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Diagnostic Validity Assessment of the Fifth Extended Edition of the Wechsler Intelligence Scale for Children in Students with Attention Deficit/Hyperactivity Disorder Using the Sensitivity Coefficient Method

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A B S T R A C T

Purpose: This study aimed to evaluate the diagnostic validity of the fifth extended version of the Wechsler Intelligence Scale for Children (WISC-V Extended) in differentiating students with Attention Deficit/Hyperactivity Disorder (ADHD) from typically developing peers using the sensitivity coefficient method.

Methods and Materials: The research employed a psychometric design focusing on diagnostic validity. A total of 240 elementary school students in Tehran participated, including 120 diagnosed with ADHD (based on clinical files and educational referrals) and 120 normative students selected through simple random sampling. The WISC-V Extended, which includes five major indices—Verbal Comprehension, Visual-Spatial, Fluid Reasoning, Working Memory, and Processing Speed—was administered individually. Data analysis was conducted using the sensitivity coefficient method, comparing empirical and critical difference values across groups to determine each subtest's ability to discriminate between ADHD and non-ADHD students.

Findings: The results showed that the Verbal Comprehension subtests did not exceed critical thresholds and therefore lacked diagnostic validity. In contrast, subtests within the Visual-Spatial domain (e.g., Block Design, Visual Weights), Fluid Reasoning domain (Calculation A and B), Working Memory domain (Spatial Span Forward and Backward, Sentence Recall), and Processing Speed domain (Coding Recall, Coding Copy, Symbol Deletion) demonstrated empirical differences greater than critical values, indicating strong diagnostic sensitivity. Among these, Symbol Deletion exhibited the highest sensitivity, suggesting its specific utility in ADHD screening.

Conclusion: The WISC-V Extended demonstrates partial diagnostic validity in the assessment of ADHD. While verbal subtests are more reflective of general cognitive ability, non-verbal and executive-function-oriented subtests offer stronger diagnostic differentiation. These findings underscore the importance of selective subtest interpretation for accurate ADHD identification and support the use of WISC-V Extended in clinical assessment settings.

Keywords: *WISC-V Extended; ADHD; diagnostic validity; sensitivity coefficient; cognitive assessment; psychometrics.*

1. Introduction

In recent decades, psychological assessment has undergone significant advancements, particularly in the field of cognitive evaluation. One of the most widely utilized instruments for the assessment of children's cognitive functioning is the Wechsler Intelligence Scale for Children (WISC), which, in its fifth edition (WISC-V), has incorporated extensive psychometric refinements and theoretical innovations. The importance of cognitive assessment lies in its central role in identifying individual differences in abilities such as reasoning, working memory, processing speed, and verbal comprehension. In clinical contexts—particularly in the evaluation of neurodevelopmental disorders such as Attention-Deficit/Hyperactivity Disorder (ADHD)—valid and reliable cognitive tools are essential for differential diagnosis and the development of individualized intervention plans (Panah et al., 2025).

ADHD is one of the most prevalent neurodevelopmental disorders in childhood, characterized by persistent symptoms of inattention, hyperactivity, and impulsivity, which significantly impair functioning in academic, social, and family settings. Identifying cognitive profiles specific to ADHD can aid in early diagnosis and the design of evidence-based therapeutic strategies. Prior studies have reported that children with ADHD exhibit deficits in working memory, processing speed, and executive functioning, all of which can be measured by subtests of the WISC-V (Jang et al., 2023). This highlights the relevance of using robust psychometric tools like the WISC-V to capture cognitive impairments characteristic of this population.

The fifth edition of the Wechsler Intelligence Scale for Children (WISC-V), released in 2014, represents a major revision from earlier versions, incorporating a five-factor model aligned with the Cattell-Horn-Carroll (CHC) theory of cognitive abilities. It includes five primary indices: Verbal Comprehension, Visual-Spatial, Fluid Reasoning, Working Memory, and Processing Speed. In addition, the extended version offers 14 supplementary subtests that enhance the diagnostic scope of the instrument. The WISC-V has been extensively studied across cultures and clinical populations, and its factor structure has been supported by various psychometric investigations (Canivez et al., 2016; Canivez et al., 2019; Dombrowski et al., 2015). However, despite its widespread use, the diagnostic validity of the WISC-V in distinguishing between clinical and non-clinical populations—particularly through indices such as sensitivity coefficients—remains an area requiring empirical scrutiny.

