

Concurrent Validity of Persian Version of Wechsler Intelligence Scale for Children - Fourth Edition and Cognitive Assessment System in Patients with Learning Disorder

Rostami, Reza¹, MD; Sadeghi, Vahid¹; Zarei, Jamileh¹; Haddadi, Parvaneh¹, MSc;
Mohazzab-Torabi, Saman²; Salamati, Payman^{*3}, MD

1. Department of Psychology and Education, University of Tehran, Tehran, Iran
2. Students Research Committee, Baqiyatallah University of Medical Sciences, Tehran, Iran
3. Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences, Tehran, Iran

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Abstract

Objective: The aim of this study was to compare the Persian version of the wechsler intelligence scale for children - fourth edition (WISC-IV) and cognitive assessment system (CAS) tests, to determine the correlation between their scales and to evaluate the probable concurrent validity of these tests in patients with learning disorders.

Methods: One-hundred-sixty-two children with learning disorder who were presented at Atieh Comprehensive Psychiatry Center were selected in a consecutive non-randomized order. All of the patients were assessed based on WISC-IV and CAS scores questionnaires. Pearson correlation coefficient was used to analyze the correlation between the data and to assess the concurrent validity of the two tests. Linear regression was used for statistical modeling. The type one error was considered 5% in maximum.

Findings: There was a strong correlation between total score of WISC-IV test and total score of CAS test in the patients ($r=0.75$, $P<0.001$). The correlations among the other scales were mostly high and all of them were statistically significant ($P<0.001$). A linear regression model was obtained ($\beta = -0.51$, $\beta = -0.81$ and $P<0.001$).

Conclusion: There is an acceptable correlation between the WISC-IV scales and CAS test in children with learning disorders. A concurrent validity is established between the two tests and their scales.

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Key Words: Correlation of Data; Learning Disorders; Wechsler Scales; Intelligence Test; Cognitive Assessment

Introduction

Many children with learning disorders (LD) are mistakenly considered as having intellectual weakness resulting in missing appropriate treatment. However, the intelligence is regarded as one of the prognostic factors in learning disorders; thus, studying the children with learning disorders in terms of intelligence is necessary^[1].

Different tests are used for assessing the

intelligence in children. Wechsler Intelligence Scale for Children - Fourth Edition (WISC-IV) is one of the most important tests for measuring the intelligence in children^[2-3]. Wechsler Intelligence Scale is one of the oldest methods for the determination of intelligence in children. WISC-IV is the result of a combination of some verbal comprehension, perceptual reasoning, working memory, processing speed, and full intelligence scales. In this test, those who are below the average range in cognitive abilities are in a lower

* Corresponding Author;

Address: Sina Trauma and Surgery Research Center, Sina Hospital, Imam Khomeini Avenue, Tehran, Iran

E-mail: psalamati@tums.ac.ir

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level than their peers in reasoning, thinking and understanding abilities and should be followed up through therapeutic interventions^[4].

Cognitive assessment system (CAS) is another test to determine children's intelligence. This test will explore the cognitive and neuropsychological functions of children. CAS objective is to measure the basic processes of individual capabilities known as cognitive processes of PASS (planning, attention, simultaneous, successive) that are the basics of human intelligence function. These four processes are interrelated and interact with the basic knowledge of the human^[5-6].

Both of the tests have been previously translated into Persian by Iranian researchers and the validity and reliability of the Persian versions have been evaluated^[7-8].

Although the Persian version of both WISC-IV and CAS tests are used for determining intelligence coefficient in patients with LD, however, there is no documented correlation between their results.

This study aimed to compare the Persian version of the two tests, to determine the correlation among their scales and to evaluate the probable concurrent validity of these tests in patients with learning disorders.

Subjects and Methods

All children aged 6 to 15 years with suspected learning disorders who were presented at Atieh Comprehensive Psychiatry Center, Tehran, from May till August 2010 were selected in a consecutive non-randomized order; the patients were examined by a single psychiatrist and those with documented disease were enrolled in a cross-sectional study. Not having any neurological and psychiatric disorders and not taking any other medication were considered as the inclusion criteria. All of the patients were assessed based on WISC-IV and CAS scores questionnaires.

