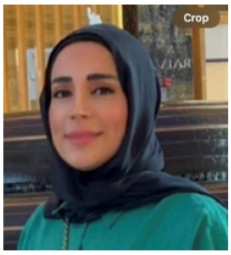
باب اللغة الإنكليزية وآدابها:

1. Exploring the Full Spectrum of ADHD: Investigating Teachers' Perceptions and the Effectiveness of AI in Supporting ADHD Learners

استكشاف الطيف الكامل لاضطراب فرط الحركة ونقص الانتباه: دراسة تصورات المعلمين وفعالية الذكاء الاصطناعي في دعم المتعلمين المصابين باضطراب فرط الحركة ونقص الانتباه



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Abstract:

Attention–Deficit Hyperactivity Disorder (ADHD) is a complex neurodevelopmental disorder that affects children and adults, characterized by symptoms such as inattention, hyperactivity, impulsivity, emotional dysregulation, and executive functioning difficulties. Its development is influenced by a combination of genetic, neurobiological, environmental,

and psychosocial factors, including prenatal exposures, family stress, diet, neuro-inflammation, and epigenetic modifications. Untreated ADHD can lead to significant academic, social, emotional, and health-related challenges, highlighting the importance of early diagnosis and intervention. Effective management often requires a multimodal approach, combining behavioral therapies, medication, parent training, school-based support, and emerging digital tools tailored to individual needs. Speech and educational therapies further support communication, executive functioning, and learning outcomes. This in return helps in enabling personalized learning, increased engagement, and adaptive support, while highlighting the necessity of teacher supervision to avoid over-reliance or overstimulation. This comprehensive review underscores the multifaceted nature of ADHD and the importance of individualized, evidence-based interventions to improve quality of life and foster personal and academic growth. Perceptions of ADHD teachers concerning their knowledge and awareness level of this disorder and advancements in addressing it were investigated through on one-to-one basis structured interviews as a data collection tool to gather qualitative insights.

Keywords: Attention-Deficit/Hyperactivity Disorder, neurodevelopmental disorder, emotional dysregulation, multimodal intervention, speech and educational therapy, artificial intelligence

المستخلص باللغة العربية:

اضطراب نقص الانتباه وفرط النشاط (ADHD) هو اضطراب عصبي نمائي معقد يصيب الأطفال والبالغين، ويتسم بأعراض مثل ضعف الانتباه، وفرط النشاط، والاندفاعية، واضطرابات التنظيم الانفعالي، وصعوبات في الوظائف التنفيذية. ويتأثر تطوره بمجموعة من العوامل الوراثية والعصبية الحيوية والبيئية والنفسية الاجتماعية، بما في ذلك التعرض للعوامل المؤثرة قبل الولادة، والضغوط الأسرية، والعوامل الغذائية، والالتهابات العصبية، والتغيرات اللاجينية.

وقد يؤدي عدم علاج اضطراب نقص الانتباه وفرط النشاط إلى تحديات أكاديمية واجتماعية وعاطفية وصحية كبيرة، مما يبرز أهمية التشخيص المبكر والتدخل الفعّال. وغالبًا ما تتطلب إدارته نهجًا متعدد الأبعاد يجمع بين العلاجات السلوكية، والعلاج الدوائي، وتدريب الوالدين، والدعم المدرسي،

والأدوات الرقمية الحديثة المصممة لتلبية الاحتياجات الفردية.

كما تسهم علاجات النطق والتدخلات التربوية في تعزيز مهارات التواصل، والوظائف التنفيذية، ومخرجات التعلم. ويساعد ذلك بدوره على دعم التعلم الشخصي، وزيادة مستوى المشاركة، وتوفير الدعم التكيفي، مع التأكيد على أهمية إشراف المعلمين لتجنب الاعتماد المفرط على التقنيات الحديثة أو التعرض للتحفيز الزائد.

وتبرز هذه المراجعة الشاملة الطبيعة متعددة الأبعاد لاضطراب نقص الانتباه وفرط النشاط، وأهمية التدخلات الفردية القائمة على الأدلة في تحسين جودة الحياة وتعزيز النمو الشخصي والأكاديمي. كما تم استقصاء آراء المعلمين بشأن مستوى معرفتهم ووعيهم بهذا الاضطراب، ومدى اطلاعهم على المستجدات والتطورات الحديثة في أساليب التعامل معه، وذلك من خلال إجراء مقابلات فردية منظمة استُخدمت أداةً لجمع البيانات النوعية وتحليلها.

الكلمات المفتاحية: اضطراب نقص الانتباه وفرط النشاط (ADHD)؛ الاضطرابات العصبية النمائية؛ التنظيم الانفعالي؛ التدخل متعدد الأبعاد؛ علاج النطق؛ التدخلات التربوية؛ الذكاء الاصطناعي.

