






# Diagnostic Validity of the Fifth Edition of Wechsler Intelligence Scale for Children (WISC-V) in Students with ADHD

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## Abstract

**Background:** This research discusses the diagnostic validity of the Wechsler Intelligence Scale for Children, fifth edition (WISC-V), in students with attention deficit-hyperactivity disorder (ADHD). The primary research question is whether the WISC-V possesses diagnostic validity for students with ADHD.

**Methods:** The study employs a psychometric design. The research population includes all students with ADHD enrolled in the first, second, and third grades of elementary school during the 2022 academic year. These students receive educational therapeutic services in private and public centers. A sample size of 250 students was selected using a purposeful sampling method. The instrument used is the WISC-V. Additionally, 250 individuals from the normative population (non-ADHD) were included as a comparison group. The confidence interval method was applied to determine the diagnostic validity of the tests.

**Results:** Data analysis indicated that among the WISC-V subscales, only the "processing speed" subscale demonstrated diagnostic validity ( $P < 0.001$ ). The other four subscales – "visual-spatial", "fluid reasoning", "working memory", and "verbal comprehension" – did not exhibit adequate validity in distinguishing between students with and without ADHD.

**Conclusions:** The findings indicate that the WISC-V has favorable diagnostic validity for the processing speed scale in students with ADHD. This scale can be effectively utilized for the clinical assessment of students with ADHD within the field of exceptional individuals.

**Keywords:** Attention Deficit-Hyperactivity Disorder, Diagnostic Validity, Fifth Edition, Students, Wechsler Intelligence Scales for Children

## 1. Background

Cognitive disorders and educational challenges, along with academic progress issues, are most prominently observed in children with attention deficit-hyperactivity disorder (ADHD). Hyperactivity is among the most prevalent psychological issues diagnosed during childhood. The ADHD is a common childhood disorder that has garnered significant attention from psychologists and psychiatrists (1). Research indicates that ADHD disrupts the natural developmental processes of childhood. Fortunately, many primary symptoms associated with hyperactivity, such as impulsivity, tend to diminish during puberty (2, 3). However, if untreated during childhood, ADHD increases the risk of psychological and social challenges

in adulthood. Secondary issues may include antisocial behavior, difficulties in social adaptation, academic decline, school dropout, and academic failure. These challenges can lead to reduced self-confidence, conduct disorders, delinquency, accidents, and substance abuse (4). Therefore, it is crucial to develop an instrument with diagnostic validity, particularly in assessing the cognitive abilities and academic progress of these children, to provide practical solutions.

Additionally, some individuals with alcoholism and mania exhibit sensory and perceptual experiences similar to those of hyperactive children (5). Implementing comprehensive programs for children and adolescents with learning disabilities (LD) in schools, establishing specialized organizations,

publishing relevant magazines, and developing necessary standards reflect the growing public interest in this issue (6). Thus, emphasizing the identification of ADHD is of significant importance and is prioritized in the assessment goals for exceptional children (7). The use of invalid intelligence tests in the education of children with LD has resulted in inaccurate assessments, leading to dissatisfaction with tests such as Godinez's intelligence, Proteus's mazes, and Raven's tests (8).

Previous research which was conducted by Shiri Aminloo et al. (9) on the diagnostic validity of the fifth edition of the Wechsler Intelligence Scale for Children (WISC-V) in students with LD in Tehran province suggested that this instrument can distinguish students with LD from those without. Kiyomarsi et al. (10) identified the "processing speed" and "fluid intelligence" scales in the second version of the Reynolds Intelligence Test as key diagnostic criteria for ADHD, indicating that the instrument possesses diagnostic validity for identifying students with ADHD. Kamkari's research (11) highlighted the instrument's reliability and validity for screening, diagnosing, and identifying ADHD. Canivez et al. (12) evaluated the WISC-V and found it to have strong construct and content validity, as well as diagnostic validity in groups of exceptional children, particularly those with attention deficit disorder and learning disorders, with sensitivity (true positive) and specificity (true negative) consistently above 0.70. Lecerf and Canivez (13) conducted confirmatory and exploratory factor analyses of the WISC-V, concluding that, based on psychometric analysis, the tool comprises four scales rather than five factors. Canivez et al. (12) in 2019 further examined the internal structure of the WISC-V. Bodaghi et al. (14) conducted a theoretical study on the diagnostic validity of the WISC-V within the Iranian population. However, due to the limited sample sizes and incomplete examination of all main subscales in previous studies, the present study features a larger sample size and examines all main scales of the WISC-V.

