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Investigating the sensitivity coefficient of the fifth version of the Wechsler children's intelligence scale in students with attention deficit disorder

Mehnoosh. Bodaghi[1], Kambiz. Kamkari[2*], Sara. Saedi[3]

[1] Ph.D. Student, Department of Psychology, Borujerd Branch, Islamic Azad University, Borujerd, Iran
[2] Associate Professor, Department of Psychology and Education of Exceptional Children, Islamshahr Branch, Islamic Azad University, Islamshahr, Iran
[3] Assistant Professor, Department of Psychology, Borujerd Branch, Islamic Azad University, Borujerd, Iran

*** Corresponding author email address**: Kambizkamkary@gmail.com

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A B S T R A C T

Objective: Attention deficit/hyperactivity disorder (ADHD) is known in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders with primary diagnostic criteria including attention deficit, impulsivity and hyperkinesis. The aim of this study was to investigate the sensitivity coefficient of the fifth version of the Wechsler Intelligence Scale in children with attention deficit disorder in Tehran.

Methods and Materials: The present research method is located in the field of psychometric studies, which is a subset of the methodological methodology. The research population consists of all students with attention deficit disorder in Tehran who have referred to psychology and counseling centers who are covered by educational-therapeutic services (they have a diagnostic record as attention deficit) and 120 people were selected as statistical sample using purposeful sampling method. The measurement tool in this study was the fifth version of the Wechsler Intelligence Scale for children. The statistical model used in this study was to determine the diagnostic validity, distribution diagram method (Davis method), confidence interval method, and sensitivity and clarity coefficient method.

Findings: Finally, the findings showed that all tests of working memory and processing speed scales have a sensitivity factor.

Conclusion: Therefore, the tests of working memory scale and processing speed have diagnostic validity and can distinguish students with attention deficit disorder from normal students.

Keywords: *Sensitivity coefficient, fifth edition, Wechsler intelligence scales for children, students, attention deficit.*

1. Introduction

Attention Deficit/Hyperactivity Disorder is recognized in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) with primary diagnostic criteria including attention deficits, impulsivity, and hyperactivity. It encompasses three often co-occurring types: predominantly inattentive, predominantly impulsive, and a combined type (American Psychiatric Association, 2022). The international prevalence of Attention Deficit/Hyperactivity Disorder ranges between 2 to 21 percent. In Iran, the prevalence ranges from a minimum of 0.95% to a maximum of 17%, with an average of 8.7% (Dombrowski et al., 2015). Approximately 70% of children with ADHD also have a learning disorder; hence, the American Academy of Child and Adolescent Psychiatry (AACAP) recommends intelligence tests be used in the clinical assessment of these children to understand their intellectual functioning, which can serve as a basis for comparing intra-individual deficits in specific areas (Dombrowski et al., 2018).

The Wechsler Intelligence Scale for Children (WISC) is widely used for the assessment of children with ADHD. These scales are globally popular due to their comprehensive and standardized approach to cognitive assessment, with various translations and norms available (D'Angiulli & Siegel, 2003). The fifth edition of the Wechsler Intelligence Scale for Children (WISC-V) is the latest version, presenting a significant revision from the fourth edition and designed to meet the needs of identifying and treating children with learning disorders through a process-oriented approach, providing increased utility markers for learning disorders and attention-deficit/hyperactivity disorder, and standard measures for assessing test behavior, problem-solving, and cognitive processes (Weiss et al., 2016). This version, as one of the most comprehensive tools available, not only assesses intelligence but also provides additional markers for diagnostic, identification, and clinical interventions, with a four-factor model introduced in the fifth version, merging fifteen subtests to provide useful information for screening and diagnosing attention deficits, as well as for educational and clinical interventions based on needs assessment (Dombrowski et al., 2018; Miller & Jones, 2023). Numerous studies have investigated the psychometric properties, particularly the diagnostic validity, of the Wechsler Intelligence Scales (Canivez et al., 2016; Canivez et al., 2019; Dombrowski et al., 2015; Kamkari et al., 2021).