1. Introduction

With the myriad responsibilities of parents that run on incessantly comes the struggle of some of them to determine whether certain behaviors exhibited by their children are alarming or not. The recent breakthroughs in early detection and professional diagnosis of new behavioral diseases made some parents, being avid readers and knowledgeable about this all, tend to scrutinize every move their child engages in to determine whether they should refer them to a specialist or not. Attention-deficit hyperactivity disorder (ADHD) is among these behavioral neurodevelopmental disorders that make parents stop with big inquiries urging them to go for a specialist's consultation (Furman, 2005).

In today's fast-paced world, parents are tasked with a multitude of responsibilities that can feel overwhelming. From managing daily routines to ensuring their children's well-being, the job of a parent never truly ends. However, with the rapid advancements in medical research and the growing availability of information, many parents are increasingly vigilant

about their children's development. The rise of online resources, social media discussions, and more comprehensive awareness about various behavioral and neurodevelopmental disorders has led some parents to scrutinize their children's behavior more closely.

ADHD, a neurodevelopmental disorder that affects both children and adults, is characterized by symptoms such as inattention, impulsivity, and hyperactivity. These behaviors can sometimes be mistaken for normal childhood development, leading many parents to wonder whether their child's actions are indicative of something more serious. The difficulty, however, lies in distinguishing between behaviors that are simply part of growing up and those that might signal a developmental issue. As awareness of ADHD has increased in recent years, so has the pressure on parents to determine whether their child's behavior is just a phase or a sign of a disorder that requires professional intervention.

The challenge is compounded by the growing body of research that emphasizes the importance of early diagnosis and intervention for conditions like ADHD. Studies have shown that the sooner a child with ADHD is diagnosed, the more effective treatment can be in helping them manage symptoms and succeed in both academic and social settings (Faraone, et al., 2021). However, with so many potential behavioral markers to consider, it's easy for parents to feel uncertain about when and how to seek professional help. This uncertainty often leads to a dilemma: should they simply wait for the behavior to pass, or should they take the step of consulting a specialist?

Additionally, the increasing prevalence of ADHD diagnoses in recent years has sparked debates within the medical community about the accuracy of diagnosis and the potential for overdiagnosis. According to a study by Polanczyk et al. (2022), the global prevalence of ADHD is estimated to be around 5%, with significant variability across different regions and cultures. While some experts argue that ADHD is underdiagnosed, particularly

in certain demographic groups, others worry that the growing trend of diagnosing ADHD may lead to over-diagnosis, especially in cases where behaviors are misinterpreted as symptoms of the disorder rather than normal childhood behaviors.

For parents, the expanding research on ADHD can be simultaneously informative and daunting. It is essential to recognize not only the clinical features of the disorder but also the social, emotional, and psychological challenges that parents encounter while managing and supporting their children. The question remains: How can parents determine when it's time to seek professional help, and how can they differentiate between typical childhood behavior and symptoms of a behavioral disorder such as ADHD?

The most common neurobehavioral condition in children is recognized to be attention-deficit hyperactivity disorder (ADHD). It is not a sickness as a whole, but rather a confluence of symptoms that cause a particular behavioral trajectory for a range of emotional, psychological, and learning challenges (Furman, 2005). According to Docking (2013), children diagnosed with ADHD typically have significant social and play deficiencies that result in social rejection from peers and a limited circle of friends. These circumstances may lead to long-term or permanent unfavorable outcomes, such as mental health problems and antisocial conduct. Due to symptoms that are closely related to the two main features of ADHD—hyperactivity and inattention—children with ADHD typically have low literacy and poor communication skills (Hawkins, 2016).

2. Statement of the Problem

Despite extensive research on ADHD and the documented effectiveness of pharmacological and behavioral interventions, challenges persist in translating evidence-based strategies into daily classroom practice. Teachers frequently encounter students who demonstrate attention regulation difficulties, impulsive behaviors, and organizational challenges, yet many educators receive limited structured guidance on integrating

supportive technological tools effectively. Although AI-based educational platforms are increasingly available, there remains insufficient qualitative research exploring how teachers perceive their usefulness specifically for students with ADHD. Moreover, while AI technologies are promoted as enhancing engagement and personalization, concerns regarding dependency, cognitive overstimulation, reduced interpersonal interaction, and inconsistent training among educators complicate their implementation. Without a clear understanding of teachers' experiences and evaluative criteria, the integration of AI in inclusive classrooms risks becoming inconsistent or superficial. This study addresses the need to explore educators' perspectives on both the opportunities and limitations of AI tools in supporting students with ADHD.

3.Research Questions

This study seeks to explore the following questions:

1- How do teachers perceive the potential benefits of AI tools when teaching students with ADHD? 2- What concerns or challenges do educators anticipate or experience when integrating AI into ADHD-inclusive classrooms?