## 2. Objectives

Therefore, this research aims to provide a reliable tool for diagnosing students with ADHD/impulsivity, focusing on the diagnostic validity of the WISC-V in students with ADHD. The primary research question is: Does the WISC-V have diagnostic validity in students with ADHD?

## 3. Methods

### 3.1. Design and Participants

The present study utilized a psychometric design, a subset of methodological studies. The statistical population included all students with ADHD enrolled in the primary grades (first, second, and third) during the 2022 academic year. These students, diagnosed with ADHD, were receiving educational-therapeutic services in private and public centers and were considered the statistical population. Participants were selected using a purposeful sampling method. Previous research suggests that the sample size required for psychometric properties, as well as exploratory and confirmatory factor analysis, ranges from 200 to 500 (15). Consequently, 250 students from centers in Tehran province were chosen as the sample. Specifically, 50 students were selected from each region (north, south, east, west, and center). After obtaining the necessary permits from the Education Department of Tehran province, schools in five districts of Tehran were randomly selected. Five centers from each district were chosen, and 10 students from each center were evaluated, totaling 250 participants. To assess diagnostic validity, 250 students from the normative population (students without ADHD) were included as a normative sample or comparison group. Inclusion criteria were age (7 - 9 years) and an ADHD diagnosis, while exclusion criteria included any severe disability that interfered with completing the WISC-V. Additionally, individuals unwilling to participate were excluded from the study. After obtaining consent, a PhD student in psychology, trained in the administration, scoring, and interpretation of the Wechsler scales, administered the WISC-V to the participants. Due to the length of the test, participants were allowed a 5-minute break between sections.

### 3.2. Measure

The WISC-V was the instrument used in this research. Designed and standardized by Edith Kaplan in 2015, the WISC-V is a clinical tool administered individually for the cognitive assessment of children aged 6 years to 16 years and 11 months. This instrument comprises five main scales: Verbal comprehension, visual-spatial processing, fluid reasoning, working memory, and processing speed.

The verbal comprehension scale includes two main tests – similarities and vocabulary – and two substitute tests – information and comprehension. The visual-spatial scale consists of one main test, block design, and one substitute test, visual puzzles. The fluid reasoning scale features two main tests, matrix reasoning and weight recognition, and two substitute tests, picture concepts and arithmetic. The working memory scale

includes one main test, digit span, and two substitute tests, picture span and letter-number sequence. The processing speed scale comprises one main test, coding, and two substitute tests, symbol search and cancellation. Overall, the WISC-V includes 16 tests and 21 subtests (16).

Additionally, the WISC-V has 14 supplementary tests, which include multiple-choice versions of similarities, vocabulary, visual vocabulary, information, and comprehension on the verbal comprehension scale. Multiple design options with blocks are included on the visual-spatial scale. The fluid reasoning scale features process picture, process arithmetic, and written arithmetic. Spatial capacity and sentence recall are part of the working memory scale, while coding recall, coding copy, and cancellation abstraction are included in the processing speed scale (17).

The study was conducted following the receipt of an ethics code from the Islamic Azad University of Tehran, Tehran, Iran (IR.IAU.CTB.REC.1403.039). The present study adhered to all ethical standards outlined in the Declaration of Helsinki.

### 3.3. Data Analysis

After examining the descriptive statistics indicators for the scale, analyses related to internal consistency were conducted to assess the psychometric properties. Cronbach's alpha and split-half methods were employed as appropriate techniques for determining internal consistency within the framework of psychometric analyses to calculate the reliability coefficient. Additionally, the test-retest method, with a time interval of 2 to 4 weeks, was used to calculate the stability coefficient using the Pearson product-moment correlation coefficient model, and the relationship between the two stages of implementation was investigated.

