Indications of The Validity and Reliability of The Saudi Arabia Version of The Wechsler Intelligence Scale (WISC-IV) for Deaf Children Via Sign Language Deaf

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Abstract:

The current research aimed to identify the indications of the validity and reliability of the Saudi version of the Wechsler Scale-IV (WISC-IV) for deaf children in sign language. The descriptive survey approach was utilized to achieve the research's goals by administering the WISC-IV in sign language to the research subjects (n=107) male and female students from deaf schools in Saudi Arabia ageing (6-11, 16) years. The validity indications of the scale were as follows: the content validity (80%), the construct validity for the values of the correlation coefficients between the sub-tests of the scale and the total score of the main test to which it belongs was higher than (0.30), except for the (Block Design) test related to the intelligence of the (PRI), which was (0.169). This result is considered a positive, non-significant value. The values of (Eigenvalue) for the factorial validity ranged between (6.849 - 0.171). While the discriminant validity of the differences between males and females has been demonstrated to have equivalent levels of intelligence in Verbal Comprehension (VCI), Perceptual Reasoning (PRI), Working memory (WMI), and Processing Speed (PSI). Regarding the indicators of scale reliability, the results showed high indicators of reliability for both the total score and the sub-scales scores. The results of the reliability coefficients by Cronbach's alpha method were (0.784 - 0.873), with a total score of (0.813). The split-half method revealed that the reliability coefficient of Cronbach's alpha for verbal tests was (0.689), and the reliability coefficient for performance tests was (0.793), while the correlation coefficient between verbal and performance tests was(0.805). The Guttman Split-Half reliability coefficient was (0.748). The reliability coefficients for the subscales varied (VCI: 0.657, PRI: 0.698, WMI: 0.947, PSI: 0.925, Total: 0.733), which are significant values at the significance level (0.01). Where the rates agreement method reached (78.2 %). The research suggests training professionals to recognize the problems related to sign language and the inadequate mental ability of deaf children, as well as conducting research on deaf perceptual intelligence.

Keywords: Deaf , Wechsler Intelligence Scale, WISC-IV, Sign Language.

Introduction

There is no doubt that mental capacity differs from person to person. The human mind is made up of numerous functions that allow it to control various mental processes. When the hearing system is impaired, the intellectual ability of deaf people is affected as a result of the poor ability of cognitive processes, and the memory also suffers resulting in the inability to auditory discrimination. As a result, deaf persons rely on their senses of sight and touch as inputs to the brain to classify objects. Deaf people's mental states may improve if their concepts are enhanced by combining them to sign language. Therefore, the current research came to provide a tool to measure the mental ability of deaf children in sign language through the development of the Saudi version of the WISC-IV for deaf children in sign language.

Research Problem

Sign language poses a significant barrier for both psychologists and those working with deaf and hard of hearing persons (D/HOH), particularly in translating the sign language used to determine deaf intelligence, which may pose a significant challenge in interpreting intelligence tests. Another problem is the dearth of studies on the intelligence of deaf children using the WISC-IV, which dealt with the use of sign language, as the previous literature that enhances this subject is insufficient. As a result, the research attempted to address the research problem by posing the following key question:

•   What are the indications of the validity and reliability of the Saudi version of the WISC-IV for the intelligence of deaf children in sign language?

The following sub-questions arise from the research problem, which deals with the psychometric properties:

1.   What are the indications of the validity of the Saudi version of the WISC-IV for deaf children in sign language?
2.   What are the indications of the reliability of the Saudi version of the WISC-IV for deaf children in sign language?

Research Importance

First: The theoretical importance of this research lies in:

•   Providing a Saudi version of the WISC-IV in sign language.
•   Understanding the mental capacity of deaf children in sign language.
•   Increasing the literature on deaf intelligence in the Kingdom of Saudi Arabia, because of the paucity of studies that dealt with this topic.

Second: The practical importance:

•   Preparing a Saudi version of the WISC-IV in sign language for deaf children to measure and diagnose their mental ability.
•   Determine the position of deaf children on the normal distribution curve.
•   Assisting researchers, instructors, and deaf sign language interpreters to benefit from the findings of this research in dealing with and communicating with the deaf category.
•   Making suitable decisions based on the findings of this research through the usage of this measure in assessing and diagnosing intelligence among deaf children.

Research Goals:

The current research aimed to verify the effectiveness of a Saudi version of the WISC-IV for deaf students and in sign language by finding indications of validity and reliability of the scale.

Research Justification:

•   The dearth of Saudi studies dealt with the intelligence test of the mental ability of deaf children in sign language.
•   Lack of a suitable diagnostic tool for measuring the intelligence of deaf children in sign language in Saudi Arabia.
•   Employing the results of the measurement and diagnosis process of the scale in preparing educational plans for deaf children.

Research Limitations:

Research limits include the following:

•   Age limits: This research was only applied to deaf children within the age group (6-11, 16) years.
-        Spatial limits: This research was only applied to the Kingdom of Saudi Arabia (middle) through schools, centres, and kindergartens.
-        Temporal limits: Research data was collected during 2020/2022.

Research Delimitations:

•   The findings of this research are influenced by what is accessible in the Saudi version of the Indicative Understanding of the Language Skills of Deaf in sign language, as well as indicators of validity and reliability that support the use of the scale and in sign language for deaf children.

- The difficulty in generalizing the findings of this research relates to the research subjects' representation of the research population.

The operational definition

Deaf people: They are the people who communicate with each other through sign language, the alphabet, lip-reading, and other methods, whether or not they use hearing aids, and their hearing ability ranges between (25-90) decibels.

Mental ability (intelligence): The performance on the Saudi version of WISC-IV in sign language for deaf children.

Sign language Is a set of symbols circulating in Saudi Arabia that are generated by hand, alphabet, and facial gestures that are produced within the agreed-upon grammatical linguistic system of Saudi Arabia's deaf community.

