

Verbal IQ as a Predictor of Deaf Children's Reading Comprehension Ability

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Abstract: Deaf children are believed to have low reading comprehension. This is due to several factors. The results of verbal IQ tests are believed to be a strong predictor for exploring reading comprehension skills of children with hearing impairment. This study is a case study using quantitative and qualitative analysis to find out how verbal IQ can be a predictor of deaf children's reading comprehension skills. This research was conducted at middle School special education of SMPLB-B YRTRW of Surakarta, Indonesia involving 4 subjects of hearing impaired children range between 17-18 years old. The data of the research were comprehension and IQ test score. IQ tests were administered using the WISC-R scale and conducted by Bureau of Psychology Consultation and Services (BKPP) team from Muhammadiyah University of Surakarta. The results show that IQ verbal has significant correlation with reading comprehension achievement in deaf children. This is due to the ability of test to give comprehensive description of deaf children's language acquisition.

Keywords: Deaf Children, Reading Comprehension, Verbal IQ.

INTRODUCTION

Reading is fundamental for the entire learning process. A person's reading competency influences other academic competency. Therefore reading skills are very important for students in learning a language and literature or other subjects [1]. The principal element of reading is reading comprehension [2]. Reading comprehension is a process that simultaneously extracts and constructs meaning through interaction with written symbols [3]. In other words, the reading comprehension skill is a skill to understand the information presented in written text [4]. Reading is not just an effort to understand words. A reader needs to know the meaning of what he is reading by identifying the main thoughts and key information found in the text. Cain and Oakhill [5] stated that comprehension enables a reader to gain information, experience and pay attention to the other world (fictional), communicate well, and achieve academic success. Comprehension skill consists of three elements: the reader, the text, and the purpose of reading [3].

In a functional view, readers will be able to estimate and interpret the meaning of a text through their linguistic competencies. To comprehend meaning a reader is not only interprets the symbolized meaning presented through the linguistic elements, but also considers the socio-cultural context embodied its

language patterns [6]. Thus, there are factors that may affect the ability of the reader to interpret a text. These factors may come from both internal and external factors. Internal factors are factors that come from the reader's side, i.e. the background of the reader's knowledge and experience, and external factors are factors that come from outside of the reader, such as reading topics, text structure, and text readability [7].

Those internal and external factors are intertwined, since the process of the development of human language is essentially the development of social and cultural understanding as well as the language itself [8]. Thus, in studying children's language skills, it needs to consider the child's developments as a social subject. In exploring these developments, we explore the ability of individuals to interpret experiences [8]. One of the modalities to gain a child's experience is through hearing. Hearing is children's modality through which they perceive speech – the spoken world where the deaf children ties with their families, environment; and society [9]. A research found that the missing of hearing before the age of 5 years has a substantial impact on the verbal intelligence and academic achievement of a person [10].

People who have hearing loss are called *deaf*. This term is still a controversial one. Yet, there are

definitions that have not been universally accepted. From some of the existing definitions, Cleve [11] mentions that deafness has characteristics as a result of several things. Functionally, deaf is the inability to hear and understand the conversation through hearing [11-13]. Such conditions lead deaf individual to have a unique experience in acquiring the language. In general, deaf children have not received language exposure before diagnosis of their deafness was established. It means that they have no accessible communication means for months or years after the loss of hearing [14]. This might affect the development of their language because of their verbal reasoning ability and academic success greatly influenced by the onset of language exposure the deaf children. Some studies have found that children with hearing impairment have low reading ability [15-17]. High school deaf children are known to have the ability to read equivalent to the ability of 4th grade hearing students [15,18,19].

The results of the research by Untari [19] who conducted a case study of five deaf children educated in special education in Surakarta, Indonesia found that based on stand five scale, the ability of reading children with hearing impairment is classified into two groups, groups that have good reading comprehension skills and groups who have poor reading comprehension skills. The deaf children with good reading comprehension skills have developed their comprehension skills that require a high-level thinking, i.e. critical and evaluative thinking. Meanwhile, children poor reading comprehension skills tend to use low-level thinking. Their reading comprehension skills is still at the stage of understanding the literal question, i.e. the question measures the ability of children to understand the information explicitly stated in the text. Children with poor reading ability have difficulty to understand questions that require integration between the information provided in the text and their background knowledge and experience. The auditory deprivation in deaf children leads to the loss of experience which may result in the lack understanding of social norms that affect the ability to think critically.