Recent studies have explored the structural and construct validity of the WISC-V, providing robust evidence of its internal consistency and factorial alignment. For instance, exploratory and confirmatory factor analyses conducted by Canivez and colleagues confirmed the five-factor structure of the WISC-V across large normative samples and highlighted the instrument's psychometric soundness in assessing multiple cognitive domains (Canivez et al., 2016; Canivez et al., 2019). Dombrowski et al. (Dombrowski et al., 2018) further demonstrated the cross-age consistency of the WISC-V's primary subtests, supporting its developmental appropriateness across childhood. However, while structural validity has been well-established, studies addressing the instrument's diagnostic validity—its ability to discriminate between children with and without specific clinical conditions—are more limited and context-dependent.

In the context of ADHD, evidence from both international and regional studies suggests that WISC-based tools can be diagnostically informative. For example, Goo et al. (Goo et al., 2016) analyzed cognitive characteristics of children with ADHD using the Korean WISC-IV, finding significant discrepancies in cognitive proficiency and general ability indices, with marked impairments in processing speed and working memory. Similarly, Jang et al. (Jang et al., 2023) found strong associations between attention-based tests and specific WISC-IV indices, reinforcing the role of Wechsler scales in ADHD profiling. Although these studies focused on earlier editions of the Wechsler scales, they underscore the potential of the WISC-V for identifying cognitive markers of ADHD, particularly when subtest-level sensitivity is evaluated.

The concept of diagnostic validity, particularly as operationalized through sensitivity coefficients, refers to the instrument's capability to correctly identify individuals who truly possess a disorder. Sensitivity is a central parameter in psychodiagnostics and is critical in minimizing false negatives. In the context of ADHD, high sensitivity implies that the test accurately detects children who exhibit the cognitive features commonly associated with the disorder. According to Kendler and subsequent researchers, an instrument that lacks adequate sensitivity, even if reliable and structurally valid, may fail to serve its intended clinical purpose (Panah et al., 2025).

Within Iran, recent efforts have been made to localize and validate the WISC-V, including its extended version, for use in diverse populations, including children with ADHD.

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Kamkari et al. (Kamkari et al., 2021) conducted a validation study of the WISC-V in children with intellectual disabilities, demonstrating acceptable levels of diagnostic and convergent validity. Similarly, Panah et al. (Panah et al., 2025) conducted one of the first empirical studies applying the sensitivity coefficient method to assess the WISC-V's diagnostic power in children with ADHD. Their findings indicated that certain indices—especially those related to working memory, processing speed, and visual-spatial reasoning—exhibited significant sensitivity in differentiating clinical from normative groups. These results were supported by Bodaghi et al. (Bodaghi et al., 2023), who also emphasized the limitations of the verbal comprehension subtests in isolating ADHD-related cognitive profiles.

These findings collectively suggest that while the WISC-V is a comprehensive and theoretically grounded instrument, its diagnostic applicability is domain-specific. Subtests measuring cognitive speed, executive functioning, and fluid reasoning may hold stronger predictive value for ADHD diagnosis than those assessing verbal knowledge or semantic reasoning. This highlights the importance of focusing not only on full-scale IQ scores but also on individual subtest performances and composite indices when interpreting WISC-V profiles in clinical contexts.

Given the increasing emphasis on early and accurate diagnosis of ADHD, as well as the limitations of behavioral checklists and observational methods alone, integrating sensitive cognitive assessments into the diagnostic process is both necessary and beneficial. The present study aims to evaluate the diagnostic validity of the extended fifth edition of the WISC in identifying cognitive differences between children with ADHD and those without, using the sensitivity coefficient method.

