and learning among ADHD students. 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 Lameris 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 essential 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. It extends the findings of Sun and Hsieh (2018) that integrating the gamification element within a classroom makes classes more exciting 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 play a significant role, thus wrapping up the learning process in the game's structure to help visualize the goal, a set of rules, and a transparent reward system for the students.

Research Question 2: Challenges

Teachers in this study reported that 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 adverse risk factor for poor reactions through affecting skills required for competent lifelong social

functioning, which is an element confirmed by teachers in 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 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) regarding students with ADHD and that children tend to show several aggressive behaviors, making it difficult to establish and maintain friendly relationships, which could hinder compelling gameplay.

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 and are frustrated, which can cause them to shut down or become angry when they see others cheating because they feel that the competition is not fair within the game. Teachers in this study described various emotional challenges during gameplay, 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 significant 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 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 specific barriers are overcome. This study may extend the difficulty students with ADHD have with working memory, reading comprehension, and attention, as Ovadya (2020)

reported, which may be 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 gameplay.

The teachers reported a final challenge for students with ADHD playing serious games as a game attribute related to the complicated structure or inflexible time limits to 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.

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 ten middle school teachers, seven general education teachers, two special education teachers, and one technology teacher in a middle school in several districts in the southern United States. The researcher recommends that this study be replicated with a larger sample of middle school teachers to determine whether the 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 using digital serious games for students with ADHD.

The second recommendation is related to the study research finding; teachers shared that the aspect of the game element provides a safe place for repetition with instant feedback and progress that moves with their ability. The researcher recommends 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 considers 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 was based on the study finding that teachers perceive that cognitively, students have difficulty reading instructions and will lose motivation if they do not progress. The researcher recommends conducting studies to confirm or disconfirm how cognitive ability alone affects learning through gameplay. 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 gameplay.

Conclusion

The problem related to this study is that little is understood about the perceptions of middle school teachers regarding the use of digital serious games for students with ADHD. This basic qualitative study aimed to explore these perceptions. To accomplish this, the researcher interviewed ten middle school teachers in grades 6 through 8 who have used digital serious games to support students with ADHD.

The critical findings for RQ1 were that middle school teachers found digital serious games 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 as more likely to retain information, interact with the content more deeply, and possibly at a higher level. Teachers thought that increased student

competitiveness during gameplay 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 critical findings for RQ2 were that middle school teachers found digital serious games 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 gameplay 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.

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Appendix: 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 Cognitive ability	Students with ADHD tend to give up easily when they’re losing; they’ll just quit. (P8) They do not get the benefits of the game when it's too long, too complicated, or 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 gameplay 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 many students with ADHD lose interest because they do not like much busy stuff on the computer. If it moves too much, the students will shut down and do not want to do it anymore because they cannot 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)