Given the lack of appropriate tools for identifying children with attention deficits in Iran and the reliance on outdated assessments, it is imperative to utilize modern technology in advancing the knowledge of Islamic countries and achieve psychometric indices for the intelligence scales among children with attention deficits. This will facilitate a developed assessment movement, allowing for proper scientific and research frameworks for identifying these children and thereafter, needs assessment and planning. Hence, this research aims to examine the sensitivity index of the fifth edition of the Wechsler Intelligence Scale for Children in students with attention deficits in the districts of Tehran.

2. Methods and Materials

2.1. Study Design and Participants

The present research falls within the domain of psychometric designs, a subset of methodological studies. In this study, after identifying sampling units, all research samples were examined through the testing process. Following the collection of data and fieldwork phases, data extraction and analysis were conducted, focusing on the diagnostic validity of the fifth edition of the Wechsler Intelligence Scale for Children among students with attention deficit disorder in Tehran districts. The population of this study included all students diagnosed with attention deficit disorder across the districts of Tehran in the academic year 2021-2022. Using purposive sampling, a non-random sampling technique, 12 psychological and counseling centers from Tehran districts were selected as sampling units, and 10 individuals were evaluated from each center, totaling 120 participants for the study. Additionally, to select normative samples consisting of male and female students from Tehran districts without attention deficit disorder, stratified random sampling was utilized, focusing on the layers of Tehran districts. As such, 10 individuals from each of the 12 districts - Islamshahr, Robat Karim, Golestan Garden, Shahr-e-Rey, Shahriar, Malard, Qods City, Firoozkooh, Damavand, Saveh, Varamin, and Karaj - were selected as normative samples.

Inclusion criteria for the study were defined based on the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), specifically a definitive diagnosis of attention deficit disorder of the hyperactivity type and no co-occurring neurodevelopmental or psychological disorders (as per counseling file review), with an IQ range of 90 to 115 as recorded in the student's

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counseling file. Exclusion criteria included any reluctance from the child or parents to continue participation during the testing process. Ethical considerations were strictly adhered to, ensuring confidentiality and privacy of information, reassuring parents in answering questions and clarifying doubts, and emphasizing the possibility of withdrawal from consent and continuation of cooperation at any stage of the research. Consent forms were obtained from the parents of all participating students.

2.2. Measures

2.2.1. Wechsler Intelligence Scale for Children-V

The fifth edition of the Wechsler Intelligence Scale for Children is the measurement instrument for this study. This clinical tool is executed individually for children aged 6 years to 16 years and 11 months for cognitive assessment. The WISC-V consists of five primary scales: Verbal Comprehension, Visual-Spatial Processing, Fluid Reasoning, Working Memory, and Processing Speed. The Verbal Comprehension scale includes primary tests of Similarities and Vocabulary and substitute tests of Information and Comprehension. The Visual-Spatial scale includes a primary test of Block Design and a substitute test of Picture Puzzles. Fluid Reasoning includes primary tests of Matrix Reasoning and Figure Weights and substitute tests of Picture Concepts and Arithmetic. Working Memory includes a primary test of Digit Span and substitute tests of Picture Span and Letter-Number Sequencing. Processing Speed includes a primary test of Coding and substitute tests of Symbol Search and Cancellation, totaling 16 tests and 21 subtests as outlined (Kamkari et al., 2021; Miller & Jones, 2023; Weiss et al., 2016).

2.3. Data analysis

Ultimately, after data collection was completed, all empirical data were entered into SPSS software version 23. Descriptive statistical indices (measures of central tendency and dispersion) and methods of sensitivity ratio and precision-orientation were used to examine diagnostic validity. Specifically, diagnostic validity was assessed using the sensitivity ratio with a dichotomous discrete variable representing the presence or absence of deficiency, disability, or disorder as identified by diagnostic tools. A cut-off point was used as an effective measure in calculating the sensitivity ratio and precision-orientation.