Those varieties in reading comprehension skills are the effects of deafness. The auditory deprivation influences the cognitive development of the deaf children. Cognitive development is a product of a child's efforts in understanding his or her environment and the wider world during the rapid growth period [9]. To be able to provide a more appropriate treatment for the development of linguistic skills of deaf children, an initial assessment is needed to assist the teacher in designing intervention to increase deaf children's language skills. Predicting the appropriate early linguistic skills is believed to make learning more effective. The teacher can identify the model of development needed for deaf children which can help improving deaf children's language skills by facilitating the development of social and emotional skills that can

support the child's cognitive development. However, in fact, in Indonesia, deaf children's educational service – especially at the middle school level – has not been based on the result of child's initial assessment on language competence. All children are treated equally by ignoring the competency of the individual child. Consequently, deaf children who have good reading skills cannot develop their language abilities more effectively. On the other hand, children who have poor language skills may be more slowly improving their language ability.

There has been considerable evidence of research showing that intelligence is a factor that affects the learning achievement on hearing students [20-23]. Thus, intelligence tests can be a tool to provide prediction of hearing students' academic achievement. In deaf children, it is also common to use nonverbal tests of cognitive ability in assessing deaf children for instructional decisions and to predict academic achievement [24]. Deaf Children are found to exhibit similar intelligence as normal hearing children's intelligence as long as the measurement does not depend on verbal measurements [10]. Deafness has no effect on either of full and performance IQ [9]. In contrast, hearing impairment causes obstruction of language input in deaf children to have a sustained impact on the acquisition of verbal knowledge and academic skills of deaf children. This verbal knowledge significantly affects the results of verbal IQ tests [9, 10]. Therefore, verbal IQ is believed as more significant prediction toward language ability of deaf children [25]. Verbal IQ demonstrates the ability of deaf children's language competence based on the components in a verbal IQ test.

Verbal IQ consists of 6 components: (1) information; (2) digit span; (3) vocabulary; (4) Arithmetic; (5) comprehension; and (6) similarities [26]. The information component taps the general knowledge storage that a person has [26]. This knowledge will be useful to link new information. The digit span shows the abstract thinking ability. The vocabulary component demonstrates a person's learning ability, verbal information storage and a richness of general knowledge including his language excellence [26]. This component is diagnosed to potentially important since this test yields information about reasoning ability, degree of abstraction, cultural milieu, educational background, coherence of thought processes, and the like [26]. Other component which correlates highly with general intelligence is arithmetic. The construction of test items in these components is dealing with every day, practical situations such that the solutions generally require computational skills taught in grade school or acquired in the course of day-to-day transactions [27, 26]. Comprehension is the component that shows the individual's understanding of the important social rules used in practical actions in everyday life for social interaction [27]. Therefore, it is

seemingly depends on the possession of a certain amount of practical information and a general ability to evaluate past experience [26]. The last component, the similarities, shows associative thinking skills. Subjects are asked to identify in terms of whether two objects have similarities or not [26, 28]. This component supports abstract thinking abilities. The whole component is a summary of the experience the deaf children have in understanding the world around which become the bases of the comprehension of the written symbols in the reading. Therefore, this study attempts to examine the effect of verbal IQ on children's hearing impairment ability.

MATERIALS AND METHODS

This study is a case study to reveal a strong predictor of the deaf children's reading comprehension. Meanwhile, the method used is quantitative and qualitative methods. The details of the methodology are explained below:

Participants

The subjects of the study consisted of 5 deaf children from middle School special education of YRTRW Surakarta, Indonesia. All of them were diagnosed to have profound hearing loss (>90 dB loss). Three children were born deaf and one acquired hearing loss after birth (at about 2 years). All the subjects were born in hearing family. The parents did not have knowledge about sign language when the children were recognized to have deafness. The subjects have been attending the same school since kindergarten and were

mainly exposed to communicate using speech both in school and home. However, the teacher used also sign language, pidgin sign, when it is needed.

