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Mathematical communication ability of 7th grade Junior High School students by using Knisley's model assisted by textbook supplements

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Abstract

Mathematical communication ability needs to be improved so that students can solve math problems well. This study aims to determine the effectiveness of Knisley's learning model assisted by textbook supplements on achieving mathematical communication ability. The type of this research was quantitative method research with a Quasi-Experimental design. The population was the students of class VII A, and VII B at SMP Muhammadiyah Pangkalan Bun Kalimantan year 2019/2020. Data collection techniques used are tests. The results showed that Knisley's learning model assisted by textbook supplement is effective in achieving students' mathematical communication ability, namely (1) the proportion of student's mathematical communication ability reaches more than 75% classical completeness, and (2) the average test results of the students' mathematical communication ability who follow Knisley's learning model assisted by the textbook supplement are better than the students' mathematical communication ability who follow Knisley's learning model without textbook supplement.

1. Introduction

Law No.23 of 2003 concerning National Education System on Chapter IV Article 3, the National Education functions to develop the capability, character, and civilization of the nation for enhancing its intellectual capacity, and is aimed at developing learners' potentials so that they become persons imbued with human values who are faithful and pious to one and only God; who possess morals and noble character; who are healthy, knowledgeable, competent, creative, independent; and as citizens, are democratic and responsible. The existence of the education that very important is integrated into learning in schools. One of the compulsory subjects that students must learn is mathematics. Mathematics is a science that is needed in varied fields, both in mathematics itself and in other fields. Basically, mathematics has a significant role in the field of education. This can be seen from teaching mathematics at the primary, secondary and tertiary levels.

One of the objectives of mathematics in the 2013 Curriculum as contained in the attachment of Regulation of Education and Cultural Ministry Number 58 of 2014 in the section of Mathematics Subject Guidelines is understanding the mathematical concepts which are competencies in explaining the interconnection between concepts and applying concepts or algorithms flexibly, accurately, efficiently and appropriately, in problem solving. In line with this, according to (Asikin, 2013), mathematical communication skills have a significant role in learning mathematics because (1) a tool for exploiting mathematical ideas and helping students' ability to discover the various relationships of mathematical materials, (2) a tool to measure understanding growth and reflects on students' understanding of mathematics, (3) tools for organizing and consolidating students' mathematical thinking, and (4) tools for constructing mathematical knowledge,

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developing problem solving, improving communication, affixing self-confidence, and increasing social skills. Mathematical communication skills are needed by students in conveying mathematical ideas either orally or written. According to (NCTM, 2000), related to mathematical communication in the *Principles and Standards for School Mathematics*, it is stated that the standard skills that must be mastered by students are (1) organizing and consolidating mathematical thinking and communicating with other students, (2) expressing mathematical ideas coherently and clearly to other students, teachers and others, (3) increasing or expanding students' mathematical knowledge by thinking about the thoughts and strategies of other students, and (4) using mathematical language appropriately in various mathematical expression.

Facts on the ground prove that the objectives of learning mathematics in Indonesia have not been well accomplished. Based on the results of the *Programme for International Student Assessment (PISA)* survey in 2012, it was found that Indonesia was ranked 64th out of 65 participating countries with an average score of 375 (OECD, 2013). The low ability of students' mathematical communication is due to the use of conventional methods in learning process. According to (Afriyani et al., 2014), conventional learning with one-way communication ignores the social nature of learning mathematics and also obstruct in the mathematical development of students so that students have not been conditioned to express mathematical ideas/ thoughts. One learning model that has the opportunity to improve mathematical communication skills is the Knisley's Model. This is because the Knisley's Model has advantages, for example, increasing the enthusiasm of students to think actively, helping a conducive learning atmosphere because students rely on individual discoveries, creating joy in the teaching and learning process because students are dynamic and open from various directions (Mulyana, 2009).

Furthermore, the researcher also conducted a preliminary test on the achievement of students' mathematical communication skills of grade VII. Figure 1 shows is an example of students solving the perimeter and area of square.