Furthermore, calculations related to diagnostic validity were performed using the scatter diagram method (Davis method). The dispersion chart method (Davis method) or the examination of clinically significant differences for tests involves calculating the standard error of measurement for each test. The standard error of measurement for the total balance scores is also obtained, followed by calculating the square root of the total standard error (target test). This figure is then multiplied by 1.96, with an emphasis on the  $\alpha = 0.05$  level, to determine the critical point of difference.

## 4. Results

The study included 250 participants, of whom 55.2% were girls and 44.8% were boys. Participants were selected from students aged 7 to 9 years, with 21% in the first grade, 42% in the second grade, and 37% in the third grade. The research questions were tested using the scatter diagram method (Davis method). Psychometric analyses, with an emphasis on the five scales of the WISC-V, are presented as follows:

According to Table 1, emphasizing the level of significance obtained from the experimental value and the critical value, there is no significant difference in the "similarities", "vocabulary", "information", and "comprehension" tests at the  $\alpha = 0.05$  level. Therefore, since the difference between the experimental value (ADHD) and the critical value (normal) is less than 3, and there is minimal difference between the experimental and critical values, it can be concluded that the "similarities", "vocabulary", "information", and "comprehension" tests in the WISC-V do not possess diagnostic validity for children with ADHD and do not perform well in diagnosing ADHD.

According to Table 2, emphasizing the level of significance obtained from the experimental value and the critical value, there is no significant difference in the "block design with time bonus", "block design without time bonus", and "visual puzzles" tests at the  $\alpha = 0.05$  level. Since the difference between the experimental value (ADHD) and the critical value (normal) is less than 3, and there is minimal difference between the experimental and critical values, it can be concluded that the "block design with time bonus", "block design without time bonus", and "visual puzzles" tests in the WISC-V do not possess diagnostic validity for students with ADHD and do not perform well in diagnosing ADHD.

According to Table 3, emphasizing the level of significance obtained from the experimental value and the critical value, there is no significant difference in the "matrix reasoning", "picture weights", "picture concepts", and "arithmetic" tests at the  $\alpha = 0.05$  level. Therefore, since the difference between the experimental value (students with ADHD) and the critical value (normal students) is less than 3, and there is minimal difference between the experimental and critical values, it can be concluded that the "matrix reasoning", "picture weights", "picture concepts", and "arithmetic" tests in the WISC-V do not possess diagnostic validity for students with ADHD and do not perform well in diagnosing these students.

According to Table 4, emphasizing the level of significance obtained from the experimental value and the critical value, there is no significant difference in the

**Table 1.** Diagnostic Validity of the Test "Verbal Comprehension" Scales with Emphasis on Scatter Diagram Method

Tests	Extent of Experimental Difference	Critical Difference Rate	The Amount of Difference Experimental and Critical	P-Value	Diagnostic Validity
Similarities	1.15	2.45	1.13	-	Don't have
Vocabulary	0.32	2.40	2.08	-	Don't have
Information	0.26	2.42	2.16	-	Don't have
Comprehension	1.26	2.59	1.33	-	Don't have

**Table 2.** Diagnostic Validity of the Test "Visual-Spatial" Scales

Tests	Extent of Experimental Difference	Critical Difference Rate	The Amount of Difference Experimental and Critical	P-Value	Diagnostic Validity
Block design with time bonus	0.88	2.51	1.63	-	Don't have
Block design without time bonus	0.08	2.52	2.44	-	Don't have
Visual puzzles	0.45	2.49	2.04	-	Don't have

"digit span forward", "digit span backward", "digit span consecutive", "picture span", "letter-number sequence", and "cancellation" tests at the  $\alpha = 0.05$  level. Therefore, since the difference between the experimental value (ADHD) and the critical value (normal students) is less than 3, and there is minimal difference between the experimental and critical values, it can be concluded that the "digit span forward", "digit span backward", "digit span consecutive", "picture span", "letter-number sequence", and "cancellation" tests in the WISC-V do not possess diagnostic validity for students with ADHD and do not show optimal performance in diagnosing these students.

According to Table 5, emphasizing the level of significance obtained from the experimental value and the critical value, there is a significant difference in the "coding", "symbol search", "random cancellation", and "structural cancellation" tests at the  $\alpha = 0.01$  level. Therefore, since the difference between the experimental value (students with ADHD) and the critical value (normative students) is more than 3, and the experimental value is higher than the critical value, it can be concluded that the "coding", "symbol search", "random cancellation", and "structural cancellation" tests in the WISC-V possess diagnostic validity for students with ADHD and demonstrate favorable efficiency in diagnosing these students.