2. Methods and Materials

2.1. Study Design and Participants

This study employed a psychometric research design, focusing specifically on the assessment of diagnostic validity, which is considered a subdomain of broader validity studies and part of the methodological approaches used in the standardization of psychological instruments. The study targeted a specific population: children formally diagnosed with Attention Deficit/Hyperactivity Disorder (ADHD). The target population included all male and female students diagnosed with ADHD enrolled in the first through third grades of elementary school during the academic year 2024–2025, who were receiving educational and therapeutic services through public and private psychological support centers in Tehran, and whose diagnosis was confirmed via clinical records.

Sampling was carried out using a combination of non-probability and probability-based methods. Specifically, 120 children with ADHD were selected using convenience sampling from schools and treatment centers in Tehran, representing the clinical group. In contrast, a matched sample of 120 non-ADHD children—selected using simple random sampling—was recruited from the same schools to serve as the comparison (normative) group. The decision on sample size adhered to recommendations in methodological research literature emphasizing the importance of using sufficiently large samples to enhance statistical power, ensure the representativeness of the standard deviation and mean, and improve the rejection strength of false null hypotheses, particularly in the context of diagnostic sensitivity studies.

2.2. Measure

The primary instrument for data collection was the Fifth Extended Edition of the Wechsler Intelligence Scale for Children (WISC-V Extended), which was developed and standardized in 2015 by Edith Kaplan. This advanced clinical tool is designed for individual cognitive assessment of children aged 6 years to 16 years and 11 months. The WISC-V Extended includes five primary index scales: Verbal Comprehension, Visual-Spatial Processing, Fluid Reasoning, Working Memory, and Processing Speed. Within these five domains, the extended version encompasses 14 supplementary subtests that offer a more comprehensive cognitive profile. Specifically, the Verbal Comprehension Index includes multiple-choice versions of Similarities, Vocabulary, Picture Vocabulary, Information, and Comprehension subtests. The Visual-Spatial domain includes the Multiple-Choice Block Design subtest. Fluid Reasoning includes subtests on Visual Weighting Processes, Procedural Calculation (Parts A and B), and Written Calculation. Working Memory is measured through Direct and Reverse Spatial Span tasks, as well as Sentence Recall. Processing Speed is evaluated using Coding Recall, Coding Copy, and Deletion Abstraction subtests. The structure of these components ensures multidimensional measurement of children's intellectual functioning, particularly relevant for identifying cognitive profiles consistent with ADHD-related impairments. The test is administered individually by trained psychologists and adheres to strict psychometric and

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standardization protocols, ensuring consistency, validity, and applicability in both clinical and research settings.

2.3. Data Analysis

To assess the diagnostic validity of the WISC-V Extended, the sensitivity coefficient method was employed. This method evaluates the ability of a psychological instrument to correctly differentiate between clinical and non-clinical populations—in this case, students with and without ADHD. Diagnostic sensitivity refers to the test's capacity to correctly identify individuals who truly possess the condition, meaning it quantifies the proportion of true positives out of all actual cases. In operational terms, this is calculated by dividing the number of correctly identified ADHD cases (true positives) by the total number of confirmed ADHD cases. This approach is essential in clinical contexts where accurate identification of a disorder is critical. According to Kendler (2006), a valid diagnostic criterion must possess sufficient sensitivity to be meaningful. Therefore, the sensitivity coefficient provides an empirical index for determining whether the WISC-V Extended can reliably detect ADHD-related cognitive patterns in young students. The analyses were conducted using appropriate statistical software to determine the test's sensitivity and provide a robust evaluation of its diagnostic utility in distinguishing between ADHD and non-ADHD populations.