WISC-IV test performance requires constant cooperation of the subjects and examiner during the test; the test consists of two practical and verbal parts. Each of the practical and verbal intelligence scales consist of several subscales. To run the test, it was necessary that the subjects and

the examiner sit behind a table in front of each other. In most of the subscales, the runtime is critical making the use of a stopwatch and recording the exact time necessary. Some scales of the test such as similarity section were performed verbally; for example the subjects were asked to express the similarity between two words or two things. Practical parts included performances such as encryption, in which the subjects were asked to place some learnt symbols into the blank places of various shapes using a pencil. During the test implementation it was tried to set the location of running test in a standard and good condition regarding ventilation, light, complete silence and proper table height. The average time needed to run the Wechsler test was one hour. This time could be slightly less or more than usual according to the responses of the subjects. If due to the subject tiredness it was needed to postpone a part of the test to another time, the next session would not be set after more than a week interval. Each sub-tests of Wechsler Intelligence Scale have a specific instruction for correcting and grading. Generally, grading of the tests, such as encryption and calculating was very simple but others, such as grading vocabulary capacity and similarities depended on the examiner's ability to evaluate and judge. After calculating the crude scores, the balance scores were calculated using tables designed according to specific age groups and the subjects' practical, verbal and total IQ scores were assessed using tables. This test has been translated to Persian, adapted and standardized by Abedi et al^[7].

The CAS test was conducted using pen and paper method by cooperation of the subject and the examiner during the test. The runtime was usually considered 1.5 hours and, with respect to how the subject responded, the test duration could be modified up to 15 minutes more or less. Some subscales such as a pairing the numbers were practically performed by the subjects; for example in pairing the numbers, the subjects were asked to circle around two identical numbers in each line. Other fields such as phrases repetitions were performed verbally; the subject is provided with sentences starting with easy phrases and ending in complex ones and he/she must take the sentences in mind and repeat the exact phrases. Because of scales such as planning and attention, which reflect the problems such as attention

Table 1: The mean and standard deviation for the scales of Wechsler Intelligence Test Fourth Edition (WISC-IV) and Cognitive Assessment System

Scale	Subscale	Mean (SD)
Wechsler Intelligence-IV	Verbal comprehension	110.37 (17.31)
	Perceptual reasoning	103.52 (16.18)
	Working memory	93.91 (15.46)
	Processing speed	100.61 (16.18)
	Full intelligence	101.28 (15.96)
Cognitive Assessment System	Planning	79.01 (13.91)
	Simultaneous	90.52 (15.76)
	Attention	87.15 (15.28)
	Successive Processes	88.75 (14.52)
	Total score	81.21 (17.17)

deficit hyperactive disorders (ADHD), the patient was recommended not to use narcotic -containing drugs such as codeine and also hyperactivity associated drugs such as Ritalin before running the test.

CAS test has two separate forms, specified for ages of 5-7 years and 8-17 years which are performed with respect to the exact age of the subjects. The test is composed of four scales of planning, attention, simultaneous, and successive; the crude score of each scale was obtained by adding the scores of the sub-scales. After putting the scores on the Scale Score Tables which are prepared based on different ages, the final scores of the scales were obtained. The reliability and validity of the test is assessed by Fathi et al^[8].

The sample size of our study was calculated as 162 cases regarding a correlation coefficient of 0.71 between the Wechsler intelligence test and CAS test total scores obtained in previous studies and an estimated precision of 0.07^[9].

Pearson correlation coefficient was used to analyze the correlation among the data and to assess the concurrent validity of the two tests. Linear regression was used for statistical modeling. The type one error was considered 5% in maximum.

