The Relationship of Intelligence Quotient Scores between the WISC-III-Thai Version and Leiter-R in Children with Learning Disabilities

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Abstract

The purpose of this study was to examine the relationship between the intelligence quotient score of the Wechsler Intelligence Scale for Children-Third Edition; Thai version (WISC-III-Thai version) and the Leiter International Performance Scale-Revised (Leiter-R) and to compare the difference of the scores in both tests. Further comparison was made between the full scale IQ (FSIQ) and the verbal component subtests; Vocabulary and Digit Span.

The subjects were 30 children who had been diagnosed with learning disabilities by a physician according to DSM-IV diagnostic criteria. The participants received service from February to May 2010 at HRH Princess Maha Chakri Sirindhorn Medical Center. A sample of children with learning disabilities as determined by the WISC-III-Thai version and Leiter-R. The statistics used in this study are the percentage, average, standard deviation, Pearson Product Moment Correlation Coefficients, and Pair Sample t-test.

The results of this study were concluded as follows: (1) There was a statistically significant FSIQ score relationship in both tests at 0.01 (r=.527 and .502 respectively). (2) There was no significant difference in the mean score between both tests. (3) There was no significant difference in mean FSIQ score between vocabulary and digit span subtests in the verbal component of WISC-III-Thai version. (4) Corresponding percentages between the FSIQ score from the vocabulary and digit span subtests of WISC-III Thai version compared with Leiter-R test was 93.33 % and 86.67%, respectively.

This current study showed that the Leiter-R test is a valid clinical tool that can be used to evaluate the level of intelligence, and diagnostically screen children for learning disabilities. This can lead to appropriate recommendations for interventions of modification or accommodation in their educational plan as well as therapeutic remediation programs as treatment modalities.

Key Words: Intelligence Test, WISC-III-Thai Version, Leiter-R, Children with Learning Disabilities

Introduction

Children who have a learning disability or LD are under the category of Individuals with Disabilities Education Act, B.E. 2551. Difficulties in the learning process typically begin to emerge as children start their formal education at the elementary level. Despite their learning challenges, those who are identified as having a learning disability will have an intelligence level which will be average to above average compared with others in the same age category. LD is not categorized as a result of impaired hearing, visual problems, cognitive problems or lack of educational opportunities. Characteristics of children with LD are expressed in terms of difficulties in reading, writing and calculation. They may have a problem with only one or a combination of all three. These problems result in a child's academic achievement being lower than their potential compared with their existing intelligence level. The cause of learning disabilities may be related to abnormal brain function as a result of : brain pathology, brain disorders, brainwave disorders and genetics. Presently, in Thailand, the number of children with LD is increasing. The survey of students in schools under the Office of the Basic Education Commission of Thailand in 2005 found that the number of students with learning problems was 113,465, which represents 47.58 percent of the total of all students with disabilities which was 238,479. In 2007, the Office of Basic Education screened Thai students using the (KUS-SI Rating Scale-ADHD/LD/Autism) in over 2,700 of approximately 30,000 schools around the country. The findings at this time identified more than 50,000 children with LD. It may therefore be speculated that the number of children in Thailand who have LD could be more than 130,000. The process of determining learning difficulties in children is extremely important in order for them to be classified and receive the needed educational services or other related assistance prescribed by law.

In Thailand, there are some studies that have developed the tools for screening children with LD. Examples are: The Screening of the LD Patient was developed by Sareya Niyomthom (2002), The Survey of Study Problems by Padung Arayawinyu (2001), and Screening Tests for ADHD, LD and Autism that were developed by Daranee Uthiratkit, Chanwit Pornnoppadol, Watjanin Rohitsuk, Niramon Yasintorn and Supattra Wongwisate (2006), etc. These screening tests are used only as