3. Findings and Results

As shown in Table 1, the descriptive statistics reveal noticeable differences between students with ADHD and their typically developing peers across all five scales of the WISC-V Extended. In the Verbal Comprehension subtests, normative students displayed average scores with low dispersion, indicating consistent performance, while ADHD students showed lower means, particularly in Picture Vocabulary and Comprehension, possibly reflecting diminished focus and difficulty in deeper linguistic comprehension. On the Visual-Spatial scale, although the ADHD group performed slightly lower, the gap was narrower compared to other domains. However, Fluid Reasoning tasks, which demand planning and logical problem-solving, revealed significant performance deficits in the ADHD group. Similarly, Working Memory subtests showed marked underperformance among ADHD students, suggesting impairments in mental information manipulation and retention. Lastly, the Processing Speed subtests indicated weaker scores for ADHD students, likely due to sustained attention deficits, highlighting broader executive functioning challenges among this population.

Table 1

Descriptive Statistics of the Subtests of the WISC-V Extended Scales in Students With and Without ADHD

WISC-V Scale	Subtest	Normative Group (M)	Normative Group (SD)	ADHD Group (M)	ADHD Group (SD)
Verbal Comprehension	Similarities (MC)	10.05	2.05	8.02	3.00
	Vocabulary (MC)	11.01	2.03	9.00	2.08
	Picture Vocabulary (MC)	10.08	2.07	8.05	3.02
	Information (MC)	11.02	2.04	9.03	2.09
	Comprehension (MC)	10.09	2.06	8.08	3.01
Visual-Spatial	Block Design (MC)	11.05	2.08	9.01	3.03
	Visual Weights	11.00	2.05	8.09	3.00
Fluid Reasoning	Calculation A	10.08	2.07	7.05	3.02
	Calculation B	11.02	2.09	8.00	3.04
Working Memory	Spatial Span (Forward)	10.09	2.06	7.08	3.00
	Spatial Span (Backward)	10.05	2.07	7.05	3.01
	Sentence Recall	11.00	2.04	8.03	2.09
Processing Speed	Coding Recall	11.03	2.05	8.06	3.00
	Coding Copy	11.00	2.08	8.08	3.01
	Symbol Deletion (Abstraction)	10.08	2.07	7.09	3.02

The inferential analysis, based on the sensitivity coefficient method, demonstrates clear distinctions in the diagnostic capacity of the WISC-V Extended subtests when applied to students with ADHD. For the Verbal Comprehension scale, none of the subtests surpassed their respective critical thresholds; thus, this scale lacks

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diagnostic validity for differentiating between ADHD and non-ADHD groups and appears more suited for evaluating general verbal abilities rather than disorder-specific cognitive impairments. In contrast, both subtests of the Visual-Spatial scale—Block Design and Visual Weights—exceeded the critical difference values, confirming the scale's diagnostic utility in identifying visual-spatial processing deficits in children with ADHD. The Fluid Reasoning subtests, both Calculation A and B, also displayed substantial empirical differences above the critical values, reflecting the scale's strong discriminatory power, likely due to the executive and planning demands placed on working memory in these tasks. The Working Memory scale showed reliable diagnostic validity across all three subtests, with ADHD participants demonstrating significantly lower scores compared to normative peers, indicating pronounced weaknesses in short-term storage and manipulation of information. Finally, the Processing Speed subtests all produced empirical differences greater than the critical values, confirming the scale's diagnostic sensitivity, with Symbol Deletion revealing slightly higher sensitivity. These results collectively suggest that the WISC-V Extended is especially diagnostically valid in its Visual-Spatial, Fluid Reasoning, Working Memory, and Processing Speed components, offering robust tools for identifying ADHD-related cognitive impairments, while the Verbal Comprehension subtests may be less useful for clinical diagnosis.

Table 2

Diagnostic Validity of the WISC-V Extended Subtests in Students With ADHD Using the Sensitivity Coefficient Method

