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THE IMPROVEMENT OF VERBAL CAPABILITY AS ONE OF THE MATHEMATICAL COMPREHENSION FACTORS ON THE STUDENTS OF PRIMARY SCHOOL

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Abstract. Mathematics have an important role in daily life. From a psychological perspective, mathematics can developed an analytical thinking process and helps to organize ideas in our mind. The ability to understand mathematics are also based on the ability to understand the language. The picture-word inductive model is one of the learning methods that emphasizes the improvement of the students' language skills. The purpose of this research was to determine the effect of the picture-word (pictorial) inductive model in improving the verbal comprehension of students in elementary school. This research used quasi-experimental research methods using experimental group. The subjects of this research are the students of primary school in Kudus District with 21 students. This research used a Wechsler scale as the measuring instrument that has been widely used in measuring intelligence, one of them is verbal ability. The results showed that the influence of the picture-word (pictorial) inductive model on the Information subtest with 0,38 as its score. Arithmetic Subtest with 0,32 as its score and the Equation Subtest with a score of 0,67. The Analysis and conclusions will be discussed further in this article.

Keywords: *Wechsler Scale, Verbal Comprehension, Pictorial Word Inductive Model*

A. Introduction

Mathematics is one of the subject that always related with numbers and calculation. This causing teachers to assuming that students who's struggles in mathematics was caused by how difficult to understand mathematics, but there are many factors that caused students have struggles to understand mathematics (Chow & Ekholm, 2018). Broadly, mathematics can help us to understand inference, deduction, human behavior, and social systems. This also strengthens the analysis, which says that many factors influence the students' ability to understand mathematics. One of these factors is language. Recent research state that one of the factors that influence the understanding of mathematics is students language skills (Chow & Jacobs, 2016; LeFevre, Fast, Skwarchuk, Smith-Chant, Bisanz, Kamawar & Penner-Wilger, 2009; Purpura & Reid, 2016). Mathematics are like any other subjects, it requires the verbal and written languages. The mathematical instructions depends on verbal explanations and interactions between teacher and students, and the introductory of mathematics curriculum is a textbook. Moreover, mathematics are consists of special vocabularies that has different purposes than daily languages, so children must evolve a language that allows them to participate not only on mathematical instructions, but also involved in the outside of their class environment (Vukovic & Lesaux, 2012).

Get to know the reading and a concept requires help from verbal abilities, because the concept are a combination of the situations, phenomenon, words, and the parts that are classified into those categories (Piacente, 2012). Understanding the reading, vocabulary and knowledge must be mastered by someone when have interaction with the reading text, this is an important part that must be mastered so that the learning process will runs well (Kintsch, 1998; Kintsch & Rawson, 2005; Piacente, 2012).

The influence of verbal language and vocabularies in development of mathematical abilities will be the material of this debate. In the research of Fuchs, Geary, Compton, Fuchs,

Hamlett, Seethaler and Schatschneider (2010) states that these relationship is not entirely right, whilst Duncan, Dowsett, Claessens, Magnuson, Huston, Klebanov and Japel (2007) showed that the verbal language and vocabularies are the predictor of mathematical abilities in 3rd and 5th grade of primary school in USA. Some several research (Duncan dkk., 2007; Foster, Anthony, Clements & Sarama, 2015; LeFevre, Fast, Skwarchuk, Smith-Chant, Bisanz, Kamawar & Penner-Wilger, 2009; Purpura & Ganley, 2014) states that languages have connection with early comprehension of mathematics. In the research by Purpura and Ganley (2014) conclude that vocabularies was the significant predictor in ability to understand mathematics, aside from comparison of numbers, sequence of numbers, identification of numbers and story problems. Similarly with the research of Bergqvist, Theens and Osterholm (2018) about the relation between the use of languages in giving mathematical assignments and the difficulty of reading and completing assignments, shows that there is a strong relation between the three variables. There is an opinion that states that the measuring of mathematical ability should not measure the reading ability, and the question makers should use the simple vocabularies. This opinion attempted to separate the reading skills from mathematical abilities, this generate the problem because reading skills are always needed in solving story problems, because students must be able to read, understand, and solve it. Secondly, the language of mathematical communication is a general matter that must be considered as the main aspect in mastering the mathematical abilities (Bergqvist, Theens & Osterholm, 2018). Bergqvist, Theens and Osterholm (2018) also says that the mathematical problem focus on learning or evaluating mathematical abilities, but there are other abilities that must be considered when working on and solving the mathematical problems, which is the ability to read. The ability to read is the ability to understand the story problems where the form of the questions are common in teaching mathematics.