### 5. Discussion

This study rigorously examines the diagnostic validity of the WISC-V in identifying students diagnosed with attention- ADHD. The primary objective is to

evaluate the WISC-V's effectiveness in distinguishing students with ADHD from their neurotypically developing counterparts. In Iran, there is a significant gap in empirical research concerning the diagnostic validity of the WISC-V, positioning this study as a crucial step toward filling that void. Previous studies have primarily focused on the psychometric properties of cognitive assessments, emphasizing reliability coefficients and various types of validity, such as construct and content validity, while notably neglecting the aspect of diagnostic validity, especially in clinical groups like those affected by ADHD. This research aims not only to assess the overall diagnostic validity of the WISC-V for identifying ADHD but also to pinpoint which specific subtests are most impactful in facilitating an accurate diagnosis. By doing so, the study seeks to contribute valuable insights that could enhance the assessment and understanding of ADHD among children in the Iranian context.

Considering the importance of exceptional assessment and the need for reliable tools to diagnose and identify exceptional children, instruments such as the WISC-V have been developed (18). Since the diagnostic validity of this edition in students with ADHD had not been thoroughly examined, this study investigated the psychometric properties of the WISC-V in this group. The main research question was: Does the fifth edition of the WISC-V have diagnostic validity for students with ADHD? To address this question, the scatter diagram method (Davis method) was used, and the findings revealed significant differences in the tests of coding, symbol search, random cancellation, and structured cancellation at the level of  $\alpha = 0.01$ . Since the

**Table 3.** Diagnostic Validity of the Test "Fluid Reasoning" Scales

Tests	Extent of Experimental Difference	Critical Difference Rate	The Amount of Difference Experimental and Critical	P-Value	Diagnostic Validity
Matrix reasoning	1.58	2.56	0.98	-	Don't have
Picture weights	0.13	2.58	2.45	-	Don't have
Picture concepts	1.29	2.61	1.32	-	Don't have
Arithmetic	0.27	2.52	2.25	-	Don't have

**Table 4.** Diagnostic Validity of the Test "Working Memory" Scales

Tests	Extent of Experimental Difference	Critical Difference Rate	The Amount of Difference Experimental and Critical	P-Value	Diagnostic Validity
Digit span forward	4.38	2.49	1.89	-	Have
Digit span backward	3.77	2.52	1.25	-	Have
Digit span consecutive	4.69	2.53	2.16	-	Have
Picture span	3.25	2.54	0.71	-	Have
Letter-number sequence	2.72	2.50	0.22	-	Have

experimental value (students with ADHD) exceeded the critical difference value (normative students) by more than 3, it is proposed that these tests in the WISC-V have diagnostic validity and can effectively identify students with ADHD.

The studies, which examined the psychometric features of the fourth and fifth editions of WISC, consistently highlight the validity and reliability of the WISC-V (14, 19).

The findings of this investigation underscore the robust diagnostic validity of the WISC-V, in identifying students with ADHD and LD. The study demonstrates the WISC-V's efficacy in distinguishing between neurotypically developing children and those exhibiting symptoms of ADHD or LD, highlighting its critical role in facilitating early detection and targeted intervention. Such capabilities are pivotal for mitigating the academic and social challenges associated with these neurodevelopmental disorders.

These results are consistent with prior research. Nazari et al. (20) established the WISC-V's diagnostic reliability for LD in diverse educational settings, while Bodaghi et al. (14) confirmed its sensitivity and specificity in identifying ADHD within specific populations. Shiri Aminlou et al. (21) further emphasized the scale's neuropsychological relevance, noting its comprehensive assessment of cognitive domains integral to learning processes. Additionally, Ünal et al. (22) validated the WISC-V's cross-cultural applicability, reinforcing its utility in distinguishing

ADHD across varied demographic contexts. Gilbert et al. (23) advise against relying solely on the WISC-V as an independent diagnostic tool, emphasizing the importance of adopting a multi-dimensional assessment strategy. Their research underscores the need to incorporate additional diagnostic tools and approaches to achieve a well-rounded evaluation of a child's cognitive and behavioral characteristics. Although the WISC-V is a dependable and effective diagnostic instrument, it should be used as part of a broader, more comprehensive framework to fully understand and address the unique needs of each individual.