3- In what ways can AI tools be adapted to accommodate the specific cognitive and behavioral characteristics of students with ADHD?

4- What role do teachers believe they should maintain when AI technologies are used in instructional settings?

5- How do educators evaluate the effectiveness of AI tools in improving academic engagement and learning outcomes for students diagnosed with ADHD?

4.Purpose of the Study

The purpose of this study is to explore teachers' perceptions regarding the integration of AI tools in classrooms that include students with ADHD. It also aims to identify perceived benefits, examine practical challenges,

understand how digital tools can be tailored to individual learning needs, clarify the role of teacher supervision, and determine the indicators educators use to assess effectiveness.

5.Literature Review

This literature review explores previous studies on ADHD focusing on its symptoms,

Symptoms of ADHD, consequences of neglecting it, and the different approaches used for management and intervention.

Attention-Deficit Hyperactivity Disorder (ADHD) is a complex neurodevelopmental disorder that manifests in various ways, with distinct symptoms that impact an individual's ability to function effectively in daily life. These symptoms can be categorized into several core areas: inattention, hyperactivity, impulsivity, emotional dysregulation, executive functioning issues, cognitive impairments, and sleep disturbances. Each of these symptoms plays a significant role in how ADHD affects individuals, influencing their academic, social, and professional lives. These are the symptoms with their implications.

Inattention is one of the hallmark features of ADHD. People who struggle with inattention may find it difficult to stay focused on tasks, often becoming easily distracted by unrelated stimuli. This leads to challenges in completing tasks, whether they are academic assignments, work duties, or even everyday chores. Individuals with ADHD may start tasks but have trouble finishing them, frequently forgetting key steps along the way. In conversations, they may lose track of what is being discussed, appearing as though they are not listening. This can result in mistakes that seem careless or avoidable, such as overlooking instructions or details in work and school assignments. According to the American Psychiatric Association (APA, 2013), hyperactivity, another key symptom of ADHD, involves an overwhelming sense of restlessness. Individuals with ADHD often find it difficult to sit still, frequently fidgeting or squirming in their seats. This

constant physical activity is usually accompanied by an inner sense of urgency or the need to be constantly moving. People with ADHD may talk excessively, interrupt others, or have difficulty waiting their turn in conversations or activities. The APA (2013) notes that hyperactivity is not just about being physically active but reflects an inability to regulate one's physical state in situations where calmness and stillness are required, such as in classrooms or during meetings. This impulsive energy can make it difficult for individuals to engage in activities that require sustained attention or quiet focus, such as reading or listening to a lecture.

Impulsivity is closely related to both inattention and hyperactivity, but it is distinct in that it involves acting without thinking. People with ADHD may make snap decisions, answer questions before the full question is asked, or blurt out thoughts without considering the consequences. This impulsiveness can lead to interpersonal difficulties, as individuals may interrupt others or act inappropriately in social settings. According to the APA (2013), impulsivity also manifests in decision-making, where individuals may struggle to delay gratification or consider long-term consequences before acting. This impulsivity can lead to risky behaviors, poor judgment, and difficulty with self-control, impacting not only social interactions but also personal and professional choices.

Emotional dysregulation is another symptom that is often overlooked but can have a significant impact on individuals with ADHD. People with ADHD may experience intense emotional reactions, such as frustration, anger, or irritability, that seem out of proportion to the situation at hand. These emotional outbursts can occur quickly and without warning, leading to mood swings that are difficult for others to understand. According to Barkley (2020), emotional dysregulation in ADHD can make it harder for individuals to manage stress or disappointment, resulting in feelings of being overwhelmed. This can affect relationships, as those with ADHD may struggle to control their emotions in social interactions or workplace settings, potentially leading to conflicts or misunderstandings.

Another critical aspect of ADHD is executive functioning issues. Executive functions refer to the cognitive processes that allow individuals to plan, organize, prioritize, and manage time effectively. For people with ADHD, these functions are often impaired, making it difficult to set clear goals, follow through on tasks, or stay organized. Barkley (2020) explains that individuals with ADHD may struggle with tasks that require future planning, such as managing deadlines or preparing for upcoming events. They might also have difficulty prioritizing tasks, often focusing on less important activities while neglecting more urgent ones. These executive function deficits can significantly affect academic and occupational performance, as well as daily life management.

Cognitive impairments are also frequently associated with ADHD. Recent research has shown that individuals with ADHD often experience deficits in areas such as working memory, cognitive flexibility, and inhibitory control. These cognitive functions are crucial for managing complex tasks, adapting to new situations, and controlling impulses. Tamm et al. (2023) highlight that these cognitive difficulties can make it harder for individuals to switch between tasks, remember instructions, or adjust to changing demands. For example, someone with ADHD might struggle to remember important details from a conversation or find it challenging to adjust to new rules in a game or work setting. These cognitive challenges can create significant barriers in academic.