a preliminary screening. The child who is diagnosed with LD also relies on additional follow up with medical personnel and clinical trials that are standardized and reliable. Other contributing causes of learning difficulties need to be ruled out such as ADHD, mental retardation or emotional problems soit is necessary to make an individualized and clear assessment of each child. In Thailand, the standardized clinical tests that are commonly used for the purpose of assessment include the WISC-III-Thai version that was developed by Pranee Channarong, Jariya Watthanasopon and Chanisa Watwirun (2004). It is an individual test for intellectual measurement in children aged between 6-16 years, which takes 50-70 minutes to administer. Another is the Wide Range Achievement Test (WRAT-Thai) that was developed by Pumreang Sayawanon (1997). This test measures achievement of learning in reading, spelling and math for students who are studying in primary school 1-6. The development of additional clinical assessment tools is necessary to enhance the breadth and depth of identifying root issues that contribute to these learning difficulties. Developing more choices in order to select the most appropriate clinical tool contributes to a higher standard of clinical accuracy. If an early intervention program can be developed to screen and assess a young child's degree of perceptual vulnerability to academic tasks, knowing their strengths and weaknesses, then an appropriate plan of intervention can be established to remediate areas of weakness and prevent a potential learning disability. Previous studies have shown that the Leiter-R test that was developed by Roid and Miller (1997) can be used with individuals aged 2 - 20 years 11 months. This test is a nonverbal intelligence test. Administration time is about 40 minutes. It is suitable for use with normal children or those who are unable to be assessed appropriately with other standard intelligence tests. For example, children who have communication disabilities, second language difficulties, hearing impairments, cognitive delays or mental retardation, impaired mobility, problems concerning attention/concentration, traumatic brain injury and children with learning disabilities. Furthermore, there are no limitations related to cultural differences between nationalities and language. This test consists of Visualization and Reasoning domains (VR-Battery) for full scale IQ measurement and Attention and Memory Domains (AM Battery). Subtests of the AM Battery can distinguish children with ADHD or other neuropsychological impairments from typical children. There are four social-emotional rating scales to be completed by an examiner, parent, self-rating and teacher. Researchers who are working in clinical psychology at the Princess Maha Chakri Sirindhorn ; Medical

Center, Faculty of Medicine, Srinakharinwirot University are responsible to assess the intellectual abilities of children with learning deficiencies associated with a medical diagnosis. When using WISC III test to assess a child's intellectual ability, it takes about 50-70minutes to administer and there are biases in terms of cultural differences, ethnicity and language. Therefore, the researchers in this study are interested in the relationship of Intelligence Quotient scores between intelligence testing using the WISC-III-Thai version and Leiter-R in children with learning disabilities. It is of interest to the researchers to determine if the Leiter-R test can be a more suitable choice for clinical assessment in children with learning disabilities. If so, then it will expedite efficiency in administration time, categorize what type of services may be needed or prescribe the appropriate level of education.

Objective

1. To study the relationship in FSIQ scores between WISC-III-Thai version ; Vocabulary and Digit Span subtests and Leiter-R in children with learning disabilities.
2. To compare the differences in FSIQ scores between WISC-III-Thai version ; Vocabulary
   and Digit Span subtests and Leiter-R in children with learning disabilities.
3. To compare the differences in FSIQ scores between Vocabulary and Digit Span subtests.
4. To study the corresponding scores between Vocabulary and Digit Span subtests of
   WISC-III Thai version and Leiter-R test for diagnosing children with learning disabilities.

Hypothesis

1. There will be a statistically significant relationship in the FSIQ score between WISC-III-Thai version using the Vocabulary and the Digit Span subtests and Leiter-R test.
2. There will be no significant difference in the FSIQ score between both tests.
3. There will be no significant difference in the FSIQ score between Vocabulary and the Digit Span subtests of WISC-III Thai version.

Methodology

Research design

This study is a descriptive research

Population and samples

1. The population of this study was comprised of children who were both male and female with learning disabilities aged 6-12 years old. They were studying in the grade levels 1-6. They were treated at HRH Princess Maha Chakri Sirindhorn Medical Center; Srinakharinwirot University and were diagnosed with learning disabilities according to DSM-IV criteria.

2. The sample used in this study had been diagnosed with learning disabilities by a physician according to DSM-IV diagnostic criteria. Parental consent was obtained for 30 children to participate in the research. The participants received service from February to May 2010 at HRH Princess Maha Chakri Sirindhorn Medical Center.

Inclusion criteria

1. A child who is studying in grade 1-6, age 6-12 years old.
2. Those that have average to above average intelligence as determined by the WISC-III-Thai version.
3. Those that had been diagnosed as having a learning disability by a child and adolescent psychiatrist according to DSM-IV criteria.
4. They had parental consent to participate in this research project.

Exclusion criteria

1. A child with a disability of physical impairment, intelligence, vision, hearing, and disadvantaged students.
2. Children who agreed to participate however they did not complete the testing process.

Research tools:

1. Wechsler Intelligence Scale for Children-Third Edition; Thai version (WISC-III-Thai version): This research studies Full Scale IQ using both Verbal and Performance components. The Verbal component was divided into two methods that incorporated either the Vocabulary or Digit Span subtest with the other four subtests.