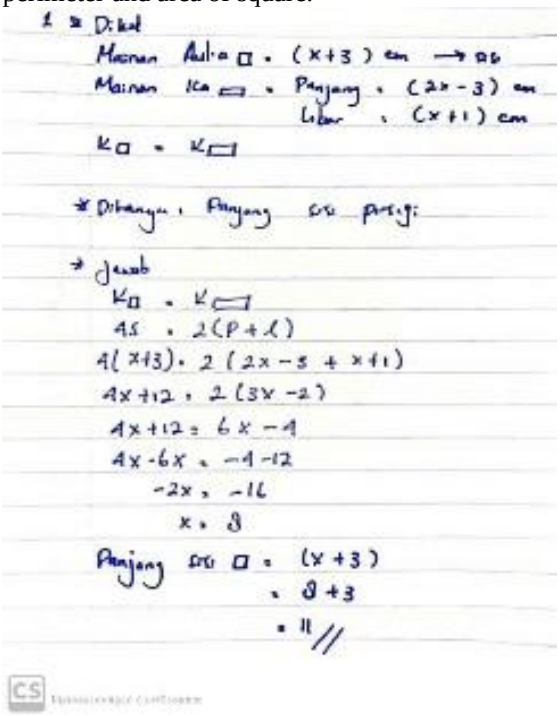

Figure 1. *Initial test answers*

Based on Figure 1. it can be seen that students' mathematical communication skills are still low. Because nearly all of the students answer the question like that. Students have not accustomed to writing down what is known, asked, drawing sketches, finishing steps, as well as conclusions. Thus, students cannot give the correct answer just yet.

In the 2013 Curriculum, all subjects must have contributed in building attitudes, skills and knowledge. There are two learning processes, they are the direct learning process and the indirect learning process. The direct learning process is the process of students developing knowledge, thinking skills, and psychomotor skills with a scientific approach (Trianto, 2007). In line with this insight, science learning is something that must be "done" by students, not something that is done to students as stated by the *National Research Council* (1996: 20) that *"Science learning is an active process. Learning science is something students to*

do, not something done for them". While the indirect learning process is a learning process to develop morals and behavior related to attitudes.

From these facts, it seems that students are required to be active and optimize their intelligence and talents. Consequently, it is necessary to improve students' understanding and thinking skills by making learning media in the form of textbook supplements. Through textbooks, teaching and learning activities at school and independent learning activities at home will be easier and more effective. With the textbooks, students' basic skills and knowledge have been attained before going to the class so that during the class they can be used for memory stabilization activities, concept understanding, critical thinking and knowledge development and active learning, students get direct experience so they are not limited merely to knowledge.

A learning model that is able to facilitate active and creative learning. One such learning model is Knisley. Knisley's learning model is a model of learning through experience in a mathematical context (Knisley, 2002). The learning is centered on students and makes experience as a process of constructing knowledge and learning. Knisley's model consists of four stages, namely: *Allegorization* (Concrete-Reflective), *Integration* (Concrete-Active), *Analysis* (Abstract-Reflective), and *Synthesis* (Abstract-Active).

Moreover, the researcher will develop *Open-Ended Textbook* Supplements about Quadrilateral material for class VII. This Quadrilateral *Open-Ended* Textbook Supplement was developed so that students can improve their mathematical communication skills step by step and provide a new innovation regarding textbooks, specifically for quadrilateral material. According to Huda (2013), *Open-Ended* learning is a learning process in which the goals and desires of the individuals or learners are openly made and accomplished. The *Open-Ended* approach is an approach to the learning process that provides a learning in it which starts by giving problems related to the mathematical concepts that will be discussed.

The purposes of this research were to determine the effectiveness of Knisley's learning model on the achievement of mathematical communication skills (1) to analyze mathematical communication skills with Knisley's learning model assisted by textbook supplements to achieve classical completeness on Quadrilateral material, (2) to analyze the average of students' mathematical communication skills who use Knisley's learning model assisted by textbook supplements is better than Knisley's learning model without textbook supplements, (3) to analyze the increase in mathematical communication skills with Knisley's learning model assisted by textbook supplements, and (4) to determine the quality of Knisley's learning model assisted by textbook supplements.