Finally, sleep disturbances are a common yet often overlooked symptom of ADHD. Recent studies, such as those by Sung et al. (2023), have shown that individuals with ADHD are more likely to experience sleep problems, including insomnia, difficulty falling asleep, and restless nights. These sleep issues can exacerbate other ADHD symptoms, such as inattention and hyperactivity, creating a cycle where poor sleep worsens cognitive and emotional functioning. Sleep deprivation can lead to increased irritability, difficulty concentrating, and even mood swings, which can further impair social and academic performance. The relationship between ADHD and

sleep is complex, as both conditions can mutually reinforce each other, making it critical for individuals with ADHD to address sleep problems as part of their overall treatment plan.

In a nutshell, ADHD is a multifaceted disorder that affects various aspects of an individual's life, from attention and behavior to emotional regulation and cognitive functioning. Each of these symptoms—whether it is inattention, hyperactivity, impulsivity, emotional dysregulation, executive functioning challenges, cognitive impairments, or sleep disturbances—presents unique challenges that require a comprehensive understanding and approach. Recent research continues to highlight the importance of early diagnosis and intervention to help individuals with ADHD manage these symptoms and improve their quality of life.

Attention-Deficit/Hyperactivity Disorder (ADHD) is recognized as a multifaceted neurodevelopmental condition shaped by the interaction of biological predispositions and environmental influences. Rather than resulting from a single cause, ADHD emerges from overlapping genetic, neurological, environmental, psychosocial, nutritional, and immunological factors. Contemporary research emphasizes that these contributors do not operate independently; instead, they interact across development to influence symptom presentation and severity.

A substantial body of research highlights the influence of genetic vulnerability in ADHD. Twin and family studies consistently report high heritability estimates, suggesting that inherited factors play a significant role in the likelihood of developing the disorder. Advances in molecular genetics have identified gene variants involved in dopamine regulation and neural signaling pathways that appear to contribute to attentional control and behavioral inhibition (Faraone et al., 2023). Dopamine plays a central role in motivation, reward processing, and executive functioning, which helps explain why disruptions in dopaminergic systems are associated with hallmark ADHD symptoms such as impulsivity and inattention. These

findings reinforce the understanding that ADHD has a strong biological foundation and is not merely the result of environmental circumstances or parenting style.

Neurodevelopmental research further clarifies the biological underpinnings of ADHD. Neuroimaging studies indicate that individuals with ADHD often show differences in the maturation and connectivity of brain networks responsible for executive control, sustained attention, and self-regulation (Sowell et al., 2023). Rather than reflecting structural damage, many findings suggest variations in developmental timing and neural efficiency. Such differences may contribute to difficulties in organizing tasks, managing impulses, and maintaining focus. This neurological perspective shifts the narrative away from behavioral blame and toward a developmental framework grounded in brain function.

Environmental influences, particularly during prenatal and early developmental stages, also play an important role in shaping ADHD risk. Research has linked prenatal exposure to tobacco smoke, alcohol, and environmental toxins to an increased likelihood of later ADHD symptoms (Perry et al., 2023). These exposures may interfere with fetal brain development and disrupt early neural pathways involved in attention and regulation. Importantly, emerging evidence suggests that environmental factors may influence gene activity through epigenetic mechanisms. Epigenetic modifications—such as changes in DNA methylation—can alter how genes are expressed without modifying the genetic code itself (Liu et al., 2023). This interaction between inherited susceptibility and environmental exposure provides a compelling explanation for why ADHD may cluster in families while still showing variability in severity and presentation.

Psychosocial conditions further influence developmental outcomes. Chronic family stress, parental psychological difficulties, and socioeconomic adversity have been associated with increased symptom expression and functional impairment in children with ADHD (Cohen et al., 2023). Persistent stress can

affect hormonal systems and emotional regulation, potentially intensifying attention and behavioral difficulties. Although psychosocial adversity does not independently cause ADHD, it may amplify vulnerabilities in genetically predisposed individuals and shape long-term adjustment.

Nutritional factors have also been explored as potential contributors. Some evidence suggests that excessive consumption of refined sugars and artificial food additives may exacerbate symptoms in certain children, while deficiencies in nutrients such as omega-3 fatty acids, iron, and zinc may be associated with attentional difficulties (Keller et al., 2023; Gomez-Pinilla, 2022). While diet alone does not account for ADHD, nutritional balance may influence symptom intensity and response to treatment, supporting the importance of a holistic management approach. More recently, researchers have investigated the role of immune and inflammatory processes. Elevated inflammatory markers have been observed in some individuals with ADHD, leading to hypotheses that neuro-inflammatory responses may affect neurotransmitter systems involved in cognitive control (Zhang et al., 2023). Although this area remains under investigation, it expands current understanding by suggesting that immune system functioning could interact with neurological pathways in shaping symptoms. Taken together, the evidence indicates that ADHD results from a complex interplay of inherited predispositions, brain development patterns, environmental exposures, psychosocial stressors, nutritional influences, and possibly immune-related mechanisms. No single pathway fully explains the condition. Instead, ADHD reflects the cumulative and interactive effects of biological and contextual factors across development.