Findings

A total of 162 children suffering from LD with a mean age of 9.07 ± 2.068 were recruited in the study during April to August 2010. The minimum

age was 6 years and the maximum was 15 years old, of which 111 (68.5%) cases were males and 51 (31.5%) females. Considering education level, 123 (75.9%) of the children were in the first grade, 32 (19.8%) in the second grade, 6 (3.7%) in the third grade and one (0.6%) in the fourth grade of primary school.

The data for Wechsler Intelligence Test - Fourth Edition (WISC-IV) and Cognitive Assessment System (CAS) were analyzed. The mean and standard deviation for the subscales of WISC-IV and CAS are presented in Table 1.

Pearson correlation showed that there was a significant positive correlation between verbal scale of WISC-IV and planning scale of CAS system ($r=0.457$). There was also significant correlation between verbal intelligence and simultaneous processes scales ($r=0.632$), between verbal intelligence scale and attention scale of CAS ($r=0.430$), between verbal intelligence and successive processes scales (0.551) and between verbal intelligence scale of WISC-IV and total score of CAS test ($r=0.573$) (Table 2).

Pearson correlation also showed that there was a significant correlation between perceptual intelligence and planning scales ($r=0.583$), between perceptual intelligence scale and simultaneous processes scale ($r=0.776$), between successive processes scale ($r=0.450$) and between perceptual intelligence scale and total score of CAS test ($r=0.695$) (Table 2).

Pearson correlation indicated a significant correlation between working memory scale of WISC-IV and planning scale ($r=0.571$), between working memory scale of WISC-IV and simultaneous processes scale ($r=0.635$), between

Table 2: The correlation between Wechsler intelligence Test Fourth Edition (WISC-IV) and Cognitive Assessment System scales

Scale	Cognitive Assessment System scales				
	Planning	Simultaneous	Attention	Successive processes	Total score
Verbal comprehension	0.457	0.632	0.430	0.551	0.573
Perceptual reasoning	0.583	0.776	0.569	0.450	0.695
Working memory	0.571	0.635	0.544	0.689	0.665
Processing speed	0.646	0.550	0.668	0.315	0.625
Full intelligence	0.637	0.773	0.627	0.617	0.750

* $P < 0.001$ in all correlations

working memory and attention scales (0.544), between working memory and successive processes scales ($r=0.689$) and between working memory scale and total score of CAS test ($r=0.665$) (Table 2).

Pearson correlation also stated a significant correlation between information processing scale of WISC-IV and planning scale ($r=0.646$), between information processing scale of intelligence and simultaneous processes scale ($r=0.550$), between information processing scale and attention scale (0.668), between information processing and successive processes scales ($r=0.315$) and between information processing scale and total score of CAS test ($r=0.625$) (Table 2).

Besides, there was a significant correlation between full intelligence score of WISC-IV test and planning scale of CAS test ($r=0.637$), between full intelligence score of WISC-IV test and simultaneous processes scale of CAS test ($r=0.773$), between full intelligence score of WISC-IV test and attention scale of CAS test (0.627), between full intelligence score of WISC-IV test and successive processes scale of CAS test ($r=0.617$) and between full intelligence score of WISC-IV test and total score of CAS test ($r=0.750$) (Table 2).

Considering intelligence score as the independent variable and CAS test score as dependent variable in a linear regression model, a significant model was obtained for which the results are as follows: $\beta = 0.51$, $\beta = 0.81$ and $P < 0.001$.

Discussion

This study showed that there was a strong correlation between total score of WISC-IV test and total score of CAS test in these patients

($r=0.75$, $P < 0.001$). The study of the correlations among the other scales of these two tests which are all statistically significant ($P < 0.001$) gives valuable information.

On the other hand, considering the score of Wechsler test as the independent variable and CAS test score as the dependent variable in a linear regression model between Total score of these two tests, a significant model was obtained ($\beta = 0.51$, $\beta = 0.81$, $P < 0.001$). Thus, we can generally conclude that there is a concurrent validity between total score of WISC-IV test and total score of CAS test and also among the scales of these two tests.