When students entering the basic education level, there is a formal

teaching and learning process about literacy and competence of mathematics. Students who mastered the verbal and numerical abilities from early age are able to support the development of their competence during the learning process and after graduating from school (Duncan, Dowsett, Claessens, Magnuson, Huston, Klebanov Japel, 2007; Geary, 2011). Chow and Ekholm (2018) states that in mathematics learning, the instructions are given through verbal language, where students need to understand the function of words that given when teacher giving instructions. Students must understand the meaning of the words that has been said by teachers, if the students are not able to understand the words that has been said by teachers properly, then they will struggle to understand the mathematics.

Intelligence in general is related to cognitive development, language and mathematical skills (Geary, 1993; Noel 2009; Primi, Ferrao, & Almeida, 2010). Some researches shows that children who entered school with low achievement are also apparently have struggles to understand mathematics in primary school (Aunola dkk, 2004; Bodovski & Farkas, 2007). The research by Foster and friends (2018) about the relation between languages ability with cognitive and mathematics are also states that there is a strong relation between the three of it. One indicator in predicting academic achievement is the early knowledge about mathematics (Duncan, Dowsett, Claessens, Magnuson, Huston, Klebanov dan Japel, 2007).

The verbal ability can be measured by using the Wechsler scale. Wechsler scale is a scale that have been through the adaption and standardization in various countries around the world. The Wechsler test are consist of the Wechsler Intelligence Scale for Children (WISC), Wechsler Preschool and Primary Scale of Intelligency (WPPSI) and Wechsler Adult Intelligence Scale (WAIS) (Lawrence dkk, 2016).

The focus of pictorial word inductive learning models is the development of vocabularies and how the vocabularies can be stored and transferred into long-term memory (Bruce, Marsha, & Emily, 2009). This model emphasizes the vocabulary abilities of students, where the students

read and spell the vocabulary that has been printed on the picture and then re-write it. The purpose of this exercise is to make students to understand and develop the vocabularies that they have mastered and apply it to the other written texts. The picture that being used is a stimulus for students to gain more language experience. The pictorial word inductive model is one of the learning models where the students can investigate languages, the form and purpose of letters, words, phrases, and sentence that can support communication process (Huda, 2014). Huda (2014) also stated that the pictorial word inductive model teaches students: (1) making vocabularies; (2) investigate the structure of words and sentences; (3) arrange text (title, sentences, and paragraphs); (4) understanding the relation of reading/writing; (5) increase the skills of phonetic and structural analysis; (6) developing the ability to express feeling with writing; (7) increasing the interest of reading nonfiction texts; and (8) developing cooperation skills in learning to read/write with others.

The purpose of this research was to analyse the effect of pictorial word inductive model on the verbal abilities of primary school students. Verbal ability is one of the abilities that required to understand mathematics. This learning methods is expected to have significant effect on students' verbal abilities, so that they can help another students to understand mathematics.

B. Research Metodology

The *Wechsler Intelligence Scale for Children* (WISC) test with subtest of verbal abilities became a measuring instrument in this research. Taking a subject by using sampling purposive technique have certain character that established by researcher to be learn and to take a conclusion later (Azwar, 1997). This research subjects were from 3rd grade students of primary school in Dawe Region, Kudus District, Central Java, with 21 students as the experimental group.