5.1 Consequences of Untreated ADHD

When ADHD remains unrecognized or untreated, its impact may extend across multiple domains of life. Academic functioning is often one of the earliest areas affected. Students with untreated ADHD commonly experience difficulties with organization, sustained attention, and task completion, which

may result in lower academic performance and increased risk of school failure (Sandler et al., 2023). Over time, repeated academic struggles can negatively influence self-esteem and educational attainment.

Mental health outcomes are also a significant concern. Individuals with untreated ADHD show higher rates of comorbid conditions, including anxiety disorders, depressive symptoms, and substance misuse (Miller et al., 2023). The persistent experience of underachievement and social difficulty may contribute to emotional distress, compounding functional impairment. In adulthood, untreated ADHD can affect occupational stability. Difficulties with time management, planning, and sustained concentration may lead to reduced job performance, increased absenteeism, and limited career progression (Goldberg et al., 2023). These challenges can contribute to financial stress and decreased professional satisfaction. Interpersonal relationships may also be strained. Impulsivity, forgetfulness, and emotional dysregulation can generate misunderstandings and conflict within family and romantic relationships (McCarthy et al., 2023). Over time, these patterns may reduce relationship quality and overall life satisfaction. Additionally, untreated ADHD has been associated with increased engagement in risky behaviors, including substance misuse and unsafe driving practices (Johnson et al., 2023). Long-term health consequences have also been reported, with higher rates of obesity, cardiovascular risk factors, and metabolic conditions observed in some untreated populations (Smith et al., 2024). These outcomes highlight the importance of timely identification and intervention.

5.2 Classical and Contemporary Interventions

Early and comprehensive intervention plays a critical role in improving outcomes for individuals with ADHD. Research consistently supports multimodal treatment approaches that combine pharmacological management with behavioral therapies. The integration of stimulant medication and cognitive-behavioral therapy has been shown to produce

meaningful improvements in symptom control and daily functioning (Thapar et al., 2023).

Parent training programs represent another effective strategy, equipping caregivers with behavioral management techniques that promote consistency and positive reinforcement (Barkley et al., 2024). Such programs not only reduce symptom severity but also enhance family dynamics. School-based interventions are equally essential. Individualized educational plans and classroom accommodations have been associated with improved academic engagement and behavioral regulation (Miller et al., 2024). These supports often include structured routines, task segmentation, and organizational scaffolding.

Emerging approaches incorporate digital tools designed to support time management and self-monitoring skills (Anderson et al., 2023). In addition, mindfulness-based practices have demonstrated potential benefits in enhancing attentional control and reducing emotional reactivity (Gordon et al., 2024). Speech and educational therapists also contribute meaningfully to intervention efforts. Speech-language therapy may address pragmatic communication and language organization difficulties (Krause et al., 2024), while educational therapy focuses on individualized learning strategies and cognitive-behavioral techniques to strengthen academic skills (Lee et al., 2023). Together, these interventions support functional improvement across communication, academic performance, and daily living.

Emerging research investigated the efficacy of digital tools and applications aimed to assist control ADHD symptoms. These technologies, which include ADHD-specific applications for time management, organization, and self-monitoring, have showed promise in helping people with ADHD by improving self-regulation and delivering real-time feedback (Anderson et al., 2023). School-Based treatments: A 2024 research emphasizes the need of school-based treatments for ADHD. Individualized education plans (IEPs) and classroom adjustments have been found to greatly improve

academic performance and conduct in the classroom (Miller et al., 2024).

Mindfulness and stress reduction practices: Recent research has shown that mindfulness and stress reduction practices can help manage ADHD symptoms. Mindfulness meditation and yoga have been demonstrated to increase attention while also reducing impulsivity and anxiety (Gordon et al., 2024). These new studies demonstrate a wide range of successful ADHD therapies, emphasizing the significance of a tailored and diverse approach to treatment. Speech and educational therapists both play important roles in controlling ADHD by providing individualized therapies suited to each individual's specific requirements. Here's a summary based on recent studies:

Educational therapists provide individualized interventions to meet the unique academic obstacles that people with ADHD confront. Recent research has shown that customized educational plans (IEPs) and tailored learning techniques can improve focus, organization, and task completion (Smith et al., 2024). These tactics frequently entail breaking down activities into manageable parts and use organizing tools to facilitate learning. Educational therapists commonly use behavioral and cognitive tactics to help kids with ADHD. This includes tactics like self-monitoring, goal-setting, and cognitive restructuring to assist students in developing better study habits and improving their academic performance (Lee et al., 2023). Recent study has demonstrated the effectiveness of these strategies in increasing engagement and lowering academic challenges.