Theoretical framework and Previous studies

First: Theoretical framework

Leahey and Harris (2001) claim that intelligence is the higher mental process that psychologists have been interested in through the process of learning, memory, knowledge and experience. Wechsler (2012) defines intelligence as the total capacity for rational thinking and purposeful behaviour that has an effective influence on the environment. While Keith & Jacobus (2005) considers the neuropsychological assessment of children a complex process through which historical information, behavioural observations and standard psychological tests are used to make conclusions about brain impairment and its effects on adaptive performance in a developmental context. And that Intelligence tests were considered a standard part of the neuropsychological assessment. Surveys have indicated that the Wechsler tests are among the most commonly used IQ assessments among neuropsychologists because intelligence tests, despite their shortcomings, are beneficial for learning about patterns of cognitive skills in neuroscientists dealing with children, the WISC Scale in its various versions has been the most extensively used intelligence test. The Wechsler Scale has evolved, and it is now the standard in neuropsychological testing as cerebral impairment is related to greater variation in performance across subtests. Many studies have been conducted on the most recent factor index, Freedom from Distractibility index, and processing speed. According to (Bodin, Pardini, Burns, and Stevens, 2009) and Watkins (2010), the Wechsler Intelligence Measure Scale-4 (WISC-IV, 2003) is a commonly used scale with outstanding psychometric properties. Whereas the factor structure of four components (verbal comprehension, PRI, WMI, and PSI) was used in different clinical samples. It should be noted that the influence of general ability level should not be underestimated when interpreting the results of the factor index. Sattler (2001) claims that the underlying problem with determining the proper assessment procedure for the deaf is that there are very few cognitive assessment procedures suitable for the D/HOH individuals. According to Landsberger et al. (2013), a sign language interpreter should preferably be a CDI Certified Deaf Interpreter, as this language will be employed during the measuring procedure. They must also be trained in all aspects of translation, such as linguistic forms and facial expressions. They also feel that sign language assessors are unable to interpret words and psychological terms literally, which may necessitate more time to complete that assessment to ensure understanding and use of facial gestures and body language. Before dealing with deaf people, a sign language interpreter should follow the testing workflow to learn more about the testing procedure, testing goals, terminology, and assessment goals. Braden (2005) indicates that Wechsler-2003 has contributed to the continued use of Wechsler tables because it contains a large number of citations in research studies on the intelligence of deaf children, as the latest version of the WISC-IV contains detailed information about the use of the test with deaf children and adolescents. Virole & Touma (2006) indicate that the examiner must adapt to the child's position to obtain correct results that have clinical significance. The psychiatrist who administers the standardized Wechsler Scale-4 (WISC-4) to D/HOH children or adolescents should be aware of the following:

• The possibility of having other disorders. Whereas American demographic research has shown in previous years that (32%) of this group have other accompanying disabilities in the behavioural, emotional, cognitive, educational, and physical aspects. Many people who have multiple disabilities also have a hearing impairment.

• To know accurately the various educational styles of the person being examined, and the criteria of the group to which he belongs.

• Paying more attention to the preferred communication patterns of these children when choosing tools or tests, or making appropriate preparations, rather than paying attention to the degree of his hearing impairment. Whereas the method of applying the (WISC-IV) differs in terms of level, and the group of systems with different methods of communication, whether it is sign language or signs alphabet.

• The examiner's knowledge of the sign language helps to control the course of the scale and maintain the basic meaning.

• The different means of communication for the sub-tests of the (WISC-IV) scale can be: symbolic, kinesthetic, visual, written and verbal.

Second: Previous studies

Although present research on deaf intelligence in sign language is quite limited, there are certain studies worth mentioning. (Simmons, 1992) conducted research titled "The performance of deaf children on the draw-a-person test: a validity study" aimed at recording the drawings of the human figure among a sample of (30) deaf people ranging in age from (5 -15) years old using the Goodenough-Harris Draw-A-Person (DAP) measure to investigate the significance of the validity of this test as a measure of intellectual maturation. The findings revealed:

• DAP standard scores positively correlated (r = .43, p < .05) with Performance Scale IQ scores of the (WISC-R), but negatively correlated with age (r = -.41, p < .05) for all subjects.

• A significant difference was observed between DAP scores and WISC-R Performance IQ scores for all subjects as the mean WISC-R IQ score exceeded the mean DAP standard score by 10 points (t = 2.7, p = .01).

Maller (1994) conducted a study entitled "Validity and item bias of the WISC-III with deaf children" that aimed to identify the ability of the scale in determining the intelligence of deaf children. The test was translated into sign language and was administered to a sample of (110) deaf children in three different sites. Their ages ranged from (8 -16) years who use sign language as their primary means of communication. The sample of the deaf children was compared to a sample of (110) hearing children with the same age and IQ performance. Construct validity was examined using a multi-sample covariance structure analysis. The following subtests: Picture Completion, Information, Similarities, Arithmetic, Vocabulary, Comprehension was also utilized. The findings revealed:

• Differences in mean ability on several subtests were more difficult for deaf children in the verbal subtests.

• Items are generally biased due to translation problems and differences in educational curricula. Thus, deaf children are at a disadvantage when the WISC-III subtests are taken.

• Practitioners are urged to consider these results when assessing deaf children.

Krouse and Braden(2011) conducted a study titled "The reliability and validity of WISC-IV scores with deaf and hard-of-Hearing Children", which aimed to identify the validity and reliability of the (WISC-IV) for use with D/HOH children. Psychologists (n = 10) provided data on (128) D/HOH children, who were assessed through the Wechsler Scale-IV as part of their continuous assessments. Sub-tests were applied to (8) of the Wechsler scale-IV, and the two intelligence indicators were used. The results indicated that:

• Split-half internal consistency coefficients were higher (p < .05) than the values reported for the normative sample.

• The mean Perceptual Reasoning was (M = 93.21).

• The Verbal Comprehension was (M = 80.86) and lower (p < .05) than the population mean (M = 100). These findings support the reliability of the WISC-IV scores for D/HOH children.

- The results suggest that the PRI may have a different indication than Performance IQ for D/HOH children.