3. Findings and Results

In this study, 120 students with attention deficits participated, consisting of 44 females (36.66%) and 76 males (63.34%). Among them, 24 (20%) were in the first grade, 58 (48.34%) in the second grade, and 38 (31.66%) in the third grade. As the diagnostic validity of measurement tools requires the use of modern technology, the sensitivity index and precision-orientation were employed to garner additional data regarding diagnostic validity with a focus on dichotomous discrete variables. Diagnostic validity in psychological tools is determined by a two-valued discrete variable representing the presence or absence of a disability, using diagnostic tools. A cut-off point and composite axes were used as an effective means of calculating the sensitivity coefficient and precision-orientation. Based on the standard test analysis process, the fifth edition of the Wechsler Intelligence Scale for Children tests were selected as screening tools for identifying attention deficits. Accordingly, twenty tests related to the five scales of Verbal Comprehension, Visual-Spatial, Fluid Reasoning, Working Memory, and Processing Speed were considered. A cut-off point of 7 on the ROC curve was determined, with scores below 7 indicating a suspicious area for attention deficits.

It's noteworthy that if a test has a sensitivity coefficient of 0.70 or higher, it indicates that the test has diagnostic validity and can distinguish students with attention deficit disorder from normal students. Since the Working Memory and Processing Speed tests have sensitivity and precision-orientation coefficients, tables related to these two scales will be provided. Therefore, focusing on the normative and attention-deficit groups with a cut-off point of 7, the following concordance tables were derived:

Table 1

Diagnostic Validity of Direct Number Capacity Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	4	3.33	116	96.67	120	100
	Students with AD	90	75	30	25	120	100

For 90 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.75 was considered. Additionally, as 116 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.96, indicating that the test has

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diagnostic validity for students with attention deficit disorder.

Table 2

Diagnostic Validity of Inverse Number Capacity Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	27	22.5	93	77.5	120	100
	Students with AD	112	93.33	8	6.67	120	100

For 93 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.77 was considered. Additionally, as 112 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.93.

Table 3

Diagnostic Validity of Sequential Number Capacity Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	35	29.17	85	70.83	120	100
	Students with AD	116	96.67	4	3.33	120	100

For 116 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.96 was considered. Additionally, as 85 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.71.

Table 4

Diagnostic Validity of Picture Capacity Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	31	25.83	89	74.17	120	100
	Students with AD	113	94.17	7	5.83	120	100

For 113 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.94 was considered. Additionally, as 89 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.74.

Table 5

Diagnostic Validity of Number-Letter Sequence Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	30	25	90	75	120	100
	Students with AD	110	91.67	10	8.33	120	100

For 110 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.92 was considered. Additionally, as 90 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.75.

Table 6

Diagnostic Validity of Coding Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	34	28.33	86	71.67	120	100
	Students with AD	112	93.33	8	6.67	120	100

For 112 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.93 was considered. Additionally, as 86 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.72.

Table 7

Diagnostic Validity of Symbol Search Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	28	23.33	92	76.67	120	100
	Students with Attention Deficits	109	90.83	11	9.17	120	100

For 109 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.91 was considered. Additionally, as 92 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.77.

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Table 8

Diagnostic Validity of Random Cancellation Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	21	17.5	99	82.5	120	100
	Students with Attention Deficits	112	93.33	8	6.67	120	100

For 112 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.93 was considered. Additionally, as 99 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.82.

Table 9

Diagnostic Validity of Structured Cancellation Test Emphasizing Sensitivity and Precision-Orientation Coefficients

Cut-off Point	Group	7 and below	%	8 and above	%	Total	%
	Normal students	24	20	96	80	120	100
	Students with Attention Deficits	113	94.17	7	5.83	120	100

For 113 students diagnosed as suspect for attention deficit disorder by the tool, a sensitivity coefficient of 0.94 was considered. Additionally, as 96 normal students were identified as not having attention deficits, the precision-orientation coefficient is 0.80.

