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Comparison of cognitive strength and weaknesses between visually impaired children and non-visually impaired children

Novellia Ardhya Dewanti[1], Dhasthra Laksita Mayantya[1], Brigita Yuriza Ardiana[1], Banyu Wicaksono[1]
[1]Department of Psychology, Faculty of Education, Universitas Negeri Yogyakarta;
Jl. Colombo No 1, Yogyakarta, 55281, Indonesia
novelliaardhya.2021@student.uny.ac.id, dhasthralaksita.2021@student.uny.ac.id,
brigitayuriza.2021@student.uny.ac.id, banyuwicaksono@uny.ac.id

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Abstract

Visually impaired children experience limited visual abilities in learning and identifying the world. However, there has yet to be an intelligence measuring instrument containing sub-tests fit to their abilities and limitations. Therefore, this study aims to determine whether the intelligence of visually impaired children and non-visually impaired children as a step for formulating measuring instruments in the future. This research was conducted by survey with a quantitative approach using the WISC-R instrument. The WISC instrument was used because of its advantage compared to other measuring tools, namely the reliability of the instrument that has been approved by many parties and its validity has been tested. The data analysis uses Mann-Whitney U Test to hypothesize that there is a significant difference in the intelligence test results between visually impaired children and non-visually impaired children, it was proven in this research, especially on the performance sub-scale. This study found a significant difference in intelligence between visually impaired children and non-visually impaired children, especially in IQ Performance. Meanwhile, there is no significant difference in verbal IQ between visually impaired children and non-visually impaired children. The results of this study are expected to be the basis for developing intelligence measuring tools for visually impaired children s in the future, adding insight into the differences in intelligence results in visually impaired children and non-visually impaired children, and knowing the weak aspects of measuring intelligence in visually impaired children s with existing tools.

Keywords: *visually impaired children; intelligence; measuring tools.*

Suggested citation

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Introduction

Intelligence as defined by Binet is the ability to come up with thought, recall, and think in abstract terms (Purwanto, 2010). Whereas, according to Wechsler, intelligence is defined as ability that is essential to achieve success, such as persistence, perseverance, concentration, and practical ability (Cohen et al., 2013). Measuring intelligence needs to be done with a series of tests and assessments to acquire accurate results (Nur'aeni, 2012). Usually, the result of such test is expressed in IQ score (intelligence quotient). IQ is a number that gives the possibility to make comparisons of intelligence level (Gregory, 2015).

Measurement of intelligence needs to be done to help individuals recognize their potential so that it is expected for them to develop strategies that support a better future. In addition, it can also measure individual readiness to adapt and start their academic journey (Cohen et al., 2013). Therefore, the measurement of intelligence is relevant to education because intelligence influences individuals' ability in receiving lessons.

Knowing a student's intelligence will make it easier for teachers and psychologist to determine strategies for guiding them to achieve educational success. Further, it can also help students recognize their potential. Therefore, a child needs to get an intelligence measurement facility to make it easier for them to plan a better future (Nur'aeni, 2012). However, measuring intelligence is especially challenging for children with special needs, especially children with visual impairments in Indonesia (Istiqomah, 2017). Consequently, many visually impaired children in Indonesia cannot receive appropriate intelligence measurements to design their future better as any other non-visually impaired children can.

Visually impaired children are they who have visual impairments because they have a limited visual system. These limitations are reduced visual acuity, difficulty perceiving images, reduced sensitivity, visual distortion, and field depth disturbances (Akbar & Yudhana, 2019). Most causes of visual impairment were uncorrected refractive errors (48.99%), cataracts (25.81%), and Age-related Macular Degeneration (AMD, 4.1%) (Ismandari, 2018). With limited visual experience, it may affect an individual's intelligence. One of the factors that influence intelligence is the environment (Nagpal et al., 2015). Therefore, it can be implied that there may be a difference in the results of intelligence measurements between visually impaired children and non-visually impaired children with the same measuring instrument.

Based on the report from the Indonesian Blind Association of Disabilities (Pertuni) (2017), 40% of the 3,750,000 visually impaired in Indonesia are visually impaired school age (6-18 years) children. This indeed isn't a small amount. Therefore, it is important to highlight the issues of appropriate cognitive measurement for visually impaired children.

Common tools used in Indonesia to measure intelligence of children is WISC-R. WISC-R consists of two subsections: Verbal (V) and Performance (P). Each subsection contains six subtests that have different indexes.

Although the WISC subtests use a lot of visual properties in stimulating behavioral samples to be measured like any other measuring instrument, the WISC-R advantage over other measuring tools is that the instrument's reliability has been approved by many parties, and its validity has been tested. WISC-R can explain the meaning specific to the intellectual function of each subtest, index scores, and Full-Scale IQ (Gregory, 2015). WISC-R produces three IQ scores: Verbal IQ, IQ Performance, and IQ Full-Scale or full-scale IQ.

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Table 1. WISC-R Index and Subtest Scores

Index Score	Verbal	Index Score	Performance
Verbal Comprehension Index (VCI)	Information	Perceptual Reasoning Index (PRI)	Picture Completion
	Comprehension		Picture Arrangement
	Similarities		Block Design
	Vocabulary		Object Assembly
Working Memory Index (WMI)	Digit Span	Processing Speed Design (PSI)	Coding
	Arithmetic		Mazes

Several research results show differences in intelligence levels of visually impaired children and non-visually impaired children. However, it has not explicitly been mapped in where and what areas to measure the weaknesses. Research with similar relevance is also conducted by Savira et al. (2019) which uses the research synthesis method to discuss the differences in children's intelligence between visually impaired children and non-visually impaired children. However, it has not yet accurately explained children's intelligence with visual disabilities because they do not use measuring instruments.