A study titled "The Structure of Intelligence of D/HOH Children: A Factor Analysis of the WISC-IV," (Krouse, 2012) examined the factor structure of intelligence of D/HOH children given the CHC theory using the WISC-IV. Measurement invariance of a three-factor (VCI, PRI and PSI) was examined among the sample of deaf children (N = 134). It was found that:

- Metric invariance was not established for the VCI subtests between groups. Yet, metric invariance was established for the PRI and PSI subtests separately between the D/HOH sample.
- Additional tests were performed for the (PRI & PSI) subtests separately, but, the data did not support the scalar invariance for these subtests across groups.
- Comparisons of mean scores exhibited that the mean scores for the VCI (M = 80.05), PRI (M = 96.18) and PSI (M = 94.16) for the D/HOH subjects were significantly lower than the mean scores for the norm group (M = 100), which were thought to represent population values (p < .05).
- Pearson Product Moment correlations were calculated among the WISC-IV subtests. Of the 28 correlations, 25 were significantly greater than zero (i.e., 95% confidence interval did not contain zero).
- In general, the CHC theory (as indicated by the WISC-IV) is an appropriate model of intelligence for D/HOH children.
- The PRI remains the most accurate estimate of g for D/HOH children.

In Jordan, Abu Drei (2017) conducted a study titled "Standardization a Jordanian version of the WISC-IV edition adapted for deaf via sign language from (6-16, 11) years". The study sought to measure the mental ability of deaf children in sign language verifying the validity and reliability of the Wechsler Scale-IV for deaf and normal subjects who participated in the study. The WISC-4 in sign language yielded indications concerning the validity of the Jordanian version, which were reflected in content validity, discriminating validity, construct validity, and concurrent validity. Cronbach's alpha, test-retest method, and the Rates Agreement Method showed the reliability

of the measure. The criteria for the scale were also reached, which consisted of converting the raw scores into standard scores and then into an IQ ratio. The results demonstrated:

- Statistically significant differences (α = 0.05) in the performance on the sub-tests of the Jordanian version of the WISC-IV in the school stage due to the variables " normal and deaf category" and to the "gender" variable.
- Statistically significant differences (α = 0.05) in the performance on the sub-tests of the Jordanian version of the WISC-IV in sign language at the school stage due to the change in the degree of hearing impairment (mild - moderate - severe - cochlear - mild + cochlear) for the age group of (6 - 16.11) years old.
- Statistically significant differences in performance on the sub-tests of the Jordanian version of the WISC-IV at the school stage attributable to the age variable in favour of the age group (11-13) years.

In a recent study, Abu Drei and Al-Rusan (2021) conducted a study entitled "The Psychometric Properties of the Jordanian Version of the WISC-IV in sign language for the age group (6-11,16) years" to identify the psychometric properties of the Jordanian version of the WISC-IV in sign language for deaf ageing (6-11.16) years to measure their mental ability. To achieve the goals of the study, the items of the WISC-IV were transferred to sign language after verifying the validity and reliability of the measure. The WISC-IV was applied to (413) deaf male and female students. The content and the construct validity of the Jordanian version of the WISC-IV were verified. The correlation coefficients ranged from (0.305 - 0.698), and the correlation coefficients of the items ranged between (0.602 - 0.823). Cronbach's Alpha was used for the scale's reliability which ranged between (0.815 - 0.922). The findings suggest that:

- There are statistically significant differences (α = 0.05) in the performance on the sub-tests of the Jordanian version of the WISC-IV in favour of the deaf group with a degree of mild hearing impairment.
- The level of deaf intelligence on the scale is largely equal among the categories of deaf students according to the degree of hearing impairment (moderate, severe, cochlear, mild + cochlear).

To identify the indicative understanding of the language skills of deaf children in sign language, and the ability of verbal tests among them, (Abu Drei, 2020) conducted a study entitled "Constructing and standardizing a standard for diagnosing the indicative understanding of the language skills of deaf children and adolescents in sign language aged (7-18) years on the Jordanian environment". The study aimed to identify the psychometric characteristics of the validity, reliability, and criteria of the scale to measure the language skills of deaf children and adolescents in sign language for the age group (7-18) years. The scale was converted into sign language, and it was applied to a sample of (385) male and female deaf students. The validity of the measure was verified through the content validity, factorial validity (13.259– 0.069), the internal validity (0.310 - 0.768), and concurrent validity with the Jordanian version of the WISC-IV for the deaf in sign language through the VCI intelligence test, which includes the following sub-tests: (similarities, vocabulary, comprehension, information, word reasoning). The correlation coefficients between the sub-items and the total measure were statistically significant at the level (0.01) for both scales, and indications of the scale's reliability were found using Cronbach's alpha method (0.905), and the split-half reliability (0.953). The results showed that:

• There are statistically significant differences in measuring the indicative understanding of language skills due to gender variables in each of the sub-tests represented in the test (pronouns, family, time, money, nature, religion, different phrases, clothes, electrical tools, human body, office supplies, Governmental bodies, Jordanian regions, Arab countries, letters of the alphabet) in favour of females.

• There are statistically significant differences in measuring the indicative understanding of language skills attributable to the degree of hearing impairment. The differences in the pronouns test were in favour of the degree of disability category (mild, severe). Where the differences in the mathematics and family test were in favour of the degree of disability (mild, moderate, and severe). And the differences in the religion test, various phrases, the alphabet, and the overall

measure, was in favour of the category mild disability.

• The arithmetical means of the efficacy of the items on the scale on all tests was (80.71/526), which indicates a low degree.