This research is a quasi-experimental research, with the research program of the one-group

pretest-posttest design (Cook & Campbel, 1979). The pre-test of this experimental group was given a treatment on March-May 2018. Then the post-test was given after the treatment was finished. This research uses the analysis of Wilcoxon non parametric test of statistical data.

C. Research Results and Discussions

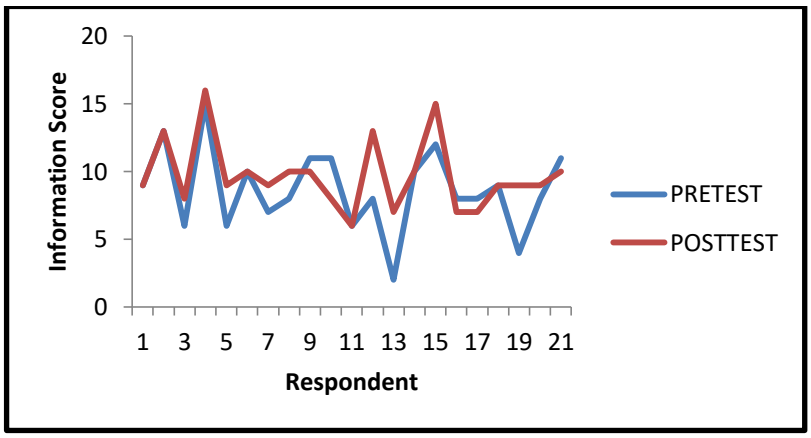
Verbal ability consists of six sub-test can be describe as down subtest. The results of verbal ability below:

Table 1
Descriptive statistic of pre-test and postes subtest of verbal ability

	Pretes					Postes				
	N	**Std**	**Mean**	**Min**	**Max**	**N**	**Std**	**Mean**	**Min**	**Max**
Information	21	3,02	8,67	2	15	21	2,59	9,71	6	16
Definition	21	4,46	6,19	0	17	21	3,02	7,29	3	16
Calculation	21	3,22	8,52	3	15	21	3,83	9,62	4	18
Equation	21	2,97	10,29	6	15	21	3,93	12,52	1	20
Vocabularies	21	3,45	3,86	0	16	21	1,84	3,10	0	6
Range numbers	21	3,22	8,95	3	16	21	3,17	9,33	3	16

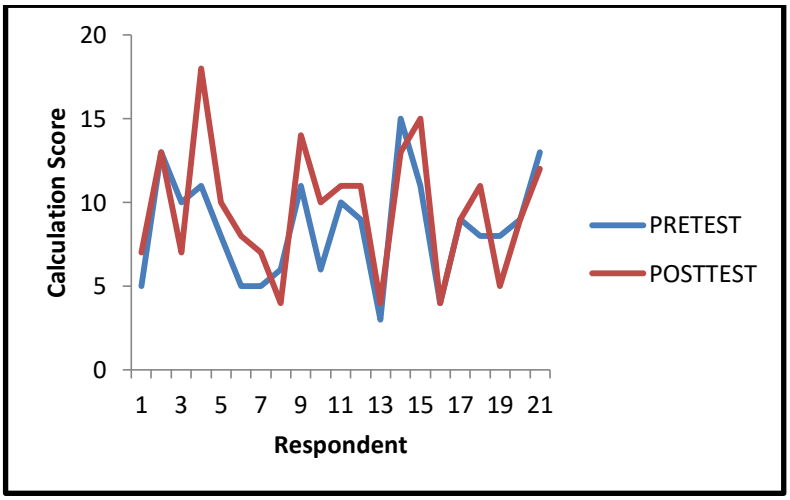
Table 1 shows the mean value, standard deviation, minimum score, and maximum score subtest of the experimental group. The higher the standard deviation, the more varied the data is.

Based on the results of significance test, the subtest that did not have a significant improvement were the subtest of definition, vocabularies, and range numbers. In the subtest of information, calculation, and equation shows the significant improvement which will be described by the researcher.