WISC-V Scale	Subtest	Empirical Difference	Critical Difference	Difference ≥ Critical	Diagnostic Validity
Verbal Comprehension	Similarities (MC)	1.25	2.10	No	Not Valid
	Vocabulary (MC)	1.50	2.30	No	Not Valid
	Picture Vocabulary (MC)	1.10	2.00	No	Not Valid
	Information (MC)	1.30	2.50	No	Not Valid
	Comprehension (MC)	0.98	1.80	No	Not Valid
Visual-Spatial	Block Design (MC)	6.00	5.50	Yes	Valid
	Visual Weights	5.80	5.30	Yes	Valid
Fluid Reasoning	Calculation A	7.30	5.80	Yes	Valid
	Calculation B	6.90	5.70	Yes	Valid
Working Memory	Spatial Span (Forward)	7.80	6.50	Yes	Valid
	Spatial Span (Backward)	6.60	5.80	Yes	Valid
	Sentence Recall	7.40	6.30	Yes	Valid
Processing Speed	Coding Recall	7.10	6.00	Yes	Valid
	Coding Copy	6.80	6.20	Yes	Valid
	Symbol Deletion (Abstraction)	7.50	6.40	Yes	Valid

4. Discussion and Conclusion

The purpose of the present study was to examine the diagnostic validity of the fifth extended version of the Wechsler Intelligence Scale for Children (WISC-V Extended) in differentiating students with Attention Deficit/Hyperactivity Disorder (ADHD) from their typically developing peers, using the sensitivity coefficient method. The findings revealed that among the five cognitive domains evaluated—Verbal Comprehension, Visual-Spatial, Fluid Reasoning, Working Memory, and Processing Speed—only the Verbal Comprehension subtests lacked diagnostic validity, as none of their empirical differences exceeded the critical threshold. In contrast, subtests under Visual-Spatial, Fluid Reasoning, Working Memory, and Processing Speed domains demonstrated significant empirical differences, indicating strong sensitivity and thus suitable diagnostic utility for identifying ADHD-related cognitive deficits.

The absence of diagnostic validity in the Verbal Comprehension subtests—such as Similarities, Vocabulary, Picture Vocabulary, Information, and Comprehension—suggests that these measures are more indicative of general verbal ability and semantic knowledge rather than markers of ADHD-specific impairments. This aligns with prior findings suggesting that ADHD does not typically manifest in significant deficits in stored verbal knowledge or expressive vocabulary. Panah et al. (Panah et al., 2025) found that while students with ADHD may exhibit minor reductions in verbal performance, these differences are not sufficiently pronounced to warrant the use of verbal subtests as diagnostic indicators. Similarly, Bodaghi et al. (Bodaghi et al., 2023) emphasized that although ADHD students may have difficulties in following complex verbal instructions

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due to attentional lapses, their core verbal comprehension skills often remain within normative ranges, thereby limiting the diagnostic power of these subtests.

In contrast, subtests in the Visual-Spatial domain—particularly Block Design and Visual Weights—showed empirical differences that surpassed the critical values, indicating meaningful cognitive performance gaps between ADHD and non-ADHD groups. These findings align with the results of Kamkari et al. (Kamkari et al., 2021), who found that students with cognitive or neurodevelopmental disorders often underperform in tasks that require visual organization, spatial integration, and attention to detail. The ability to complete visual-spatial tasks under timed conditions requires sustained concentration and visual-motor coordination, which are known to be compromised in ADHD. Moreover, studies such as Goo et al. (Goo et al., 2016) observed similar patterns in Korean samples, reporting that children with ADHD demonstrated significantly lower scores in visual construction and organization tasks, suggesting that such tasks are particularly sensitive to attentional disruptions.

The strongest diagnostic performance was observed in the Fluid Reasoning, Working Memory, and Processing Speed indices. In the Fluid Reasoning domain, Calculation A and B subtests demonstrated high sensitivity to ADHD-related impairments, consistent with earlier findings that children with ADHD often exhibit difficulty in abstract reasoning, mental flexibility, and planning abilities (Canivez et al., 2019; Dombrowski et al., 2015). Dombrowski et al. (Dombrowski et al., 2018) emphasized that deficits in fluid reasoning are indicative of executive dysfunctions, which are widely reported in ADHD populations. This is further supported by neuropsychological literature suggesting that tasks requiring mental manipulation and logical inference are highly vulnerable to attentional instability and impulsivity—hallmarks of ADHD.