In 2021, Abu Drei conducted two recent studies titled "Psychometric properties of the Wechsler-4 Scale for Deaf People with Moderate Intellectual Disability" and "Psychometric Properties of the Wechsler Intelligence Scale, WISC-IV for Deaf Intelligence with Wardenburg Syndrome and Level of Intelligence for the Different Mental States". In his first study, he sought to identify the psychometric properties of the WISC-IV for the intelligence of deaf people with moderate mental disabilities, Abu Drei used the descriptive survey method and applied the scale in sign language to a sample of (n=73) male and female students from all deaf schools in Jordan aged (6-11,16) years. Validity indicators were as follows: Content validity (80%), Internal construct validity (0.351 - 0.435) for each of the tests (PRI, WMI, PSI), except for the VCI test, the value of the correlation coefficient with overall intelligence was (0.074), which are non-significant values at the significance level (0.01), and concurrent validity with the Goodenough-Harris Drawing scale (0.688) and achievement (0.887). Where the reliability of the scale by Test re-test method was (0.866), rates agreement method (78.2%), the Split Half (0.901), and Cronbach Alpha for sub-tests was (0.797). The result of the overall (IQ) level was (50.23). The results exhibited differences in the level of the sub-tests of the scale, where the mean value of the cancellation test was (22.85) which is the highest value, followed by the coding test with a mean (16.10). These two tests represent the intelligence of the PSI with a mean of (64.14). The similarities test came with a mean (1.29) followed by the word reasoning test which ranked last with a mean (0.67). These two tests represent the intelligence of VCI with a mean of (58.37). The mean value of intelligence for each of the VCI was (62.02), PRI (52.73), and the WMI was (52.68). Regarding the result of the effect of the variable, it was found that:

• Gender variable: There are statistically significant differences in the level of (PRI) attributable to gender variable in favour of males. Where there were no statistically

significant differences in the level of intelligence (VCI, WMI, PSI and the overall intelligence).

• The degree of hearing impairment: There were no statistically significant differences in the level of intelligence (Abu Drei, 2021,b).

In his second study which dealt with a new category of deaf people, namely the deaf people with Waardenburg syndrome, (Abu Drei, 2021, a) tried to identify the psychometric properties of the WISC-VI for deaf people with Waardenburg syndrome and the level of intelligence according to different mental state. To achieve the objectives of the study, the descriptive survey method was used. The WISC-VI was applied to a sample (n=17) of male and female students from all deaf schools in Jordan, whose ages ranged between (8-17) years. Indicators of construct validity were (2.741 - 0.243). The reliability correlation coefficients of the scale ranged between (0.487 - 0.898). It was found that there were no differences in the IQ level of deaf people with Waardenburg syndrome attributed to gender, no differences in the IQ level of deaf people with Waardenburg syndrome is due to the mental state variable in favour of the deaf group of those with the borderline between gifted and superior, but the overall IQ level of the deaf person with Waardenburg syndrome is within the lower limits (IQ = 71), which is considered a learning disability. The results also demonstrated differences in the level of the sub-tests of the scale as the cancellation test obtained the highest score followed by the coding test. However, these two tests represent the intelligence of the performance section of the scale (PSI) of this sample. On the other hand, the (verbal reasoning) test came in the last rank, and in the penultimate rank came the (similarities) test. These two tests represent the intelligence of the verbal part of the scale (VCI).

Methods and Procedures

This section presents a detailed description of the study subjects, the method of selection, and a description of the study tool represented in the Wechsler Intelligence Scale, translated into the sign language. It also describes methods for verifying the validity and reliability of these tests, the methodology used in the study and the statistical analysis of data, as follows:

Research approach:

The descriptive survey method was used as it is the most appropriate method for this study which aimed to verify the psychometric properties of the Wechsler Scale-IV for the intelligence of the deaf the Saudi version.

Population and Sampling

The research population consisted of deaf children in the Kingdom of Saudi Arabia, whose ages ranged between (6-11.16) years. The study population is considered one of the large communities due to the wide presence of this category in Saudi society.

Sample

The subjects of the research (n=107) were chosen purposefully from the deaf category in the Kingdom of Saudi Arabia who are within the age group (1-11, 16) years to determine the psychometric properties of the Wechsler Scale-IV for deaf children at the school stage in sign language. Table (1) shows the distribution of subjects by gender:

Table 1. Distribution of subjects (n=107) by gender

Gender	Frequency	Ratio
Male	67	62.6%
Female	40	37.4%
Total	107	100%

Table (1) clearly demonstrated that approximately sixty-three (62.6%) of the deaf subjects are males, whereas only (37.4%) of the deaf subjects are females.

Instrument

The Jordanian version of the Wechsler Scale-IV for deaf children in sign language, for the age group (6-11.16) years.

The original version of WISC-IV (Liban Tests Editions) has been translated into sign language by (Abu Drei, 2017) to suit the Jordanian environment. The original version of the scale consisted of (4) sub-scales, each scale contains sub-tests as follows: The VCI Scale which includes the following sub-tests (similarities, vocabulary, comprehension, information, verbal reasoning). The PRI Scale includes (Block Design, Picture Completion, Picture Concepts, and Matrix Reasoning). The WMI Scale includes (Digit Span, letter-number sequencing, arithmetic). Where the PSI scale includes (coding, symbol search, Cancellation). The total intelligence scale includes (VCI, PRI, WMI, PSI).

The validity of the Jordanian version

The validity of the original version of the scale (Abu Drei, 2017) was tested by presenting it to (10) sign language interpreters to determine the linguistic formulation's suitability to the rules and sign language, as well as its applicability to the Jordanian environment. In addition to the extent to which the items are related to their dimension. The scale was presented to (8) deaf individuals, to determine the suitability of the sign language formulation and its rules and suitability for the deaf community in the Jordanian environment. It obtained more than (80%) agreement for its suitability. The calculation of the correlation coefficient between performance on the WISC-IV for deaf aged (6-11.16) and the Goodenough-Harris Draw-A-Person (DAP) yielded indications of concurrent validity, as the Jordanian version of the WISC-IV and DAP scale was applied to a sample (n= 30) of deaf children. The value of the correlation coefficient was (0.688) with a statistical significance of less than (0.01), which shows the concurrent validity of the two scales. Indications of the validity of the original version were obtained through the Principal Component Analysis (PCA) for the scores of the subjects using Orthogonal Rotation by Varimax rotation. The number of sub-factors was determined by four, to be equal to those that make up the original scale (in its original version).

