



(RESEARCH ARTICLE)



Psychometric assessment for ADHD and the role of ICTs

Pinelopi Christani *

Department of Greek Philology, Democritus University of Thrace, Greece.

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Abstract

The Attention Deficit Hyperactivity Disorder (ADHD), with or without Hyperactivity, is a matter of concern for a significant portion of the student population. This study aims to undertake an exploratory approach regarding the diagnostic process, especially the use of psychometric tools in the assessment and diagnosis of a child considered to have ADHD. In order for this analysis to be feasible, a widely accepted definition of what this disorder is, as well as its basic characteristics, must be provided. This will make it clear what symptoms can be observed in individuals diagnosed with this disorder.

Keywords: ADHD; ADD; Assessment; ICT; Psychometry; Cognition; Tools;

1. Introduction

In the following sections, a concise presentation of some cognitive and intellectual areas explored during the psychometric assessment of the disorder will be attempted, with a brief analysis of them. Additionally, some of the approved tools used by relevant authorities in this direction will be discussed. Finally, conclusions will be presented based on the literature review and research conducted within the scope of this study.

2. Main Part

2.1. Definition of ADHD and Key Characteristics

Within the framework of the evolution and progress of education towards a more comprehensive and inclusive approach that does not exclude any student from the educational process of regular schools, competent scientific teams are striving to deeply analyze disorders that, until now, remained undiagnosed or lacked sufficient information regarding their nature and the difficulties they pose. Among these disorders is Attention Deficit Hyperactivity Disorder (ADHD), with or without Hyperactivity. To achieve a comprehensive assessment and a successful intervention program, a crucial element is the formulation of a functional definition of the disorder that is widely accepted by a multitude of scientists.

Several scientists have attempted to define the difficulties faced by children, both in terms of cognitive and intellectual aspects and in terms of development. The categorization and definition of these phenomena are based on the common symptomatology observed in individuals belonging to this category. Regarding Attention Deficit Hyperactivity Disorder (ADHD), with or without Hyperactivity, the basic symptomatology, as it manifests in individual cases and is apparent from the early developmental stages of the individual, is included in the definition. In more detail, according to Babaletsou (n.d.), ADHD is recognized as one of the most common neurodevelopmental disorders characterized by a difficulty in maintaining focused attention and/or hyperactive-impulsive behavior to a degree that is incompatible with the child's developmental stage.

* Corresponding author: Pinelopi Christani

Papadaniil (2019) provides a definition of ADHD while also mentioning its symptomatology, adding that it is treatable but not yet curable, and its characteristics cause problems in the child's personal, social, and academic life. In his article, the researcher Skaloubakas (n.d.) highlights that students with ADHD make up 5-7% of the total school population (Skounti, 2006; Skaloubakas, n.d.). This substantial percentage signifies that a considerable number of children who previously had their difficulties undiagnosed can now receive special pedagogical treatment to help them succeed academically or even overcome their difficulties. With the law of 2000, 281/2000, and the establishment and institutionalization of organizations and bodies such as "inclusive education, the establishment of inclusion departments, diagnostic services for ADHD/LEDDY, and the institution of parallel support" (Tzivinikou, 2015), it appears that these children have been able to receive the significant assistance necessary for their development.

ADHD is a developmental disorder, which means that difficulties associated with it, manifest throughout an individual's developmental process, even into adulthood. Many references in the literature also note the comorbidity of ADHD with other developmental or non-developmental disorders such as Language Disorders, Learning Disorders, Autism Spectrum Disorder, or Motor Coordination Disorders (Papadaniel, 2019). The existence of comorbidity, according to Kakourou and Maniadaki (2000), in accordance with the "international literature, the rates of comorbidity between ADHD and learning difficulties range from 8% to 60%," which is quite remarkable (Kakourou & Maniadaki, 2000).

This developmental disorder is divided into three subtypes or categories. Specifically, the literature distinguishes the combined type or ADHD-C, characterized by both inattentive and hyperactive/impulsive symptoms with equal or similar frequency. The second type is ADHD-I, which is primarily characterized by inattention, often to a more frequent and intense degree. The third type is primarily characterized by the dominant symptoms of hyperactivity and impulsivity.

2.2. Symptoms and Cognitive Areas Affected

As evident from the above classification, there are three main categories of symptoms that children diagnosed with ADHD may exhibit. Among these, there is the "combined type" or ADHD-C, in which both inattentive and hyperactive-impulsive symptoms are present with similar or equal frequency. The second type is ADHD-I, characterized by predominantly inattentive symptoms that occur more frequently and intensely, while the third type is ADHD-H, distinguished by predominant symptoms of hyperactivity and impulsivity.