Individuals with ADHD benefit greatly from both speech and educational therapy. Their solutions target specific deficiencies and problems, resulting in improved communication, academic performance, and general well-being.

6. Methodology

6.1 Research Design

This study adopted a qualitative research design in order to explore teachers' perceptions of integrating artificial intelligence (AI) tools in classrooms that include students with Attention-Deficit/Hyperactivity Disorder (ADHD). A qualitative approach was considered appropriate because the aim of the study was not to measure numerical outcomes, but rather to gain an in-depth understanding of teachers' experiences, beliefs, and concerns regarding AI integration. Through open-ended questioning and interactive discussion, the research sought to capture rich, detailed insights that could not be obtained through standardized surveys alone.

A semi-structured interview format was selected as the primary data collection method. This design allowed the researcher to prepare guiding questions while still giving participants the freedom to elaborate on their responses, provide examples from their classrooms, and raise additional points that they considered important. The semi-structured approach ensured consistency across interviews while maintaining flexibility to explore emerging themes. The study followed an exploratory framework. Since the integration of AI tools for students with ADHD is still an evolving area in educational practice, the research aimed to identify patterns, perceptions, and recurring themes rather than test a predetermined hypothesis. Data were analyzed thematically. After conducting the interviews, responses were carefully reviewed, coded, and grouped into categories reflecting benefits, challenges, teacher roles, evaluation methods, and selection criteria for AI tools. This process allowed common themes and contrasting viewpoints to emerge naturally from the data.

6.2 Participants

The participants in this study consisted of five teachers working at LWAH. All participants were actively teaching in classrooms that include students diagnosed with ADHD. Their ages ranged from 21 to 38 years old,

representing a mix of early-career and more experienced educators. This variation in age and teaching experience contributed to diverse perspectives regarding the use of technology in education. The teachers were selected using purposive sampling. They were chosen specifically because they had practical experience both with ADHD students and with the integration of digital or AI-based tools in their teaching. Participation was voluntary. Each teacher was informed about the purpose of the study and assured that their responses would remain confidential. To maintain anonymity, participants were referred to by initials rather than full names throughout the research.

Although the sample size was limited, the goal of the study was depth rather than generalization. The small group allowed for detailed, meaningful discussions and provided valuable insight into classroom practices within this specific educational context.

6.3 Instruments

The primary instrument used in this study was a semi-structured interview guide developed by the researchers. The interview guide consisted of five main questions, each focusing on a central theme related to AI integration and ADHD education. These questions addressed perceived benefits, anticipated challenges, customization of AI tools, the teacher's role, and methods for evaluating effectiveness. In addition to the main questions, probing questions were used when necessary to encourage participants to clarify their responses or provide concrete classroom examples. The interview guide was reviewed to ensure that the questions were clear, relevant, and aligned with the research objectives. Interviews were conducted individually to allow participants to speak freely without influence from colleagues. Each interview lasted approximately 25–35 minutes. With participants' consent, notes were taken during the interviews to ensure accurate documentation of responses.

6.4 Tools and Data Collection Procedures

Data collection took place within the school setting in a quiet and comfortable environment to encourage open discussion. Interviews were conducted face-to-face, allowing for natural interaction and observation of participants' expressions and tone. The AI tools discussed during the interviews included digital learning platforms and interactive technologies commonly used in classrooms, such as interactive boards and educational websites. While the research did not involve direct experimental implementation of specific tools, teachers reflected on their real classroom experiences using these technologies with ADHD students. Following data collection, the researchers organized the responses and began the process of thematic analysis. Similar ideas and recurring concepts were grouped together under broader themes, such as engagement, personalization, over-reliance, teacher supervision, and evaluation indicators. Attention was given to both shared opinions and contrasting viewpoints to present a balanced interpretation of the findings.

Ethical considerations were respected throughout the study. Participants were informed about the purpose of the research, their right to withdraw at any time, and the confidentiality of their responses. No identifying information was disclosed, and all data were used strictly for academic purposes.

6.5 Reporting and analyzing the findings

In order to explore the benefits and challenges of integrating AI tools inside a classroom that includes students with ADHD, individual interviews were conducted with 5 teachers at LWAH.

Teachers were questioned about their insights of AI's probable advantages for students with ADHD, including examples of helpful tools. They also discussed anticipated challenges or concerns related to integrating AI into the classroom, such as possible drawbacks. Further questions explored how AI tools could be tailored to meet the specific needs of ADHD students,

the key factors in selecting effective AI-based learning programs, and the role teachers should play in guiding AI use. Finally, teachers were asked how they would evaluate the effectiveness of these tools and what indicators would help determine improvements in learning outcomes for ADHD students.