Instrument

For quantitative data, the instruments used in this study are: comprehension and IQ test. The results of comprehension test were used to determine the ability of deaf children's reading comprehension. The comprehension test was built based on Barrett's Taxonomy. The Test was in the form of multiple choice tests with 4 alternatives answer. Comprehension questions were developed based on narration texts which were presented in different plots (progressive and flash back). The categories of understanding in Taxonomy Barrett are grouped into: 1) literal understanding, 2) reorganization, 3) inferential, 4) evaluation, and 5) appreciation. The literal understanding in the taxonomy of Barrett is grouped into 2, namely the category of recognition and recall. Recognition requires an oral response, while the recall requires a written response. In this study the category of recognition was not conducted because of the consideration that the subjects were failed in preliminary oral-test comprehension.

The comprehension questions consist of 81 items. Statistical data in the form of comprehension test score data is calculated by considering the weight of questions based on category in Barrett's taxonomy. The model was described in table 1.

Table-1: Distribution of category of questions on Barrett's reading comprehension and its scoring system

Category	Number of items	TOTAL	Weight	number x weight
Literal	3 x 6 classification	18	1	18
Reorganization	3 x 4 classification	12	2	24
Inference	3 x 8 classification	24	3	72
Evaluation	3 x 5 classification	15	4	60
Appreciation	3 x 4 classification	12	5	60
		81	SCORE	234

WISC-R test was conducted to measure subjects' IQ. It was conducted to know the factors that play role in the reading comprehension of the subjects of research. This test covers verbal and performance subtests. Quantitatively the effect of IQ verbal test results on reading comprehension ability is analyzed by linear regression.

For qualitative method is used to verify findings from quantitative data. It is used to support the quantitative findings by providing information of deaf children' experience related to their behavior. This information was gained through interview conducted to parents and teachers of the subjects of this research. Furthermore the results of verbal tests were interpreted further qualitatively to gain the information obtained from verbal tests that to see the factors that can affect

the results of understanding written text. The implementation of WISC-R test was conducted by the Bureau of Psychology Consultation and Services (BKPP) team from Muhammadiyah University of Surakarta.

Validity and reliability

The comprehension test was tested for both validity and reliability. Validity of content and face was used to validate the developed instruments. It was assessed by panel discussion with experts from the school who examined the content of the instruments. The panel resulted in some modifications on the instrument according to the suggestions. Then the final form of the instrument was finally taken into the field.

While, the reliability of the instruments was achieved by computing Cronbach's α . The result showed that the items were acceptable in reliability with the Cronbrach's $\alpha \geq 0.6$.

RESULTS

Quantitative Analysis

The mean verbal IQ score of all subjects was 67 the mean score of comprehension ability was 120.25. The data analysis was done by SPSS data software. To

know the influence of verbal IQ on reading comprehension ability of deaf children, linear regression test was done. From the results of statistical analysis with linear regression in obtaining data value of significance 0.012 (Table 1) and value R = 0.988 (table 2). This means that there is a verbal IQ effect on the ability of reading comprehension of a very strong deaf child. Thus, it can be concluded that verbal IQ can be a predictor of reading comprehension ability of children with hearing impairment.

Table-1: Linear Regression Analysis

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regressi on	6140.948	1	6140.948	81.988	.012 ^a
	Residual	149.802	2	74.901		
	Total	6290.750	3			
a. Predictors: (Constant), verbal IQ						
b. Dependent Variable: reading comprehension						

Tabel-2: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.988 ^a	.976	.964	8.65453

a. Predictors: (Constant), IQverbal

Qualitative Analysis

Qualitative data were obtained from qualitative interpretation of test components in verbal IQ test. The

interpretation was also confirmed by the background of the subjects obtained from interview.

Tabel-3: Result of interpretation of Verbal IQ components

NO	SUBJEK	CATEGORY					
		Information	Comprehension	Aristhmetic	Similarities	Vocabulary	Digit Span
1	S1	NG	NG	NG	NG	NG	NG
2	S2	NG	P	A	A	NG	NG
3	S3	P	P	NG	NG	P	NG
4	S5	NG	P	P	NG	P	P

Keterangan: A: Average, NG: Not Good, P: Poor

Qualitative descriptions on table 3 show that each component of the subject's verbal IQ was mostly not good. Deaf children in general have limited experience so that information stores tend to be not good. The inadequate experience of deaf children had an impact on their lack of comprehension of the social rules that form meaning in linguistic concepts. The test results showed the component of comprehension is the poorest one. It caused the low results in reading comprehension test. From this result, it seemed that the component became the key component in deaf children's comprehension of written text. Kaufman & Lichtenberger [26] mention that comprehension component almost always tells us something about the subject's social and cultural background. This component was very significant for deaf children's social interaction considering that it reflected the subject's possession of a certain amount of practical information and a general ability to evaluate past

experience. The low comprehension ability caused the subject to be less prepared for daily social events. The subjects of the research tended to isolate themselves from their environment. Thus, their knowledge of social rules became poor. Consequently, they had low comprehension on language grammatical rules. Therefore, the subjects' syntax knowledge was low. The data showed that better comprehension performance the better subjects reading comprehension ability. Otherwise, auditory constraint in deaf children caused them to have low performance on almost all components of verbal IQ test.