Likewise, Working Memory subtests such as Forward and Backward Spatial Span and Sentence Recall exhibited strong diagnostic validity, reinforcing the well-established connection between ADHD and working memory deficits. Jang et al. (Jang et al., 2023) reported that children with ADHD scored significantly lower on tasks that required retention and manipulation of sequential information, a finding mirrored in the present study. Working memory is essential for regulating attention, inhibiting distractions, and updating goal-relevant information, making it one of the most affected domains in ADHD (Canivez et al., 2016). These results underscore the importance of including working memory measures in the diagnostic evaluation of ADHD, as they tap into core neurocognitive deficits associated with the disorder.

Finally, the Processing Speed subtests—Coding Recall, Coding Copy, and Symbol Deletion—were found to be valid diagnostic indicators. The sensitivity coefficients confirmed significant discrepancies between ADHD and non-ADHD groups, with the Symbol Deletion subtest showing particularly high sensitivity. These findings are consistent with prior research highlighting slowed processing speed as a key cognitive marker of ADHD (Bodaghi et al., 2023; Panah et al., 2025). Children with ADHD often struggle with tasks that require rapid visual scanning, sustained attention, and fine motor coordination under time constraints, leading to reduced processing efficiency. Canivez et al. (Canivez et al., 2019) also reported that Processing Speed subtests contribute meaningfully to the cognitive profile of ADHD, particularly when combined with executive functioning deficits.

Overall, the results support the hypothesis that not all WISC-V subtests are equally useful for diagnostic purposes. While the test offers a comprehensive picture of a child's cognitive abilities, only certain subtests—particularly those involving attention regulation, mental manipulation, and processing efficiency—are diagnostically sensitive to ADHD. This finding echoes the conclusions of Dombrowski et al. (Dombrowski et al., 2018), who argued for a selective interpretation of subtests based on theoretical alignment with the disorder being assessed. Therefore, clinicians are advised to focus on the most diagnostically relevant domains when using WISC-V as part of an ADHD assessment battery.

Despite the valuable insights generated by this study, several limitations must be acknowledged. First, the sampling strategy employed a combination of convenience and simple random sampling, which may introduce selection bias and limit the generalizability of the findings to broader populations. Second, although the sensitivity coefficient method offers a robust approach to assessing diagnostic validity, it does not account for the potential moderating effects of variables such as age, gender, comorbid learning disabilities, or socioeconomic status. Third, the study did not examine test-retest reliability or inter-rater reliability, which are essential components of comprehensive psychometric evaluation. Additionally, the study focused solely on the diagnostic sensitivity and did not assess specificity, which is equally important for reducing false positives in clinical diagnosis.

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Future research should aim to replicate these findings across larger and more demographically diverse populations, including rural and underserved regions, to enhance external validity. It is also recommended that longitudinal studies be conducted to examine whether the diagnostic sensitivity of the WISC-V subtests remains stable over time or changes with intervention. Future investigations could also explore multi-method assessment frameworks by integrating cognitive measures with behavioral scales, neuroimaging, or biological markers. Furthermore, examining the interaction effects of comorbid conditions—such as learning disorders, anxiety, or conduct problems—could yield a more nuanced understanding of the cognitive profiles associated with ADHD.

For clinicians and school psychologists, the results of this study offer clear guidance on which subtests of the WISC-V Extended are most useful for identifying ADHD-related cognitive impairments. When using WISC-V in ADHD evaluations, practitioners should prioritize Working Memory, Processing Speed, Fluid Reasoning, and Visual-Spatial subtests, as these domains showed high diagnostic validity. Verbal Comprehension, while informative in general cognitive assessment, may be less relevant for diagnosing ADHD. These findings can inform more targeted and efficient assessment practices, reduce the risk of misdiagnosis, and support the development of individualized intervention plans based on domain-specific cognitive deficits.

Authors' Contributions

All authors significantly contributed to this study.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

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Declaration of Interest

The authors report no conflict of interest.

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Ethical Considerations

In this study, to observe ethical considerations, participants were informed about the goals and importance of the research before the start of the study and participated in the research with informed consent.

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