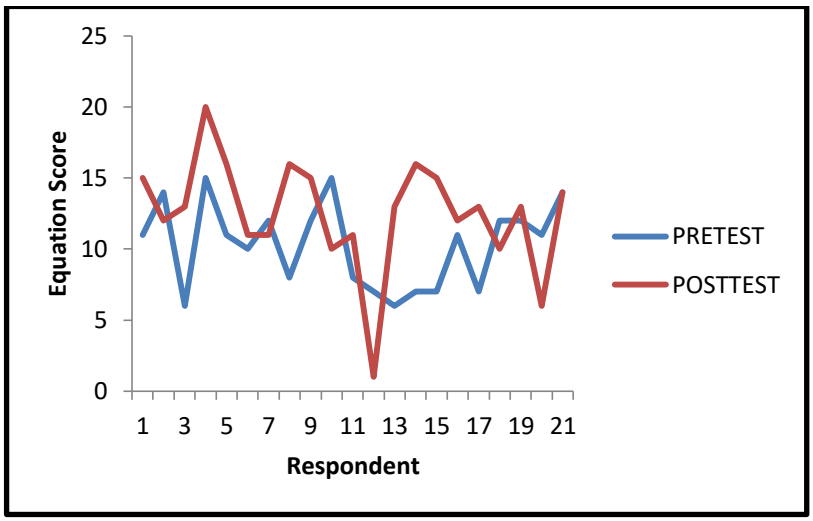
Picture 1
Pretest-Posttest Score of Information Subtest

Picture 1 shows the changes in information subtest score before and after giving the inductive models of pictorial word learning method. These changes are indicated by a significant improvement as big as 0,023 where $Sig < 0{,}05$.



Picture 2
Pretest-Posttest Score of Calculation Subtest

The changes in the score of the calculation subtest as shown in picture 2 shows a significant improvement with the sig result of 0,013 where $Sig > 0{,}05$.



Picture 3
Pretest-Posttest Score of Equation Subtest

In the picture 3 shows the changes in the score of the equation subtest after getting the inductive models of pictorial word learning method. The significant improvement in the equation subtest with the sig result of 0,018 where $Sig < 0{,}05$.

Table 2
Normality and Significance Test of Verbal Capability Subtest

No	Subtest	Size Effect	Interpretation
1	Information	0,38	Medium
2	Calculation	0,32	Medium
3	Equation	0,67	Medium

The table 2 shows that the effective contribution of the pictorial word inductive learning models to the subtest of information, calculation, and equation. Cognitive ability is an important factor in the social and economic area. In a population, the macro level of cognitive skills is associated with economic growth. In the micro level, cognitive skill is associated with health, mental ability or high salary, and also a good education (Dahmann, 2017). The pictorial word inductive model is one of the learning methods that used as the effort to improve the cognitive abilities. There are several factors that affect the students' mathematical abilities, some recent research says that one of these factors is the verbal language skills

(Chow & Ekholm, 2018). LeFevre, Fast, Skwarchuk, Smith-Chant, Bisanz, Kamawar and Penner-Wilger (2009) stated that there are three things that affect the numerical skills, one of them is language as a strong and consistent predictor. The research by Seethaler, Fuchs, Star and Bryant (2011) also support this thing, that language skills are related to mathematical abilities. Students with low language skills can significantly show the low ability to solve story problems than the students with good language skills (Jordan, Levine & Huttenlocher, 1995). Parmar, Cawley, and Frazita, (1996) also stated that the students with mathematics problems oftenly have struggle with story problem about problem solving.

The children needs an familiarization to the language and rules of mathematics, in the same time also introducing the relationship between informal language and knowledge. Children need to hear the language of mathematics that used in the contexts, children need to learn words to compare and differentiate directions and locations at the same time when they learn to counts and numbers (NCTM, 2006). Concepts, calculation, and languages are connected in one developmental process, because the language skills support the development of numbers, where children are use language to determine their understanding of quantitative (Miura & Okamoto, 2003., Spelke, 2003., Purpura & Reid, 2016). The understanding of quantitative languages (such as more, less than, several, and few) allows children to make and describe comparisons between groups and amount/numbers. The understanding of spatial languages (such as before, above and close) allows children to talk about the relationship between physical object and between numbers on the number series (Purpura & Reid, 2015).