DISCUSSION

The results of the linear regression test showed that there was a significant correlation between the verbal IQ test result and the reading comprehension test result in deaf children. Correlation can be seen from the correlation coefficient between predictors (constant),

verbal IQ, with dependent variable, reading comprehension ability, that is R Square = 0.976. The significance value is 0.012. This value indicates a very strong correlation. This suggests that the hypothesis proposed that verbal IQ is a strong predictor of the reading comprehension ability of this deaf child is acceptable. In other words verbal IQ is a strong predictor of reading comprehension ability in children with hearing impairment. The results of this test strengthen the finding of the previous studies that show that verbal IQ is a stronger factor in determining children's hearing ability compared to nonverbal IQ [10, 17, 28, 29].

Verbal IQ describes the experience and the general knowledge and culture of deaf children. All subjects were born on the hearing family where the main means of communication is speech. The diagnosis of their deafness was established after the subjects reached more than 1 year old. It means that they experience delay in language systematic exposure. Moreover, at first, all the parents were unable to communicate with the subjects. Braden [10] mentions that the deaf children's irregularity in gaining exposure to spoken language reduces their chances to learn the knowledge. The consequences of this lack of language exposure can affect their intellectual development, especially on cognitive processes that require language and hearing, such as reading. This can be seen from the results of qualitative analysis of verbal IQ components. In general, deaf children's ability is somewhat lower in overall components of verbal IQ test. This result gives brief description of subjects' language ability.

The verbal IQ measures the conceptual knowledge that becomes the modality for a reader's initial knowledge. The test results also reveal the subject's desire to gain knowledge and awareness of the community's environment and culture [30]. In general, the results of the assessment by psychologists find the concentration and motivation to obtain information from all research subjects is quite low, even, one subject had very low desire to obtain this information. These factors may affect the score of the arithmetic component [30]. In other words, the verbal IQ describes the knowledge gained by everyone from the social and cultural environment where he lives [27].

Several studies have shown deaf children's low vocabulary knowledge [31-33]. This occurs as a result of the obstruction in auditory access to information. This situation causes the deaf children to have low verbal and general knowledge so that they have inadequate long-term memory. This condition is described in the result of vocabulary component. The subjects were found to have low vocabulary knowledge. Unlike normal hearing children who are easily predicted the knowledge they can or cannot answer, deaf children are unpredictable. It is difficult to predict which words they understand or not. Maller [34] mentioned that there

are several factors contribute to the condition; they can be traced back from the differences in language exposure at home and at school, communication methods, or access to sensory input. The results of interview reveal that the environment around deaf children was less likely to provide adequate linguistic access facilities for deaf children. Even, they severely limited or altogether excluded from language exposure. This is shown in the achievement of component comprehension test results. From the analysis it was known that deaf children had low understanding of the important social rules used in everyday life to interact with the society. This is due to the low knowledge of practical information and ability to evaluate past experiences. Thus, the general knowledge of the subjects is also low. The low comprehension component achievement affects the ability of other components. Therefore, deaf children tend to have low achievement in almost all components of verbal IQ test.

From the results of this assessment it seems that verbal IQ can provide a prediction of the condition of children with hearing impairment so that it can be a strong predictor of the deaf children's reading comprehension ability. The description shows deaf children's language ability before a treatment is given. By understanding the initial condition, an appropriate intervention can be designed to contribute deaf children language proficiency affectively.

CONCLUSION

Verbal IQ provides a thorough assessment of the condition language competence of deaf children. In other words this test is a representation of child's cultural experience. Despite the purpose of the instrument that is designed to measure the intelligence of children aged 6 -16 years, this instrument can be used as initial assessment to fulfill the requirement for deaf education. Description of verbal IQ may provide information of deaf children's language proficiency to design effective learning intervention in accordance with each individual condition.

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