The reliability of the Jordanian version of the WISC-IV

The reliability of the Jordanian version of the WISC-IV (Abu Drei, 2017) was verified. The reliability coefficient was calculated by using Cronbach's alpha coefficient of internal consistency between the scale's paragraphs (0.869) and the test-retest method (0.866). The scale's reliability was confirmed by calculating the Spearman-Brown coefficient of split-half. The Spearman-Brown coefficients reached (0.904). The reliability of the scale was also established by calculating the Cronbach's alpha coefficient, which was (0.838) for the overall scale, which is an acceptable value for the objectives of the current research.

Procedures for preparing the Saudi version of the WISC-IV in sign language for the deaf

The Saudi version of WISC-IV in sign language for the deaf was prepared following these procedures:

1.   Financial support was obtained from (Imam Abdulrahman bin Faisal University).
2.   Written approval was obtained from the publisher (Liban Tests Editions) to use the Wechsler Scale-IV on the Saudi environment, as well as through the Jordanian version of the Wechsler Scale-4 in sign language (Abu Drei, 2017).
3.   The initial Saudi Arabic version was prepared
4.   The initial Arabic version of the scale in sign language was prepared with including details:
-        a list of terms to be translated into sign language.
-        Photographing (4000) photographs in sign language by researchers over three months.
-        Revising the sign language terms.
-        Preparing three copies of the Wechsler Scale-IV in sign language.
5.   Translating the scale using sign language grammar for deaf, which includes (109) special grammatical sentences in sign language in the sub-tests of the scale (Comprehension, information, arithmetic, verbal reasoning) as illustrated in the following examples: *In Comprehension* test in ordinary language, we ask the question "Why do people brush their teeth?". While in sign language it is

asked like this (people teeth cleaning reason?).
In signs it is expressed as follows: `

Fig 1. Sign language for the question "Why do people brush their teeth?"

Using sign language requires:

-        Unifying facial gestures.
-        Determining the tense used in sign language (past, present, imperative) to convey the correct meaning.
-        Correctly identifying areas of sign language use with deaf students.
-        Unifying the alphabet used by deaf people for using them in the sub-test of the WISC-IV (Letter-Number Sequencing).
-        Unifying numbers used by deaf people for using them in the following sub-tests of the WISC-IV (Digit Span, Letter-Number Sequencing).

6.   Preparing a guide for the WISC-IV for deaf in sign language by the researcher, including booklets for the signs covering each of the following:
-        The items of the scale in sign language.
-        Examiner's guide to the WISC-IV subtests in sign language.
-        Scale questions based on the grammar of the sign language.

7.   Nominating the training team (5) translators provided holding a bachelor's degree and a doctorate in special education and a professional license of sign language translation by the Supreme Council for the Affairs of Persons with Disabilities including the researcher. They were trained in several stages including:
-        Standardization of sign language grammar of the WISC-IV used by interpreters and deaf people.
-        Training on (examiner's guide, test items, test questions, test correction).
-        Training and testing the subjects to ensure their understanding of the WISC-IV.

-        Correcting the test: Deaf sample (n = 107). The correction of the Saudi version of WISC-IV in sign language for the deaf took a large period due to the conversion of the written sign language (following their rules) to the ordinary language and then giving the appropriate mark for the answers, for example, "The question (why do people brush their teeth?" the answer was (important- teeth-clean) which is interpreted to (clean teeth) and the answer (tooth perfectly 100/100) is interpreted (clean teeth).

8.   Five (5) packages of the WISC-IV were prepared by researchers, including all the tools necessary for the implementation of the scale.

9.   Duration of the application:

The WISC-IV was applied in schools for 4 hours per day from (8:00 am-12:00 pm). This was followed by the correction period from (4:00 pm-9:00 pm). The scale was applied to the subjects (n=107) for 23 working days.

Statistical Analysis:

To answer the research questions, the following statistical methods were utilized:

-        Validity indicators (construct validity) of the scale for the deaf children was obtained through (Principal Component Analysis, Varimax Rotation). And the One-way analysis of variance (ANOVA).
-        Reliability indicators of the scale was verified using reliability coefficient by (split-half reliability method), reliability coefficient by (internal consistency method) using Cronbach's alpha.

-       Pearson Correlation to measure the correlation between the item score and the dimension to which it belongs.
-       Using an independent sample t-test for differences between genders (males - females).

Research procedures:

To achieve the research goals, the following procedures were followed:

- The Saudi version of the scale was applied to a pilot sample (n = 30) to validate the extent of the linguistic formulation and processes for applying and correcting the scale in its Saudi version for the deaf.
- The scale was administered to the sample for (75) minutes. The items of the scale were translated into sign language by licensed interpreters.
- The results of the sample (n = 107) were extracted.
- The data were statistically processed according to the appropriate methods previously mentioned in this research.
- Validity and reliability indicators of the Saudi version of the WISC-IV were obtained.

Results and Discussion

The current research aimed to verify the effectiveness of a Saudi version of the WISC-IV for the deaf childern in sign language, by finding the indicators of validity, reliability and the effectiveness of scale items. In this section, the research questions will be answered.

1- What are the indications of the validity of the Saudi version of the WISC-IV in sign language?

Validity indicators for the Saudi version of the WISC-IV for deaf aged (1-11, 16)years was verified through:

A.   Content validity:

The Saudi version of the scale in sign language was presented to (13) sign language interpreters to assess the appropriateness of the linguistic formulation with the sign language rules and its suitability to the Saudi environment, as well as the extent to which the items is affiliated to their field.

The scale was also administered to (5) deaf people to determine its appropriateness to the deaf community in Saudi Arabia.

B.   Construct validity: As shown in Table (2), the construct validity indications of the scale were derived by calculating the correlation of the items' degree with their field.