1. Question: How do you perceive the potential benefits of using AI tools in teaching students with ADHD? Can you share any specific examples of AI tools you believe might be helpful?

The research revealed that AI tools offers several crucial benefits in education, including maintaining focus and interaction of students especially for those with ADHD, as well as being able to provide tailored and personalized learning experiences, besides the adaptive organization and pace that these tools contribute to. Most participants acknowledged the positive impact of involving AI tools in the educational process. According to instructor S.M. (21 years old) one of these 5 participants "AI tools increases and heightens students' attention and motivates them to interact with the lesson explained as opposed to times where AI tools are not involved in the teaching process".

Several AI tools were mentioned in this research, including the active board, different websites like Kahoot, Word Wall and Quizlet. These tools were found to be most effective in providing a clear structure for a modified learning environment and in offering a tailored strategy that allowed minimal distracting opportunities. Four out of five participants reported that they typically choose AI tools based on a range of different criteria like the movements, colors, music and familiarity of the characters involved. Instructor R.S. (25 years old) reported that "the results of the assessments, and evaluations done in class, as well as the overall focused state of students determines whether the chosen AI tool is effective or not".

Overall, instructors noted that AI tools can facilitate the personalized learning experience for students with ADHD, however, concerns still arise

when it comes to long-term efficiency and constraints.

2.Question: What challenges or concerns do you have about integrating AI into the classroom for ADHD students? Are there any potential drawbacks you anticipate?

Three out of five Participants communicated apprehension that increased use of AI could lead to over-reliance, and over-stimulation possibly reducing critical thinking or teacher-student interaction. The remaining two participants highlighted the importance of balancing AI use with significant interpersonal engagement. They reported that the value of integrating AI into the classroom for ADHD students depended on the frequency and efficiency of the tools. Instructor R.S. insisted that "integrating AI tools in my classroom has been rewarding as long as I know when and how to use them as well as which tool is suitable".

Teachers expressed mixed views on the use of AI for supporting ADHD students, with many highlighting the greater flexibility and increased engagement when using AI-driven platforms. Nevertheless, concerns were raised by some teachers regarding the limitations of AI in addressing the behavioral aspects of ADHD. Teachers noted that while AI offers structure, it may fall short in addressing impulsiveness, motivation, or attention span without human intervention. To illustrate, two teachers showed resistance to adopting AI, citing a lack of training, trust, or belief in its long-term effectiveness. Despite acknowledging AI's potential, they maintained that it should remain a supplementary tool rather than a primary instructional method. They preferred hands-on traditional teaching especially when it comes to attention challenges. Instructor H.G. (38 years old) noted that "personally, I prefer traditional teaching and the conventional methods because AI tools can only maintain students' attention for 2 minutes, and I have to keep them occupied for longer than that, so I have to be involved for most of the time to ensure the achievement of the learning outcomes. Hence, I don't regard AI tools as a crucial instructional method".

This perhaps is due to reasons concerning age and inexperience with technology. Some educators prefer to stay within their comfort zone and utilize what they are already acquitted with rather than getting accustomed to new and unconventional methods.

3.Question: How would you ensure that AI tools used for teaching ADHD students are tailored to their specific needs? What factors do you think are most important when selecting AI-based learning programs?

Educators emphasized the importance of customizing AI tools in order to accommodate students and their varied needs in particular those with ADHD. Four of them asserted that they decide on a specific AI tool depending on its flexibility and ability to be adjusted, its engagement and relativity to a lesson's objectives, in addition to it being user-friendly and not overwhelming but easy to use. Instructor M.H. (24 years old) said that she prioritized tools that aligned with the learning goals, that provided effective feedback and is able to track students' progress. She also indicated that "AI tools that includes specific bright colors, purposeful movement, and engaging activities are preferred. It's important to note that the AI tools have to be innovative, new and not overly used to maintain the attention of ADHD students". While teacher H.G. persisted that when she chooses an AI tool in her teachings, she prefers to choose "consistent video patterns with familiar characters to create an easy structured routine that can involve students with and without learning difficulties".

As for the teacher's role in ensuring the effectiveness of AI tools for diverse needs, all five teachers regarded their role as necessary in steering and monitoring the learning process involving the use of AI tools, especially to meet the needs of students with diverse learning profiles. Moreover, Educators emphasized that useful utilization of AI requires teacher surveillance, instructional coalition, and continuous assessment. C.D. (23 years old) highlighted that her involvement in the process is critical to ensuring effectiveness.

4.Question: What role do you think teachers should play in guiding the use of AI for ADHD students? Should AI be used as a supplement to traditional teaching methods, or do you think it could replace certain aspects of classroom instruction?