Learning disorders are born due to poor functioning of the brain and can influence the individual mental processes such as word recognition, memory, reading comprehension, auditory language processing and mathematical analysis. Learning disorders can also be associated with different types of ADHD, behavioral disorders and sensory disabilities^[10-13].

Since 1905, Binet's intelligence scales were considered as the preferred tests. The weaknesses of Binet's scales led Wechsler to provide new intelligence scales; the latest in children were called WISC-III and WISC-IV^[14-15].

On the other hand, there have been efforts in the recent years to provide tests that follow the new knowledge of psychology. These tests are based on approaches that study intelligence as a group of cognitive processes.

CAS test was developed and reviewed in the mid-nineties by Naglieri and colleagues and applied in 2200 American children aged 5-17 years who were categorized according to age, sex, race and ethnicity, geographic region, educational status and parental education. It is an appropriate alternative to the conventional intelligence tests^[16].

CAS test is a test with high validity in structure, prediction and content. The theory of PASS is a useful method for evaluating and understanding the cognitive function^[17]. There are a few studies questioning the results of the CAS test.

Kranzler et al studied confirmatory factor analysis of the CAS in 1999. They investigated 2200 subjects from 5 through 17 years old. However, they couldn't get construct validity for the CAS^[5]. Taddei and his co-worker tried to examine differences between children with ADHD and specific learning disabilities based on cognitive function using WISC and CAS. They realized that there was a mild sensitivity for WISC. However, CAS scores seemed to be more useful for differentiating the patients^[18]. Validity analyses are the best methods for assessing translated version of questionnaires^[19]. In other hand, evaluating concurrent validity between tests is common and has been performed in many studies^[20-21].

The correlation and validity of these two tests have been previously investigated in a number of studies; our study confirmed their results. Feiz et al in a study which was conducted in the present center during last year, evaluated the correlation between Wechsler Intelligence test- third edition and the CAS test among 100 children aged 5-16 years who were referred for further investigations to this specialized clinic using a Persian questionnaire. The correlations among all scales of these tests were significant and the correlation between mathematical analysis scale of Wechsler test and all scales of CAS test was significant^[22].

In a study conducted by Naglieri et al, the correlation between Wechsler intelligence test (third edition) and cognitive assessment system with Woodcock-Johnson Tests of Achievement (WJ-III) was assessed in a sample of 119 children aged 6 to 16 years. All of these children were referred to specialized psychological clinic for investigation. The three tests were conducted for all individuals. The survey results showed the validity of the CAS test in investigating the general intelligence of Wechsler (third edition) test^[23].

In another study conducted by Naglieri et al, two matched groups of 25 children with ADHD and anxiety/depression disorders were studied using Wechsler tests (third edition) and CAS and then were compared with those parameters in normal population. The findings showed that

Wechsler test differentiated the samples to a few level while the CAS test scales were sensitive to cognitive processing problems in children with ADHD^[24].

The design of study was our limitation. We suggest other researchers to conduct similar studies via prospective longitudinal ones with larger sample size.

Conclusion

In this study, an acceptable correlation was observed between the WISC-IV scales and CAS test in children with learning disorders; hence, it can be concluded that a concurrent validity is established between the two tests and their scales. So, each test can be substituted by the other one in appropriate situations.

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Conflict of Interest: None

References

1. Kolligian J, Sternberg RJ. Intelligence, information processing, and specific learning disabilities: a triarchic synthesis. *J Learn Disabil* 1987;20(1):8-17.
2. Watkins MW, Kush JC, Schaefer BA. Diagnostic utility of the learning disability index. *J Learn Disabil* 2002; 35(2):98-103.
3. Huang LV, Bardos AN, D'Amato RC. Identifying students with learning disabilities: composite profile analysis using the cognitive assessment system. *J Psychoeduc Assess* 2010;28(1):19-30
4. Kaufman AS, Mascolo JT. Test review: Wechsler intelligence scale for children, fourth edition (WISC-IV). *J Psychoeduc Assess* 2006;24(3):278-95.
5. Kranzler JH, Keith TZ. Independent confirmatory factor analysis of the cognitive assessment system (CAS)? What does the CAS measure? *School Psychol Rev* 1999;28(1):117-44.