Table 2. Sub-tests correlation coefficients with the total score of the main test by Pearson test for the Saudi version of WISC-IV

VCI		PRI		WMI		PSI	
Sub-test	Correlation coefficients with total degree	Sub-test	Correlation coefficients with total degree	Sub-test	Correlation coefficients with total degree	Sub-test	Correlation coefficients with total degree
Similarities	.697**	Block Design	.169	Digit Span	.847**	Coding	.806**
Vocabulary	.776**	Picture Concepts	.647**	Letter-Number Sequencing	.671**	Symbol Search	.856**
Comprehension	.637**	Matrix Reasoning	.690**	Arithmetic	.773**	Cancellation	.869**

Information	.898**	Picture Completion	.858**	
Word Reasoning	.659**			

:**Statistically significant at (0.01) or less.

The correlation coefficients between the scale's sub-tests and the overall score of the major test to which it is linked were greater than (0.30), which is the minimum permissible for distinguishing the sub-tests, except for the "Block Design" test, which belongs to the major test related to (PRI). The value of the correlation coefficient was (0.169), which is a positive, non-significant value. However, if the correlation coefficient is positive but non-significant, this test should be reviewed because it is almost incomprehensible to the deaf sample in Saudi Arabia. This demonstrates that all significant subtests effectively contribute to the scale's overall score, as shown in Table (3):

Table 3. Sub-tests correlation coefficients with the total score /Pearson test for the construct validity of the Saudi version of WISC-IV.

Subtests	Total Correlation coefficients
Block Design	.070
Similarities	.704**
Digit Span	.599**
Picture Concepts	.547**
Coding	.715**
Vocabulary	.740**
Letter-Number Sequencing	.432**
Matrix	.604**
Comprehension	.661**
Symbol Search	.727**
Picture Completion	.693**
Cancellation	.711**
Information	.812**
Arithmetic	.667**
Word Reasoning	.725**

C.   Factorial validity

The Principal Component Analysis for the subjects' scores utilizing the orthogonal rotation approach (Varimax test) yielded indications of the construct validity in the Saudi version for deaf. The number of sub-factors has been determined by fifteen, to be equal to those that make up the original scale (in its original version). Table (4) displays the number of sub-tests and the amount of variance that is explained for each of the tests:

Table (4). The explained variance for each factor of the Saudi version of WISC-IV

Components	Initial eigenvalues		
	Eigen Value	Explained Variance %	Cumulative Percentage Explained Variance %
Block Design	6.849	45.658	45.658
Similarities	1.319	8.794	54.452
Digit Span	1.177	7.845	62.297
Picture Concepts	.935	6.231	68.529
Coding	.724	4.829	73.358
Vocabulary	.593	3.955	77.313
Letter-Number Sequencing	.551	3.675	80.987
Matrix Reasoning	.540	3.603	84.590
Comprehension	.467	3.113	87.703
Symbol Search	.416	2.776	90.479
Picture Completion	.393	2.623	93.102
Cancellation	.327	2.178	95.280
Information	.289	1.928	97.208
Arithmetic	.248	1.655	98.863
Word Reasoning	.171	1.137	100.000

The values of the eigenvalue of the Saudi deaf sample ranged between (6.849 - 0.171). The first factor (Block design) explained (45.658%) of the total variance of the WISC-IV for deaf, The second factor (similarities) explained (8.794%) of the total variance, whereas (7.845%) of the scale variance was explained by the third factor (Digit Span), and the fourth factor (Picture Concepts) explained (6,231) of the variance total scale. The other factors Coding, Vocabulary, Letter-Number Sequencing, Matrix Reasoning, Comprehension, Symbol Search, Picture Completion, Cancellation, Information, Arithmetic and Word Reasoning explained respectively the following percentage (4.829%, 3.955, 3.675%, 3.603%, 3.113%, 2.776%, 2.623%, 2.178%, 1.928%, 1,655% of the variance total scale. And that what was explained amounted (100 %) for all factors, and thus the research states that each of the fifteen factors is important and complementary to each other and contributes to the total degree of the total variance of the scale and that they are basic and important components of the Wechsler Scale-IV for the deaf students in the Saudi environment. The accompanying figure demonstrates that the scale's factors are fifteen and that the scale is not uni-dimensional, as the difference between the first and second factors was greater than one (2.00).
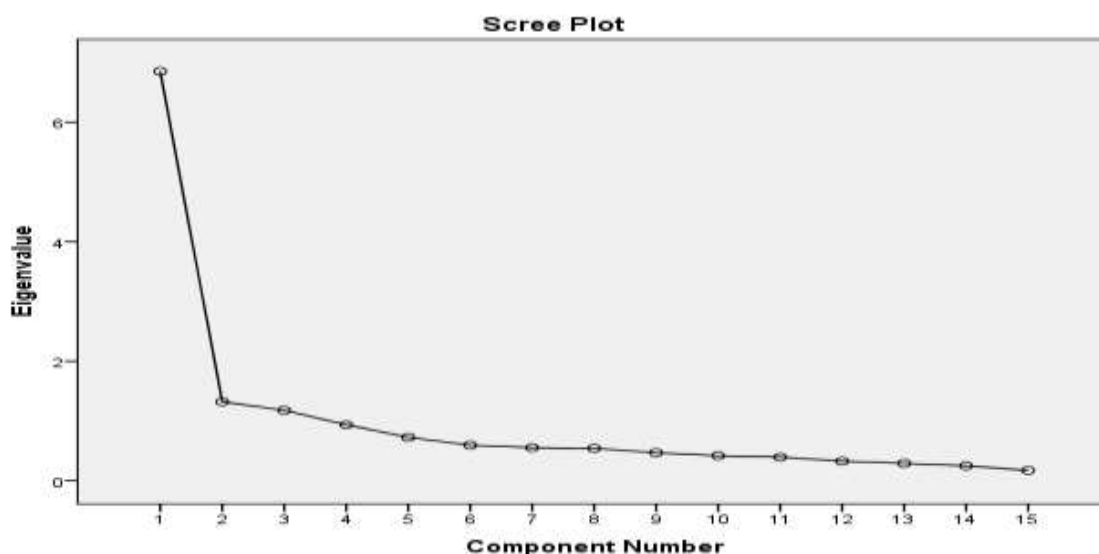
Chart 1. The eigenvalue of the Saudi WISC-IV for the 15 factors

D.   Discriminant validity

To extract the discriminatory validity coefficients, a t-test was used to identify the differences between males and females on the Wechsler scale - IV for deaf and on the four basic tests in addition to the overall scale (see Table 5).