1. Verbal component consists of five subtests; scored and divided into two types
   1.1 Scoring five subtests using the Vocabulary subtest: Information, Similarities, Arithmetic, Comprehension, and Vocabulary.

1.2 Scoring five subtests using the Digit Span subtest: Information, Similarities, Arithmetic, Comprehension, and Digit Span.

2. Performance component consists of five subtests: Picture Completion, Coding, Picture Arrangement, Block Design and Object Assembly.

The steps of full scale IQ scoring by using WISC-III-Thai version test in this research are;

1. Total the raw scores of each of the 10 subtests.

2. Use the total raw scores of each subtest to compare with normal values in the table based on age to obtain the scaled score.

3. The total scaled score in the verbal component is divided into two methods.

3.1 First, obtain the "Verbal Scaled Score" by the total of five verbal subtest scaled scores using the Vocabulary subtest: Information, Similarities, Arithmetic, Comprehension, and Vocabulary.

3.2 Second, obtain the "Verbal Scaled Score" by the total of five verbal subtest scaled scores using the Digit Span subtest: Information, Similarities, Arithmetic, Comprehension, and Digit Span.

3. Obtain the "Performance Scaled Score" by the total scaled scores in the performance component of all five subtests; Picture Completion, Coding, Picture Arrangement, Block Design and Object Assembly.

5. Total both Verbal and Performance scaled scores to obtain the "Full Scale score".

6. Use the verbal scaled score, performance scaled score and full scale score to compare in the Conversion table to obtain Verbal IQ, Performance IQ and Full Scale IQ.

2. **Leiter International Performance Scale-Revised (Leiter-R)** : This research looks at the scores of this nonverbal intelligence test which measures the following; Figure Ground (FG) (the find it game), Design Analogies (DA) (the funny squares game), Form Completion (FC) (the put together game), Sequential Order (SO) (the which comes next game), Repeated Patterns (RP) (the over and over game) and Paper Folding (PF) (the folding game).

The Leiter-R scoring follows these steps:

1. Total the raw score of each subtest.

2. Use the total raw scores of each subtest to compare with normal values in the table based on age to obtain the "Scaled Score".

3. Total all the subtest scaled scores to obtain the "Full Scale Score".

4. Use the full scale score to compare in the conversion table to obtain the Full Scale IQ.

Data collection

1. It was explained to the parents and children the reasons and procedures for testing and the parental consent form was signed.
2. The Researcher administered the Leiter-R with individual participants according to test procedures which are as follows.

    2.1 Prepare the location appropriately for test administration.

    2.2 Establish rapport with the participants.

    2.3 Clarify the purpose of testing with the participants.

    2.4 The researcher must test the participants individually by the steps outlined in the test manual.

    2.5 Review and score tests as specified in the test manual.

    2.6 Evaluate the results based on the test manual.

Data analysis

The statistics used in this study are as follows:

1. The average, Standard Deviation and percentage of basic data for analysis.
2. Pearson Product Moment Correlation Coefficients for the correlation between WISC-III-Thai version and Leiter-R test.
3. Pair Sample t-test to compare differences between scores of WISC-III-Thai version and Leiter-R.
4. Pair Sample t-test to compare the difference between Vocabulary and Digit Span subtests.
5. Used percentage to analyze corresponding results of IQ scores that were obtained

    from WISC-III-Thai version and Leiter-R.

Results

1. General Information

Of those children in the study with a diagnosis of learning disabilities, 76.6 % were male, with 70% having an average age of 8 - 10 years old. In this population, 33.3% were studying in grade 3. It was identified that 36.67% of the children had a primary problem in all three aspects of learning disabilities: reading, writing and mathematics. It was identified that 30% had primary difficulty with both reading and writing. Those with only a writing impairment were 20%. It was identified that 10% had primary difficulty with a combination of both writing and mathematics. Those with only a problem particularly in mathematics were 3.3 %.

2. Hypothesis tests

The first hypothesis

There will be a statistically significant relationship in the FSIQ score between WISC-III-Thai version using the Vocabulary and the Digit Span subtests and Leiter-R test.

Table1. The correlation coefficient between FSIQ score between WISC-III-Thai version; Vocabulary and Digit Span subtests and Leiter-R in children with learning disabilities (n= 30)

Tools	1	2	3
1. WISC-III (vocabulary)		.970**	.527**
2. WISC-III (digit span)			.502**
3. Leiter-R			

** Significant level at 0.01.

Table 1 shows that FSIQ scores between Vocabulary and Digit Span subtests of WISC-III-Thai version correlated with the FSIQ score that was obtained from the Leiter-R. They were found to be statistically significant at 0.01 (r = .527 and .502, respectively).