Based on table 8, from six subtest of verbal abilities, only three of them can significantly improved. Through the pictorial word inductive learning models, showed the possibility of other learning methods that could improve subtest of verbal ability. Some results of the pictorial word inductive model research, shows that students' language skill has increased significantly. The research by Andariah (2017) about improving the ability to write poetry in

primary school students. The research by Patty (2015), Putra (2016), Bali, Fakhruddin and Rifa'i (2016) in improving writing learning and literacy for early ages. The pictorial word inductive model is the proper model to improving language skills, but as far as the researcher know, this learning models has not specifically focused on subtests of verbal ability from WISC.

Verbal ability have an important role in mathematical concept. The research on increasing mathematical concept is inseparable from the role of verbal abilities. Research by Hakim, Jamaludin and Mukhtar (2017) about improving mathematical abilities through Jarimatika approach, emphasizing the use of verbal information about calculation operation concept and way to counting on students when giving treatment.

Sidik's research (2016) found that the primary school students who have difficulties about mathematics, generally due to their weak understanding of the concept question, in this case is to understand sentences on the mathematics problem. Yustitia's research (2017) also states that the reasoning ability profile in solving mathematical problems are also closely related to the ability to understand questions and communicate these questions with their own language.

For decades, the analysis about language skill's roles on arithmetic at primary schools has been expanded and have effect and also widely accepted as a theoretical framework (Dehaene, S., Piazza, M., Pinel, P., & Cohen, L, 2003; LeFevre, Fast, Skwarchuk, Smith-Chant, Bisanz, Kamawar & Penner-Wilger., 2009; Vukovic & Lesaux, 2013). Some previous research found that the development of arithmetic abilities depends on languages, such as spelling and grammar skills (De Smedt & Boets, 2010; Kleemans, Segers, & Verhoeven, 2014). Other research also shows that language skills is directly related to arithmetic skills in primary schools (Kleemans, Segers, & Verhoeven, 2014; LeFevre, Fast, Skwarchuk, Smith-Chant, Bisanz, Kamawar & Penner-Wilger., 2009; Purpura & Reid, 2016). The research of Vukovic dan Lesaux (2013) about the relationship between general verbal abilities and spelling ability of primary students from 3rd grade also indicate that

indirect verbal analogy is related with counting knowledge through the variables between numbers and symbol ability, while the spell ability have directly related with calculation ability.

This research focus on verbal analogy, spell ability, numbers and symbols ability, counting procedure, and story problems. This strengthen the basis of WISC subtest verbal ability have effect in improving language ability, which will improve student's mathematical ability later.

Although there is a consistent relationship between language skill generally towards counting skill, improving children's language skills would not show the positive effect to their counting skill (Jordan, Glutting, Dyson, Hassinger & Irwin, 2012). This matter caused that the language skills generally have role as proxy measurement of language skill, specifically mathematics (Purpura & Reid, 2016). The research by Kleemans, Segers and Verhoeven (2018) about relation between basic language skills (spelling and grammar) and advanced language skills (academic vocabulary and verbal reasoning) with mathematics for primary school (arithmetic, geometry, and fractions), concluded that basic language skills with variable between arithmetic, are indirectly related with geometry and fractions. Advanced language skills with arithmetic control variable, are directly related with geometry and fractions.

D. Conclusion

Significant effect was seen at the subtest of Information, Calculation and Equations. Although the improvement of verbal ability does not mean it can directly improve students' mathematical skills, but verbal ability have an important role at the mathematics learning process. The limitation of this research is the numbers of research subject, which surely become consideration for the further research. The learning model which being used apparently will be more appropriate if paying attention to every subtest from verbal ability, so

that all verbal ability subtests are expected to increase significantly.

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