Table 5. T-test for independent samples (the discriminatory) validity of the Saudi version

Source	Gender	N	Mean	SD	DF	T Value	Sig
Verbal Comprehension	Male	67	19.95	10.54	105	-.075-	.940
	Female	40	20.10	8.40			
Perceptual Reasoning	Male	67	7.80	2.70	105	-.217-	.829
	Female	40	7.93	2.55			
Working Memory	Male	67	4.85	2.69	105	-.526-	.600
	Female	40	5.13	2.60			
Processing Speed	Male	67	9.26	5.21	105	.629	.531
	Female	40	8.64	4.47			
Total Scale	Male	67	11.98	5.27	105	-.102-	.919
	Female	40	12.08	4.24			

Table (5) reveals that the values of the statistic (T) reached (-0.075, -0.217, -0.526, 0.629, -0.102) respectively, which are non-significant values at the significance level (0.05), indicating that the sample has equal levels of intelligence related to verbal comprehension, perceptual reasoning working memory, processing speed. It also indicates that the sub-tests are distinct and understandable for deaf people in the Saudi environment and of both genders.

The second question:

What are the indications of the validity of the Saudi version of the WISC-IV for deaf children in sign language? The reliability of the WISC-IV for deaf aged (6-11.16) years has been verified in the Saudi sign language through:

1. *Chronbach Alaph:*

The reliability of the WISC-IV for the age group (6-11.16) years was confirmed in Saudi sign language by extracting Cronbach's alpha values, as shown in Table (6).

Table (6) Cronbach's alpha test to check the scale reliability by (If Item Deleted) method

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Block Design	178.7444	5337.586	.058	.817
Similarities	164.6000	4399.321	.622	.787
Digit Span	176.7333	4974.243	.558	.803
Picture Concepts	172.2333	5110.585	.517	.808
Coding	171.0667	4922.894	.684	.799
Vocabulary	153.4111	4103.773	.641	.784
Letter-Number Sequencing	175.6444	5182.299	.402	.811
Matrix Reasoning	170.9778	5050.067	.572	.805
Comprehension	169.4111	4862.312	.617	.798
Symbol Search	173.1111	4705.336	.681	.792
Picture Completion	167.7000	4690.842	.638	.792
Cancellation	168.2111	4677.472	.659	.791
Information	137.3889	2847.544	.600	.873
Arithmetic	173.3444	5058.116	.642	.805
Word Reasoning	171.1556	4866.110	.692	.797
Total scale (15 subtests)				0.813

Table (6) shows all values of Cronbach's alpha for the fifteen sub-tests ranging between (0.784 - 0.873) and with a total score of (0.813), which are considerable values. This indicates that all sub-tests contribute to the total score of the scale, and they are important tests and belong to the overall scale.

2. *Reliability by Guttman Split-Half*

The Saudi version of WISC-IV for deaf aged (6-11.16) years was divided into two parts:

- Part one: (verbal tests) which are represented by: (Similarities, Digit Span, vocabulary, Letter-Number Sequencing, Comprehension, Information, Arithmetic, Word Reasoning).

- Part two: (Performance Tests), which are represented by: (Block Design, Picture Concepts, coding, Matrix Reasoning, Symbol Search, Picture Completion, Cancellation).

The results of the Split-Half reliability test showed that the reliability coefficient of Cronbach's alpha for the verbal tests (Part 1) was (0.689), and for the performance tests (Part 2) was (0.793). The correlation coefficient between the first and the second part was (0.805). The reliability coefficient of the split-half Guttman was (0.748), these reliability values are acceptable. This indicates the possibility of applying the Saudi version of WISC-IV for deaf among the age group (6-

11.16) years. Table (7) shows the results of the Guttman split-half test.

Table (7) The Split-Halt test for the reliability of the Saudi version of WISC-IV

Reliability Statistics			
Cronbach's Alpha	Part 1	Value	.689
		N of Items	8[a]
	Part 2	Value	.793
		N of Items	7[b]
		Total N of Items	15
Correlation Between Forms			.805
Spearman-Brown Coefficient	Equal Length		.892
	Unequal Length		.892
Guttman Split-Half Coefficient			.748

3.   Reliability by Test-Retest Method

The test-retest method was used to obtain the reliability of the Saudi version of WISC-IV for deaf aged (6-11.16) years in sign language. The test was applied to the deaf subjects (n=25) and it was re-applied after two weeks, then the Pearson correlation coefficient was calculated between the two periods of scale application with its fifteen dimensions and the overall measure. The reliability coefficients for the subscales ranged (VCI: 0.657, PRI: 0.698, WMI: 0.947, PSI: 0.925, total scale: 0.733). These values are significant at (0.01), which indicates that the reliability coefficients were good and acceptable and have high-level correlations.

4.   Reliability Coefficients by the Rates Agreement Method (RAM) (n = 30):

To check the reliability of the WISC-IV, the researchers conducted a Pearson Correlation test. The value of the correlation coefficient by the rates agreement method reached (0.782), which is a statistically significant value at the significance level (0.01) or less. The reliability was extracted using the (Holsti) method, which is: Reliability = 2M/ N1+N2

In the equation, M stands for the rate agreement number, and N1+N2 represents the total sum of coding decisions by the encoders. To achieve that purpose, two encoders (analysts) were

trained, who individually analyzed the results of (25) deaf students (n = 25), during the period of the procedures of test-retest, and they were provided with a copy of the registration form. The items in the analysis were 312 items, of which (156) items were for each coder related to the test. The number of decisions agreed upon by the encoders is 122 out of 156 decisions (units), thus, the application of the Holstey equation was as follows: 122 x 2/ 156+156 312= 244 = 78.2%

This equation shows that the degree of reliability is (78.2%), and accordingly, the scale applies to the Saudi environment.