The second hypothesis

There will be no significant difference in the FSIQ score between the WISC-III-Thai version and the Leiter-R.

Table 2 Comparison of the difference of Mean FSIQ scores between WISC-III-Thai version by using Vocabulary subtest and Leiter-R in children with learning disabilities.

Tools	*n*	Mean	*SD*	*t*
WISC-III (vocabulary)	30	100.20	8.160	2.340
Leiter-R	30	96.97	7.327	

Table 2 shows that there was no significant difference of the Mean FSIQ score between Vocabulary subtest of WISC-III Thai version and Leiter-R.

Table 3 Comparison of the difference of Mean FSIQ score between WISC-III-Thai version by using Digit Span subtest and Leiter-R in children with learning disabilities.

Tools	*n*	Mean	*SD*	*t*
WISC-III (digit span)	30	99.77	9.438	1.791
Leiter-R	30	96.97	7.327	

Table 3 shows that there was no significant difference of Mean FSIQ score between Digit Span subtest of WISC-III Thai version and Leiter-R.

The third hypothesis

There will be no significant difference in the FSIQ score between Vocabulary and the Digit Span subtests of the WISC-III Thai version.

Table 4 Comparison the difference of Mean FSIQ score between vocabulary and the digit span subtests of WISC-III Thai version in children with learning disabilities.

Subtest	*n*	Mean	*SD*	*t*
WISC-III (vocabulary)	30	100.20	8.160	.944
WISC-III (digit span)	30	99.77	9.438	

Table 4 shows that there was no significant difference of mean FSIQ score between vocabulary and the digit span subtests of WISC-III Thai version.

3. Corresponding percentages between FSIQ score from vocabulary and digit span subtests of the WISC-III Thai version compared with Leiter-R test

It was found that the corresponding percentages between FSIQ score that were obtained from WISC-III Thai by using Vocabulary and Digit Span subtests and FSIQ score that was obtained from the Leiter-R test are 93.33 and 86.67, respectively.

Conclusion

1. Findings show that the FSIQ score of WISC-III Thai version; Vocabulary and the Digit Span subtests correlated with FSIQ score of Leiter-R test, at a statistically significant level of 0.01 (r = .527 and .502, respectively).
2. There was no difference between mean FSIQ score obtained from WISC-III Thai version by using Vocabulary subtest and FSIQ score of Leiter-R test.
3. There was no difference between the mean FSIQ score obtained from WISC-III Thai version by using Digit Span subtest and FSIQ score of Leiter-R test.
4. There was no difference between the mean FSIQ score obtained from WISC-III Thai version by using Vocabulary and Digit Span subtest.
5. Findings show that the corresponding percentages between FSIQ score from vocabulary and digit span subtest of WISC-III Thai version compared with Leiter-R test as 93.33% and 86.67%, respectively.

Discussion

1. The results of studying the relationship of FSIQ scores between the intelligence testing of the WISC-III-Thai version; Vocabulary and Digit Span subtests and the Leiter-R in children with learning disabilities were found to be at a relatively moderate level of statistical significance at the level 0.01, the Pearson correlation coefficient being 0.527 and 0.502, respectively. This is consistent with the hypothesis that the FSIQ score of the WISC-III-Thai version were correlated with the FSIQ score of the Leiter-R test which is consistent with the study of Roid and Miller (1997, p. 108) that studied the relationship between FSIQ scores of Leiter-R and WISC-III. There were 126 people aged 6-16 years old. Full scale IQ test from WISC-III and Leiter-R were correlated with a statistically significant level of .001 (r = .86). In

addition, Koehn (1998) examined the Hispanic American children that used English as a second language (28 people) compared with a group of Anglo American children (45 people). The Hispanic American group found FSIQ scores that were obtained from the WISC-III and Leiter-R were correlated with a statistically significant level of .001. (r = .74). In the Anglo American group found the FSIQ scores that were obtained from the WISC-III and Leiter-R test were correlated with a statistically significant level of .001 (r = .71). The majority of the previous studies that are mentioned above were found correlated with a high level of intellectual scores between WISC-III-Thai version and Leiter-R. However, in this study, there was found to be just a moderate correlation of FSIQ scores between WISC-III-Thai version both Vocabulary and Digit Span subtests and Leiter-R (r = .527 and .502). This finding is probably due to the sample group used in this study consisting of children with learning deficiencies. Nevertheless, the previous studies used normal children in their research. This could be the factor that causes the relationship between the FSIQ scores for both tests to be at a moderate level (r = .527 and .502). In addition, the WISC-III-Thai version and Leiter-R test have "g" factor, “general factor” that is the basic component of the test construction. It is confirmed that the Leiter-R test is a tool which can measure "g" reliably.