During the interviews the instructors described their position as central to handling the effective use of AI tools in the classroom. They revealed that it is essential that they act as key facilitators, ensuring that AI was used appropriately and to personalize its application to student needs especially those with attention deficit. Instructor S.M. asserted that her role as a teacher is "irreplaceable and very crucial to prepare lesson plans that include the appropriate AI tool and ensure the engagement of such a tailored tool based on different students' needs, pace and abilities".

Furthermore, educators stressed the importance of maintaining a balance between AI-assisted learning and traditional teaching approaches. They noted that merging AI with conventional teaching enhanced engagement and allowed for customized differentiated assistance. Findings showed that AI was not seen as a substitute for foundational teaching practices but was viewed as a helpful addition. Three of the participants reported that if a balance is achieved between AI and face-to-face teaching, there could be a high chance of maintaining student focus and connection with ADHD students. Participant M.H. reported that "AI tools can help achieve inclusivity, we as teachers need more training on how to attain this balance for an elevated learning experience that adheres to both students with and without learning difficulties".

As a result, most teachers stressed that AI should be treated as a support mechanism, not a replacement for teacher judgment and interaction. Findings implied that AI as an assistive tool received appropriate support, but justifiably resistance about AI replacing the human element remained. R.S. acknowledged the role of AI tools in the classroom, but fully rejected the notion that it can replace the human touch that is needed for emotional

support, progress monitoring as well as adjustments and customization.

5.Question: How do you evaluate the effectiveness of AI tools when working with ADHD students? What measures or indicators would help you determine whether AI is improving learning outcomes for these students?

In terms of the evaluation criteria for AI effectiveness, participants revealed that they based their efficiency on their ability to support and adapt to individualized learning and interaction. Also, educators reported collectively that they rely on parental supervision to monitor and report behavioral improvement. Additionally, the findings indicated that AI use contributed to increased attention, task completion on time and higher engagement among students with ADHD. Four out of five participants assured that the integration of AI tools in the educational process contributed to "a more engaged and better assessed differentiated experience for ADHD students", according to teacher C.D.

In regard to metrics and indicators used to assess AI in ADHD education, most participants reported that they used to assess AI effectiveness through student progress tracking, engagement levels, and time-on-task data. They relied on indicators such as improved assessment grades, and qualitative response from students and parents. Moreover, several participants highlighted the value of continuous monitoring and alteration based on student response to the AI tool. Educators C.D. and R.S. valued ongoing assessments and the improvement of ADHD students attention span and task completion when evaluating the effectiveness and appropriateness of the integrated AI tools.

Consequently, the findings showed that participants of this study were aware of a number of advantages of implementing AI in the classroom, including its capacity to enhance student engagement and enable individualized learning for ADHD students. Particular technologies, such as those previously mentioned, were emphasized for their ability to deliver

real-time feedback and adaptive education. Concerns were expressed, meanwhile, regarding an excessive dependence on AI, a decrease in human connection, and the possibility of distraction for students with ADHD. When choosing AI technologies, educators stressed the value of flexibility and adaptability as well as specific requirements like usability, and alignment with learning objectives. They believed that their supervision of AI use was crucial to guarantee that it supplements rather than replaces conventional educational methods. The majority of participants said AI was a useful addition that needed teacher supervision to work well. To evaluate AI's impact, educators used a mix of indicators including student engagement, behavioral improvements, academic performance, and ongoing teacher observation.

6.Conclusion

ADHD is a multifaceted neurodevelopmental disorder influenced by genetic, neurobiological, environmental, and psychosocial factors. Its symptoms, ranging from inattention, hyperactivity, and impulsivity to emotional dysregulation and executive functioning challenges, can significantly impact an individual's quality of life. Understanding the causes of ADHD, including genetic predispositions, brain development abnormalities, and environmental influences such as prenatal exposure to toxins, offers insights into its complexity and variability (Faraone et al., 2023; Sowell et al., 2023). Untreated ADHD can have profound consequences, including academic underachievement, mental health challenges, strained relationships, and increased risk of chronic conditions (Sandler et al., 2023; Miller et al., 2023). These findings underscore the importance of early intervention, which can transform lives by fostering personal growth and enabling individuals to achieve their full potential. Effective treatment often involves a multimodal approach, combining behavioral therapy, medication, parent training, and innovative digital tools. School-based interventions, mindfulness practices, and nutritional management also show promise in addressing ADHD symptoms (Thapar et al., 2023; Gordon et

al., 2024). Speech and educational therapies further enhance outcomes by improving communication skills, executive functioning, and academic performance (Krause et al., 2024; Smith et al., 2024). The growing body of research highlights the interconnectedness of ADHD's causes and its management. As our understanding of ADHD deepens through studies on neuro-inflammation, epigenetics, and emerging therapies, the potential for tailored, effective interventions continues to expand (Liu et al., 2023; Zhang et al., 2023). This comprehensive approach not only alleviates symptoms but also empowers individuals to overcome challenges and thrive in their personal and professional lives.