6. Naglieri JA, Goldstein S, Delauder BY, et al. Relationships between the WISC-III and the cognitive assessment system with Conners' rating scales and continuous performance tests. *Arch Clin Neuropsychol* 2005; 20(3):385-401.
7. Abedi MR, Sadeghi A, Rabi M. Wechsler intelligence scale for children-IV implementing and grading guide/David Wechsler. Isfahan, Iran: Neveshteh publications. 2009. [In Persian]
8. Fathi, A. Comparison of cognitive brain functions among normal children and children with attention deficit disorder/hyperactivity and children with complex partial seizures [dissertation]. Tehran Al-Zahra University, 2007.
9. Naglieri JA, Das JP. Cognitive assessment system: interpretive handbook. Illinois: Riverside Publishing 1997; Pp: 70-73.
10. Bryant ET, Scott ML, Tori CD, et al. Neuropsychological deficits, learning disability, and violent behavior. *J Consul Clin Psychol* 1984;52(2): 323-4.
11. Swanson HL, Sachse-Lee C. Mathematical problem solving and working memory in children with learning disabilities: both executive and phonological processes are important. *J Exp Child Psychol* 2001;79(3):294-321.
12. Geary DC. Role of cognitive theory in the study of learning disability in mathematics. *J Learn Disabil* 2005;38(4):305-7.
13. Semrud-Clikeman M, Biederman J, Sprich-Buckminster S, et al. Comorbidity between ADHD and learning disability: a review and report in a clinically referred sample. *J Am Acad Child Adolesc Psychiatry* 1992;31(3):439-48.
14. Hoseinifar J, Zirak SR, Sheikholeslami A, et al. Examination of the relationship between ADHD and learning disorder in primary school children in Tehran. *Procedia - Social Behav Sci* 2011;15:3763-7.
15. Mayes SD, Calhoun SL. WISC-IV and WISC-III profiles in children with ADHD. *J Atten Disord* 2006;9(3): 486-93.
16. Naglieri JA. How valid is the PASS theory and CAS? *School Psychol Rev* 1999;28(1):145-62.
17. Sparrow SS, Davis SM. Recent advances in the assessment of intelligence and cognition. *J Child Psychol Psychiat* 2000; 41(1):117-31.
18. Taddei S, Contena B, Caria M, et al. Evaluation of children with attention deficit hyperactivity disorder and specific learning disability on the WISC and cognitive assessment system (CAS). *Procedia - Social Behav Sci* 2011; 29:574-82.
19. San Miguel Montes LE, Allen DN, Puente AE, et al. Validity of the WISC-IV Spanish for a clinically referred sample of Hispanic children. *Psychol Assess* 2010;22(2):465-9.
20. Gollenberg AL, Lynch CD, Jackson LW, et al. Concurrent validity of the parent-completed ages and stages questionnaires, 2nd ed. with the Bayley scales of infant development II in a low-risk sample. *Child Care Health Dev* 2010;36(4):485-90.
21. Provost B, Heimerl S, McClain C, et al. Concurrent validity of the Bayley scales of infant development II motor scale and the Peabody developmental motor Scales-2 in children with developmental delays. *Pediatr Phys Ther* 2004; 16(3):149-56.
22. Feiz P, Emamipour S, Rostami R, et al. The relationships between Wechsler intelligence Scale for Children (WISC-R) with the cognitive assessment system (CAS). *Procedia Social Behav Sci* 2010; 5: 1726-30
23. Naglieri JA, De Lauder BY, Goldstein S, et al. WISC-III and CAS: which correlates higher with achievement for a clinical sample? *School Psychol Quart* 2006;21(1):62-76.
24. Naglieri JA, Goldstein S, Iseman JS, et al. Performance of children with attention deficit hyperactivity disorder and anxiety/depression on the WISC-III and cognitive assessment system (CAS). *J Psychoeduc Assess* 2003;21(1):32-42.