The symptoms of inattention, or easy distractibility, are central to understanding ADHD. This can be described as the "inability of these children to focus their attention for a significant amount of time, especially when it is deemed necessary," such as in a school setting. As described in the same article, children with ADHD "rarely manage to engage in the same activity for more than three minutes" (Roussou, 1988; Karabatzaki, n.d.). In Skaloubakas' article (n.d.), a concise list of all possible symptoms of these children is examined and named, with a focus on inattention. These symptoms include difficulty concentrating on both play and academic tasks, resulting in careless mistakes, significant challenges in organizing their tasks, and often not completing them. Other symptoms include appearing as if they are not listening or paying attention when spoken to, frequently experiencing difficulty in locating their belongings and losing them, and often being distracted and divided by external stimuli.

The second group of symptoms concerns hyperactivity, which includes factors such as very intense physical activity. Children with ADHD find it impossible to remain still or in one place for an extended period, even when necessary, such as in a classroom or during mealtime. Instead, during these activities, they may constantly fidget, spin around, or exhibit persistent movement of a body part.

The third group of symptoms that distinguishes ADHD is impulsivity. This element can be easily described by considering situations where these children cannot wait for a question to be completed when someone addresses them, or their inability to wait their turn, such as in group games. Along the same lines, they frequently interrupt their conversation partner, and they may even "invade the personal space of others" (Papadaniel, n.d.).

Experts recognize the existence of equally significant accompanying or secondary symptoms beyond these three symptom groups that require attention and intervention. In her article, Karampatzaki refers to these as "conduct disorders" (Eisert, 1992; Karampatzaki, n.d.). Such symptomatology may include "lying, cheating, stealing, and violent quarrels" (Bezevegis, n.d.; Karampatzaki, n.d.). In summary, it is worth mentioning difficulties in school learning, lack of self-esteem and low self-esteem, as well as clumsiness in movements (Karampatzaki, n.d.).

According to the revised DSM-V of the American Psychiatric Association, there are 18 criteria that could be included in the symptoms of ADHD, revolving around the three areas of inattention, impulsivity, and/or hyperactivity. Among them,

the most prominent position is occupied by symptoms related to the executive functions of the individual, such as concentration or attention, memory, and visual-spatial perception.

In the realm of executive function deficits in individuals with ADHD, there has been an increased research interest focusing on the analysis of brain structure in those diagnosed with this disorder, as well as in individuals with typical development. Specifically, researchers have directed their attention, according to Varvogli (2005), to the prefrontal cortex, which "houses executive functions and is intricately involved in combinations with other brain systems" (Bresnahan, Anderson, & Barry, 1999; Chabot & Serfontein, 1996). Findings regarding differences in brain volume between typically developing children and those with ADHD in terms of brain anatomy have also attracted attention (Acosta Castellanos et al., 2014).

Regarding deficits in attention, which is a prominent feature of this disorder, they remain incompletely explained. According to James M. Swanson et al. (1991), they cannot be adequately explained by specific cognitive functions or neurological systems. On this basis, researchers have examined the two parts of the brain, the frontal and posterior, and observed that while attention response correctly activated areas of the posterior brain, the same did not occur with the frontal areas, where a time delay was observed.

Human memory is divided into two parts: short-term or working memory, which can be further categorized into verbal and visuospatial working memory, and long-term memory. According to Stuart (n.d.), "working memory is the foundation of executive functions in the brain" and is also "the most important function of cognitive processes." It allows individuals to "perform actions that were planned earlier, solve problems, organize information, and maintain focus on the task at hand." As evident from the discussion, working memory plays a central role in the dysfunction seen in children with ADHD.

The direct impacts of working memory deficits are apparent in reading comprehension, spelling, language development, and mathematical processes. For example, Lehto and colleagues (2003) studied the significant influence of memory on performance in subjects such as Geography, Mathematics, foreign languages, and phonological awareness, with a particular focus on foreign language performance. Clair-Thompson and Gathercole (2006) also concluded that both executive function of memory and visuospatial perception profoundly affect children's performance in language, mathematics, and natural sciences. Moreover, Kofler et al. (2011) observed the direct impact of deficits in this cognitive domain on the social relationships of individuals with developmental coordination disorder. Specifically, they mentioned problems related to visuospatial perception and sustaining attention as sources of rejection by peers.