By comparing the findings of the current research with previous studies, we determined that the diagnostic validity of the fifth version of the WISC-V is consistent with several recent studies. Specifically, Shiri Aminlou et al. (24) examined the diagnostic validity of the WISC-V in students with LD in Tehran province, confirming its effectiveness in this population. Erden et al. (15) investigated the diagnostic utility of the WISC-IV in identifying gifted children, emphasizing its effectiveness in cognitive assessments. Their findings highlighted that the WISC-IV not only accurately identifies giftedness but also provides valuable insights into the cognitive profiles of these children, such as strengths in verbal comprehension and perceptual reasoning. This underscores the importance of using comprehensive intelligence tests for early identification and tailored educational interventions. Kamkari (11) focused on the diagnostic validity of the new edition of

**Table 5.** Examining the Diagnostic Validity of the Test "Processing Speed" Scales

Tests	Extent of Experimental Difference	Critical Difference Rate	The Amount of Difference Experimental and Critical	P-Value	Diagnostic Validity
Coding	5.25	2.01	3.24	0.001	Have
Symbol search	5.72	2.10	3.62	0.001	Have
Random cancellation	6.66	2.56	4.10	0.001	Have
Structural cancellation	5.55	2.51	3.04	0.001	Have

the Tehran-Stanford-Binet Intelligence Test in students with ADHD, further supporting the reliability of intelligence assessments in this group. These studies collectively reinforce the diagnostic validity of the WISC-V and other intelligence tests in identifying LD and ADHD in various populations.

Additionally, Forsberg et al. (25) demonstrated that working memory significantly influences long-term memory encoding and retrieval in children and adults. Their findings suggest that working memory limitations can impair the recall of objects and their associations. These results support the use of tools like the WISC-V, which effectively assesses working memory and other cognitive domains, to identify strengths and weaknesses in learning-related areas. Similarly, Dembrowski et al. (26) analyzed the internal structure of the WISC-V, conducting an exploratory two-factor analysis of the WISC-V with 16 tests, suggesting that the instrument has five factors: Verbal comprehension (4 tests), visual-spatial reasoning (2 tests), fluid reasoning (4 tests), working memory (4 tests), and processing speed (3 tests). These results align with the study by Rodríguez-Cancino and Concha-Salgado (19), who explored the internal structure of the WISC-V in Chile using exploratory and confirmatory factor analyses of the 15 subtests. Their research further supports the robustness of the WISC-V's factor structure across different cultural contexts. Collectively, these findings confirm that the WISC-V has strong construct and concurrent validity, making it a reliable and valid instrument for screening, diagnosing, and identifying ADHD.

### 5.1. Conclusions

This study's findings indicate that the fifth edition of the WISC-V has strong diagnostic validity in identifying students with ADHD. Specifically, subtests related to processing speed, such as coding and symbol search, demonstrated significant differences between students with ADHD and the normative group. These results suggest that the WISC-V not only serves as a comprehensive tool for assessing intelligence but also

functions effectively as a diagnostic instrument for identifying neurodevelopmental disorders like ADHD.

This study has several limitations. First, there was a lack of specialized statistical software to suggest the optimal cut point on the reading axis. Second, some participants were uncooperative due to the time-consuming nature of the WISC-V implementation. Third, there is a scarcity of authentic research on the fifth version of the Wechsler IQ Scale for Children, limiting comparability with other studies. Given the research findings focus on the desirable psychometric properties of the WISC-V for diagnosing students with ADHD, it is suggested that this tool be used to assess cross-cultural validity in other countries and cultures. Further research is recommended on clinical samples, even at the national level, considering differences in social status, gender, and various statistical methods and models for evaluation and comparison.

### Footnotes

**Authors' Contribution:** K. K.: Study concept and design; N. M.: Analysis and interpretation of data; N. M.: Drafting of the manuscript; K. K. and A. B.: Critical revision of the manuscript for important intellectual content; A. B.: Statistical analysis.

**Conflict of Interests Statement:** The authors declared no conflict of interest.

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