Currently in Indonesia there are yet any tools thet was specifically designed to measure visually impaired children's cognitive ability, this research was conducted to determine strength(s) and weakness(es) of visually impaired children in standard intelligence test. This research is pilot research in a series of study that attempts to develop intelligence measurement instruments for visually impaired children.

Method

The current study is a survey study with a quantitative approach and aims to compare the intelligence profiles of visually impaired children with non-visually impaired children to find their strength(s) and weakness(es). The subjects studied were ten children consisting of five visually impaired children s and five non-visually impaired children. The research instrument used is the Wechsler Intelligence Test for Children Revised (WISC-R) to measure intelligence on both visually impaired children as well as non-visually impaired children aged 6-16 years.

The WISC test is done manually by asking questions verbally by the tester. The testee was asked to answer questions that had been given, then the answers obtained will be analyzed according to the WISC-R manual (Wechsler, 1974). The score was then compared using Mann-Whitney U test.

Result and Discussion

Result

Table 2. Average Verbal IQ Rating of Each Group

Group		N	Mean Rank	Sum of Ranks
Verbal IQ	Visually impaired	5	4.30	21.50
	Non-Visually Impaired	5	6.70	33.50
	Total	10		

Although the average score of visually impaired children may seemed lower (Mean = 4.30) than the non-visually impaired children (Mean = 6.70), no significant difference was found (Mann-Whitney U = 6,50; $n_1 = n_2 = 5$; p > .05 two-tailed).

Table 3. Average WMI and VCI Ratings of Each Group

Group		N	Mean Rank	Sum of Ranks
WMI	Visually impaired	5	4.60	23.00
	Non-Visually Impaired	5	6.40	32.00
	Total	10		
VCI	Visually impaired	5	4.40	22.00
	Non-Visually Impaired	5	6.60	33.00
	Total	10		

Again, although the average score of visually impaired children may seemed lower on both WMI (Mean = 4.60) and VCI (Mean = 4.40) compared to non-visually impaired children (WMI = 6.40; VCI = 6.60), no significant difference was found (Mann-Whitney U = 8.00; $n_1 = n_2 = 5$; p > .05 two-tailed).

Table 4. Different Test for Each Verbal Subtest using Mann-Whitney U

	Information	Comprehension	Arithmetic	Similarities	Vocabulary	Digit Span
Mann-Whitney U	8.000	8.500	6.500	5.500	8.000	11.000
Z	-.946	-0.849	-1.273	-1.519	-0.955	-0.319
Asymp. Sig. (2-tailed)	0.344	0.396	0.203	0.129	0.340	0.750

In the performance subtest, visually impaired children are practically unable to perform, therefore no score can be obtained. Consequentially, Full-Scale IQ could not to be obtained for visually impaired children.

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Table 5. Comparison of Each Verbal Subtest per Group

Group		N	Mean Rank	Sum of Ranks
Information	Visually impaired	5	4.60	23.00
	Non-Visually Impaired	5	6.40	32.00
	Total	10		
Comprehension	Visually impaired	5	4.70	23.50
	Non-Visually Impaired	5	6.30	31.50
	Total	10		
Arithmetic	Visually impaired	5	4.30	2.50
	Non-Visually Impaired	5	6.70	33.50
	Total	10		
Similarities	Visually impaired	5	4.10	20.50
	Non-Visually Impaired	5	6.90	34.50
	Total	10		
Vocabulary	Visually impaired	5	4.60	23.00
	Non-Visually Impaired	5	6.40	32.00
	Total	10		
Digit Span	Visually impaired	5	5.80	29.00
	Non-Visually Impaired	5	5.20	26.00
	Total	10		

Discussion

The measurement results showed that visually impaired children have difficulties in performance subtest due to the heavy visual elements and materials on the subtest. Non-visually impaired children are able to perform well on the subtest. Further, Full-scale IQ result for visually impaired children could not be obtained.

However, there is no significant difference in verbal IQ between children with visual impairment and non-visually impaired children. This is in line with the study results from Savira et al. (2019), which underlines that having limitation in their visual ability does not affect the cognitive function of visually impaired children. However, it should be noted that developmental challenges and a lack of support in the learning process may affect cognitive ability of children with visual impairment (Poljan et al., 2020).

We also noticed that during testing, totally blind children have a more pronounced difficulties in similarities and arithmetic. This may be caused by each subtest requires a certain degree of visual experience that they did not have prior experience on. Experience such as seeing shape and color of objects to appropriately compare two objects, a crucial feature in the similarity subtest. Further, vignette question on the arithmetic subtest also noted as difficult due to it requiring a certain degree

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of imaging an object. However, despite the difficulties, no difference in similarities and arithmetic scores was found between visually impaired children with non-visually impaired children.

Further, in digit span sub-test, visually impaired children have slightly higher average compared to the non-visually impaired children. This may indicate that visually impaired children has stronger memory as noted by Chen et al. (2021) that visually impaired children show good WMI (Working Memory Index) because they are trained with listening habits in their daily activities where they rely more on their auditory to understand the world around them. Poljan et al. (2000) also noted that visually impaired children depend on their ability to process information, performance, and memory.

Conclusion

From the results of the study, it can be concluded that visually impaired children experience difficulties in performance subtest, as well as similarities and arithmetic subscales. Therefore, no full-scale IQ can be obtained for children with visual impairments. This finding indicates that WISC-R as the commonly used tools in Indonesia to measure intelligence in children is not appropriate to assess cognitive ability of visually impaired children due to the several limitations experienced by children with visual impairment. Thus, further research is needed to develop a measuring tool that is specifically designed for visually impaired children that can accommodate their difficulties.

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