2. Comparison of the difference between FSIQ scores of WISC-III-Thai version by using Vocabulary and Digit Span subtests and Leiter-R test in children with learning disabilities. There was no significant difference in FSIQ mean scores of WISC-III-Thai version both Vocabulary and Digit Span subtest and Leiter-R which is in accordance with the hypothesis of this research. There was no significant difference in FSIQ scores between both tests. The results of this study are consistent with the comparison between intelligence testing of WISC-III and Leiter-R by Roid and Miller (1997, p. 180) which tested in a sample of 126 people. They found the mean score to be 98.7 (SD = 25.7) on the WISC-III and found the mean scores on the Leiter-R to be 95.7 (SD = 23.1). The mean score of both intellectual tests differ only slightly with a difference of 2.9 points which is classified within the same level. The results in this research are probably because the Leiter-R test was designed based on the theory of Hierarchical "g" that is created by Gustafsson (1984) and Carroll (1993). This theory has “g” at the top of general intelligence ability. This "g" factor is similar to the structure of the WISC –III which also incorporates "g" in its design. Moreover, Leiter-R also has a structure similar to the verbal component measurement of the WISC-III. Although Leiter-R is a nonverbal test, it uses language skills required for decoding in each

sub-test. This shows that the Leiter-R test can be used to evaluate general intellectual ability and Cognitive Function in children with learning disabilities reliably.

3. Comparison of the difference between FSIQ scores subtests of WISC-III-Thai version; Vocabulary and Digit Span subtests in children with learning disabilities. There was no significant difference in FSIQ mean scores of both Vocabulary and Digit Span subtests which is in accordance with the hypothesis of this research. It shows that the intelligence estimation in children with learning disabilities on both subtests is not significantly different. Therefore it can be used interchangeably.

4. According to the study of corresponding results of IQ scores that can be obtained from the WISC-III-Thai version and Leiter-R for diagnostic screening of children with learning disabilities. The findings showed that the corresponding percentages between the FSIQ scores from the vocabulary and digit span subtests of WISC-III Thai version compared with the Leiter-R test was 93.33% and 86.67%, respectively.

From this result, we see that the Leiter-R test is an efficient evaluation tool for diagnostic screening of children with learning disabilities. It is a reliable assessment tool to estimate the IQ level and cognitive function of a child with learning disabilities accurately because the Leiter-R was created on the basis of the theory of Hierarchical "g" by Carroll (1993) and Gustafsson (1984) which stands for general intelligence and is at the top of the Hierarchical model called the "g" factor. The secondary levels below “g” are the basic learning constructs that directly affect the academic achievement of the child. Throughout life there are some situations that may cause the IQ test results to change. Therefore, clinical data is used to help reevaluate the IQ ability of children as decisions are made in educational planning and providing treatment. If the designed program is not appropriate to the children’s ability, it may hinder the chances for them to improve in their learning skills. Understanding the intellectual level of children with learning disabilities by using the Leiter-R may allow us to better understand the level of intelligence, as well as the strengths and weaknesses of the children. Preferably, it is important for professionals to use the test results from Leiter-R to diagnose the condition of a learning disability. It is important that the IQ test be able to assess the ability of intelligence covering various fields. The more reliable the testing instrument and the breadth of information gained from it, the more appropriate the prescribed the level of education and treatment services will be. Thus, Leiter-R test can be applied as being an option to assess cognitive ability and IQ status in children with learning disabilities.

Suggestions in this study

This study has found that there was no significant difference between the FSIQ score when using the vocabulary and digit span subtest within the verbal component of the WISC-III-Thai version and Leiter-R test. It shows that the Leiter-R test can be used to assess cognitive and IQ status in children with learning disabilities with a medical diagnosis.

Recommendations for further study

1. The present study investigated only children with a learning disability. Therefore, further research could include a study of normal children as well as other groups of children with special needs such as autism, hearing impairments, communication impairments and cognitive impairment. This will enable us to know the benefits of using the Leiter-R test to identify nonverbal intelligence in these populations.

2. This study investigated the relationship between the intellectual testing of WISC-III-Thai version and Leiter-R Test only. Further research could include the comparison with other types of intellectual testing such as Stanford-Binet Intelligence Scale, Standard Progressive Matrices parallel versions (SPM parallel versions) or the TONI-3 to identify the efficacy of the Leiter-R.

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