2.3. Diagnostic Procedure and Psychometry in ADHD

Diagnosis is always conducted by a competent diagnostic entity and by field specialists. According to Karampatsaki (n.d.), a comprehensive assessment should include historical background, interviews with the child, observation of their behavior in different settings, such as school or other environments, specific tests, questionnaires addressed to educators, primary caregivers, the social environment, i.e., peers, as well as other neurological examinations. All these elements can contribute to the diagnosis, provided that basic criteria are met, such as "multiple manifestations in daily life" and "conditions are pervasive and appear in various situations (both at school and at home)" (Steinhaussen, 1992, as cited in Karampatsaki, n.d.).

A crucial element in the diagnostic assessment is the conduct of both valid and timely diagnosis by the interdisciplinary team of competent authorities. The significance of validity is readily understood when one considers the importance of diagnosis for the correct intervention and educational support. Regarding the element of time and how timely the diagnosis should be, it will be discussed in more detail. A developmental difficulty, like the mentioned disorder, permeates the child's life constantly and is present in all developmental stages. Therefore, the earlier the diagnostic and, by extension, the intervention process is carried out, the faster the child will find relief and learn to manage their difficulties in a way that does not discourage them from their daily activities. Additionally, timely intervention can prevent the emergence of secondary symptoms. These symptoms range from marginalization by peers, increasing the likelihood of victimization (Dawkins, 1996), to the manifestation of psychological dysfunctions (Fombonne, 1998; Mental Health Foundation, 1999, as cited in Antoniadou & Bimbou-Nakou, 2000), or even delinquent behavior as a consequence of all the aforementioned (Nikolopoulos, 2008).

In addition to biological, psycho-social, and environmental factors that should be considered during the diagnostic process, the assessment of areas that may be affected by the presence of this disorder holds a prominent position. Deficits can manifest in areas such as emotional perception and cognitive domains. The cognitive deficits assessed in psychometric evaluations specifically include deficits in attention, concentration, executive functioning, and memory.

Furthermore, secondary areas that are influenced as a result of dysfunctional cognitive domains include writing and reading, spelling, numeracy, time perception, as well as metacognitive skills, as discussed in a previous section.

2.4. Examples of Psychometric tools for ADHD

In order to explore all the areas mentioned, it is important to conduct a psychometric assessment by the competent interdisciplinary teams of the ΚΕΣΣΥ-Diagnostic Centers, which are certified to provide assessments and diagnoses in the Greek territory. Psychometric assessment has been "the main approach to diagnosing learning difficulties" (Tzouriadou & Anagnostopoulou, 2011). It can also be carried out quite early, even from preschool age, thus avoiding the negative consequences of a late diagnosis. A fundamental element of this process is the multifaceted psychocognitive assessment of these individuals, which will include approved and standardized assessment tests, interviews with the child themselves, parents, and educators who spend many hours with them every week, as well as various forms of evaluative observation. In addition, the role of the examiner is crucial. The interdisciplinary team should consist of personnel who are specially trained and specialized in the utilization of psychometric tools, as the examiner is responsible for selecting the most suitable and reliable tools among the multitude of available options and for interpreting the results that will arise from them (Stowe & Eder, 2002).

Regarding the psychometric tools used in the psychometric assessment of individuals with ADHD, among them, the Greek ADHD Rating Scale by Kalantzi-Azizi, A., Aggeli, K., & Efstathiou, G. (2012) holds a prominent position. This tool was created through the adaptation of the initial ADHD Rating Scale IV by G.J. DuPaul, T.J. Power, A.D. Anastopoulos, & R. Reid. The original scale was based on the DSM-IV and aimed to assess parents and educators, as it included two scales for these two groups of individuals surrounding the child, regarding the frequency of symptoms as defined by the DSM-IV. The total number of questions is 18, and the responses are recorded on a Likert scale with gradations ranging from "almost never" to "very often." The questions, whether directed at parents or educators, focus on the child's behavior over the past six months or more. The administration of these two scales is done separately for parents and educators, while the scoring is based on categorizing the questions according to various criteria of the DSM-IV and in percentile units, taking into account the child's gender and age being assessed. As for the adaptation into Greek, Kalantzi-Azizi, A., Aggeli, K., & Efstathiou, G. (2012) successfully adapted this tool, ensuring reliability through repeated measurements, internal consistency, and external validity criterion. Finally, the assessment is for children aged 5-17 years old, and it takes 10 minutes to complete each scale.

Another equally important psychometric tool for the assessment of this developmental disorder is the test consisting of three subscales. The first subscale is the CBCL (Child Behavior Checklist) by Achenbach & Rescorla (2001). According to Bordin et al (2013), this tool consists of questionnaires that are completed by parents based on the child's abilities, emotional, behavioral, and social problems they encounter. The responses are given on a 3-level Likert scale, ranging from "not at all true" to "very true" based on how well each statement describes the child. Finally, the scores are calculated by domain and cumulatively at the end.