4. Discussion and Conclusion

The aim of the study was to investigate the sensitivity coefficient of the fifth edition of the Wechsler Intelligence Scale for Children among students with attention deficits in the districts of Tehran. This research, rooted in the absence of empirical data or findings regarding the diagnostic validity of the fifth edition of the Wechsler Intelligence Scale for Children for students with attention deficits, seeks to obtain psychometric information as the dimensions of the issue at hand. Although various studies have been conducted on the psychometric characteristics of individual cognitive scales in Iran, most have not addressed diagnostic validity, focusing instead on presenting reliability coefficients and construct or content validity. Therefore, emphasizing diagnostic validity using sensitivity and precision-orientation methods in clinical groups, particularly attention deficits, was pursued to examine diagnostic validity in line with answering the research questions as follows:

In this research, the methods of sensitivity and precision-orientation were employed. It was found that in tests such as "Direct Number Capacity," "Inverse Number Capacity," "Sequential Number Capacity," "Picture Capacity," and "Number-Letter Sequence" from the Working Memory scale, and "Coding," "Symbol Search," "Random Cancellation," and "Structured Cancellation" from the Processing Speed scale, the frequency of students diagnosed with attention deficits by both the tool and the specialist (sensitivity coefficient) is higher than those not diagnosed by either (precision-orientation coefficient). Since the sensitivity coefficient is greater than 0.70, it is inferred that the aforementioned tests of the fifth edition of the Wechsler Intelligence Scale for Children possess diagnostic validity for students with attention deficits using the sensitivity method and can efficiently identify students with attention deficits from normal students. In other words, they can indicate the occurrence of this disorder and identify students with attention deficits. It is important to note that the precision-orientation coefficient is also higher than 0.70 in tests from the Working Memory and Processing Speed scales, suggesting that these tests can avoid incorrect labeling and indicate the absence of a disorder when it does not exist. The results are in line with the previous findings (Canivez et al., 2016; Canivez et al., 2019; Dombrowski et al., 2018; Dombrowski et al., 2015; Kamkari et al., 2021; Miller & Jones, 2023; Weiss et al., 2016).

5. Limitations & Suggestions

One limitation of this article is that it primarily focuses on the diagnostic validity of the fifth edition of the Wechsler Intelligence Scale for Children exclusively within the context of students with attention deficits in Tehran's districts. This geographical and contextual limitation may affect the generalizability of the findings to other populations or regions. Additionally, the study relies on the precision-orientation and sensitivity coefficients for validity, which, while robust, do not encompass the entire spectrum of psychometric properties like test-retest reliability or inter-rater reliability. Furthermore, as it is a cross-sectional study, the results are limited to a specific point in time without considering the longitudinal changes in the diagnostic

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validity or the potential evolution of the disorder's characteristics in the population studied.

For future research, it is recommended to extend the study to include a more diverse demographic and geographic population to enhance the generalizability of the findings. Additionally, incorporating a longitudinal design could provide insights into the stability of the diagnostic validity over time and how changes in cognitive development might affect the results. Researchers might also consider including a broader range of psychometric properties, such as test-retest reliability and inter-rater reliability, to provide a more comprehensive understanding of the scale's effectiveness. Finally, integrating qualitative data could enrich the understanding of the tool's applicability and the lived experiences of individuals diagnosed with attention deficit disorder, offering a more nuanced view of the scale's practical utility in various contexts.

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Declaration of Interest

The authors of this article declared no conflict of interest.

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Ethics Considerations

Ethical considerations were observed in this study, including confidentiality, privacy, and honesty. Participation in the study did not pose any potential harm to the participants.

Authors' Contributions

The authors' contributions to this study titled "Investigating the sensitivity coefficient of the fifth version of the Wechsler Children's Intelligence Scale in students with attention deficit disorder" are as follows: Mehnoosh Bodaghi contributed to the conceptualization of the research objectives, participated in data collection by selecting the research population and determining the sample size, and played a role in data analysis, applying statistical methods to interpret the findings. Kambiz Kamkari was involved in conceptualizing the research, contributed to the development of research questions, participated in data analysis, and provided valuable insights into the interpretation of results. Sara Saedi contributed to data collection by assessing students with attention deficit disorder, participated in data analysis, and lent her expertise to the manuscript writing process, including the abstract, results, and discussion sections. All authors have read and approved the final manuscript.

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