Discussion

1.   What are the indications of the validity of the Saudi version of the WISC-IV for deaf children in sign language?

The findings revealed the availability of indications of the scale's validity represented by the content validity (80%), and the construct validity of the values of the correlation coefficients between the scale's subtests and the total score of its main test that were greater than (0.30), except for the "Block Design" test of the main test (PRI), where the value of the correlation coefficient was (0.169), which is a positive non-significant value. The factorial validity showed that the values of the "Eigenvalue" of the Saudi deaf sample ranged

between (6.849 - 0.171) and that the values of the correlation coefficients between the sub-tests of the scale and the total degree of their main test were higher than (0.30). As for the discriminatory validity of the differences between males and females demonstrated that they have equal levels of intelligence related to VCI, PRI, WMI, and PSI. These results are consistent with the results of (Simmons, 1992), which confirmed that the standard scores of the scale are positively correlated with the intelligence scores of the Wechsler Intelligence Scale for Children-Revised, WISC-R). And also, (Maller, 1994), which showed differences in the mean ability on many sub-tests, where the level was more difficult for deaf children in the VCI sub-tests. These results agreed with the results of (Krouse and Braden, 2011) that the PRI may have a different meaning than Performance IQ for D/HOH children, which is one of the lower arithmetic means as the mean of PRI was (M = 93.21). And also, with (Krouse, 2012) that the validity of the factorial construct through comparisons of mean scores is that the mean scores for each of (VCI, M = 80.05), PRI, M = 96.18) and PSI, M = 94.16), and it is believed that (WISC-IV) is a clinically relevant tool for use in the assessment of deaf children and that the PRI continues to be the best estimate for deaf children. And with the results of (Abu Drei, 2017) which indicated statistically significant differences (α = 0.05) in the performance on the sub-tests of the Jordanian version of the WISC®-IV attributable to a variable of the category "ordinary & deaf" children. And with (Abu Drei &, Al-Rusan, 2021) that the construct validity ranged between (0.305-0.698), and the correlation coefficients for the items ranged between (0.602-0.823). And with (Abu Drei, 2020) that the correlative validity with the Jordanian version of the WISC-IV for deaf children in sign language through the verbal comprehension intelligence test, includes the following sub-tests: (similarities, vocabulary, comprehension, information, word reasoning). The correlation coefficients between the sub-items and the overall scale are statistically significant at the level (0.01) for both scales, and the arithmetic means related to the effectiveness of the items of the "Diagnosing the Indicative Understanding of the Language Skills of Deaf in sign language" on all tests reached (80.71/526), which is of a low level.

Abu Drei (2021, a) indicated that the construct validity of the scale in its Jordanian version for deaf people with Waardenburg syndrome ranged between (2.741 - 0.243). Abu Drei's (2017) results suggest no differences for the gender variable in the deaf category, (Abu Drei, 2021,b) confirmed that in the internal content validity, the values of the correlation coefficients ranged between (0.351 - 0.435) for each of the tests (PRI, WMI, and PSI), except the VCI test, where the value of the correlation coefficient with total intelligence was (0.074), and there were no statistically significant differences in the level of intelligence (VCI, WMI, PSI and overall intelligence) for the gender variable. While the findings of this research differ with (Abu Drei, 2021,b) that there are statistically significant differences in the level of (PRI) due to gender in favour of males. The researcher attributes these results to the fact that this is a good indication of the validity of the scale, as it encourages its application on deaf children. And that the sign language translation method and the conversion of all its components in accordance with the culture of the deaf language through the correct application of sign language norms resulted in sign language coherence with the verbal and performative paragraphs of the scale.

2.   What are the indications of the reliability of the Saudi version of the WISC-IV for deaf children in sign language?

The results of the research demonstrated high-reliability indications on the total score and the sub-scales. The results of reliability coefficients by Cronbach's alpha method were (0.784 - 0.873), and with a total score of (0.813), and by the split-half method, the reliability coefficient of Cronbach's alpha for verbal tests was (0.689), and Cronbach's alpha reliability coefficient for the performance tests (0.793), the correlation coefficient between the verbal and performance tests was (0.805), and the Guttman split-half for the reliability coefficient was (0.748), and by the test-retest method, the reliability coefficients for the sub-scales ranged (VCI: 0.657, PRI: 0.698, WMI: 0.947, PSI: 0.925, total scale: 0.733), which are significant values at the significance level (0.01), and the method of rates agreement was (78.2%). Thus, the reliability coefficients by any of the previous methods are considered acceptable

and fair. The findings of the current research are consistent with (Krouse & Braden, 2011) the reliability coefficients by the split-half method were higher than (p < .05), and that the mean of VCI (M = 80.86) was less than (P < .05) among the mean of the sample. It also agrees with (Abu Drei, Al-Rusan, 2021) that the indicators of scale reliability by Cronbach's Alpha for the sub-tests ranged between (0.815 - 0.922), and with (Abu Drei, 2021b) that Cronbach's alpha coefficients for the subtests are (0.797), as well as with (Abu Drei, 2021a) that the reliability coefficients of the scale ranged between (0.487 - 0.898). The researcher believes that in light of the results of this research, this result is a good indication of scale validity as it promotes its application of the developed scale with deaf children as well.

Recommendations:

• Educational recommendations:
- Training teachers to communicate in sign language.
- Training teachers to design educational plans suitable to the level of intelligence of deaf students.
- Training professionals to identify the problems related to sign language and the low mental ability of deaf students and linking them to intelligence measures.
• Suggestions for research purposes.
Conducting more studies on intelligence standards for deaf people.
Conducting more studies encouraging translating intelligence tests for the deaf category.
Conducting studies related to the perceptual reasoning of deaf students.

Conclusion

The Arab world lack specialized researchers who hold a high degree (Master's and PhD) in sign language translation which makes it difficult for educators and researchers to determine the best-specialized intelligence tests in sign language, as a result, many of the diagnostic methods used for deaf may have incorrect outcomes, particularly if verbal tests are used. Therefore, what makes this research distinct is the researchers' knowledge of the characteristics and rules of sign language which

indeed facilitates the usage of sign language and the translation of the scale items.

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