In the same vein, there is the TRF (Teacher's Report Form) scale, which is completed by educators who spend most of their time with the child during the week. The questions in this scale pertain to the child's social skills, behavioral issues, and emotional maturity. The questions are also filled out on a 5-point Likert scale based on how true each statement is for the child, and the scoring is done by domain and cumulatively at the end (Bordin et al., 2013).

Another important subscale is the Youth Self-Report (YSR), which is directed at the children or adolescents themselves. It consists of three subcategories of questions that explore various areas such as activities, sociability, and school-related issues. The questionnaire includes 20 questions, and the responses are given on a 5-point Likert scale based on how true each statement is. The scoring involves calculating scores for each subdomain and the overall score (Bordin et al., 2013).

It's worth noting that all three of these subscales can be used in combination and have undergone reliability and validity testing (Naar-King et al., 2004). As mentioned by Bordin et al. (2013) in their article, all three of these scales were developed separately in 1991 and revised in 2001 with differences in the number of questions. These scales have not been standardized in Greek, but they are used in combination for more accurate results.

Another tool used in the psychometric assessment of ADHD is the CAB-ADHD, which consists of "examinations and tasks aimed at the direct and precise identification and evaluation of the presence of symptoms, characteristics, and dysfunctions in cognitive processes affected" (CogniFit Research). According to the same website, the test is intended for individuals aged 7 to adults, and it takes 30 to 40 minutes to complete. The comprehensive version includes scales that measure memory problems, hyperactivity, impulsivity, and self-perception issues, corresponding to the categories

of the DSM-IV. The test consists of 66 items divided into 9 subscales, and responses are recorded on a 4-point Likert scale ranging from "never" to "very often." Each question assesses the frequency of symptom occurrence (Conners, C.K., Erhardt, D., Sparrow, M.A., 1999).

Similarly, there is the Connors Scale, which is revised and includes scales that are completed by the children themselves. The revised version, Connors' Rating Scales-Revised (CRS-R), comprises two different scales. One scale is answered by children aged 12-17 years, while the other scale is answered by parents and educators, covering children aged 3 to 17 years, including preschool, school-age, and adolescent children. The assessment is done individually, and the brief version takes 5 to 10 minutes to complete, while the comprehensive version takes 15 to 25 minutes. Scoring is done separately for each subscale and cumulatively at the end (Conners, 2001).

3. The role of ICTs

The positive and useful contributions that digital technologies provide to the field of education should be highlighted as a final point. Mobile devices (32-35), a range of ICT apps (36-55), AI STEM Games & ROBOTICS (56-63), are some examples of the technologies that enable and improve educational processes including evaluation, intervention, and learning. Additionally, the use of ICTs in conjunction with theories and models of metacognition, mindfulness, meditation, and the development of emotional intelligence [64-97] accelerates and improves educational practices and outcomes, especially for students with ADHD.

4. Conclusion

ADHD (Attention-Deficit/Hyperactivity Disorder) is one of the common disorders among the student population and requires careful attention from both parents and educators. This is essential for students to improve or even overcome the challenges posed by this disorder. The use of psychometrics in diagnosing difficulties is a fundamental process for achieving the most effective intervention and adapting educational processes to the specific needs of each student. Psychometric tools enable specialists to safely determine not only the diagnosis of the disorder but also the areas it affects and the extent to which it impacts an individual's cognitive or functional abilities.

Beyond ADHD, all diagnoses of various disorders or difficulties benefit significantly from the extensive use of psychometrics in education. It's important to emphasize the role of specialists or teams of experts in using, measuring, drawing conclusions from, and interpreting the results of psychometric assessments. Therefore, responsible organizations rely on numerous specialists from multidisciplinary teams to ensure the proper use of tools and the provision of timely and accurate diagnoses. A delayed or inaccurate diagnosis can be particularly traumatic.

Furthermore, careful consideration should be given to the appropriate selection of psychometric tools that can reliably and validly measure an individual's characteristics for investigation. For this reason, experts recommend the use of tools that have been validated and thoroughly tested in multiple countries, as there are indications that these tools lead to safer conclusions.

Lastly, to ensure that results are representative of reality, it is recommended to employ multiple and different assessment methods, such as interviews, observations, and questionnaires. These assessments should be conducted not only by the students themselves but also by their primary caregivers, teachers with longer interactions, and, in some cases, their peers.

Compliance with ethical standards

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Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

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