2. Methods

This research was conducted at SMP Muhammadiyah Pangkalan Bun and was held in the class VII academic year of 2019/2020. The research method used was a combination method with *True Experimental Design* in the form of *pre-test* and *post-test*. An overview of the quantitative research design according to (Cresswell, 2012) there are two sample groups, namely the experimental group and the control group. The experimental group was given learning by using Knisley's model assisted by textbook supplements, while the control group was given learning by using Knisley model without textbook supplements. Before learning, both groups were given a *pre-test* and after learning the two groups were given a *post-test.*

The sample was selected by *probability sampling* technique, then it was obtained the experimental class was a class that used the Knisley's learning model assisted by textbook supplements, namely class VII A. Whereas the control class was a class that used the Knisley's learning model without textbook supplements, namely class VII B. To support the results of the research, the selection of research subjects conducted by *purposive sampling* technique.

The method of collecting data included: 1) tests, and 2) documentation. The instruments in this research were: 1) the mathematical communication skills test in the form of *pre-test* and *post-test* which have the same questions. The techniques in analyzing the instrument of mathematical communication skills consisted of validity test, reliability test, discriminating power test, and item difficulty test.

The learning process was carried out four times in the experimental class using the Knisley's model assisted by textbook supplements and the control class using the Knisley's model without textbook supplements. The material used is a rectangle, specifically on the perimeter and area of the square, rectangle and parallelogram. The variable used in this study is mathematical communication skills.

3. Result & Discussion

Based on the results of preliminary data analysis, it was found that the prior data for the experimental class and control class were normally distributed, had homogeneous variations and there was no difference in prior ability between the experimental class and the control class. It means that the samples come from the same initial conditions. Meanwhile, the final data analysis shows that the final data of the experimental class and control class are normally distributed and have homogeneous variants.

Hypothesis 1 test using the average test score obtained t value = 19,042 while t table = 1,699. It is clear that t value $\geq t$ table, then H_0 is rejected. So, the average of students' mathematical communication skills who follow the Knisley's learning model assisted by textbook supplements is higher than the BLA.

Hypothesis 2 t test using average proportion difference test obtained z value = 3,204 while z table = 1,645. It is clear that z value $\geq z$ table, then H_0 is rejected. Therefore, the proportion of students who reach the BLA in Knisley's learning model assisted by textbook supplements is more than 75%.

Hypothesis test 3 using the average difference test obtained t value = 12,0613 while t table = 2,0017. It is clear that t value $\geq t$ table, then H_0 is rejected. Thus, the average of students' mathematical communication skills of the Knisley's learning model assisted by textbook supplements is better than the average of students' mathematical communication skills in Knisley's learning model assisted without textbook supplements.

Hypothesis test 4 by using one way the proportion of different test obtained z value = 1,7770 while z table = 1,645. It is clear that z value $\geq z$ table, then H_0 is rejected. So, the proportion of the classical completeness of class students who obtain the Knisley's learning model assisted by textbook supplements is better than the proportion of the classical completeness of class students who obtain the Knisley's learning model assisted without textbook supplements.

Based on the results of quantitative data analysis, it was found that the proportion of students' mathematical communication skills in Knisley's learning model assisted by *WhatsApp* and textbook supplements had reached the specified proportion, namely 75%. Whereas the average mathematical communication skills of students in the Knisley's learning model assisted by *WhatsApp* and textbook supplements have reached BLA, namely 43. This proves that Knisley's learning model assisted by *WhatsApp* and textbook supplements are supporting factors for students' mathematical communication skills. According to research by N. Sefiany et al. (2017) also stated that learning mathematics using the Knisley's Model is effective. This is because students' mathematical communication skills who were taught by using the Knisley's Model can reach the mastery learning, better than students' mathematical communication skills who were taught by using the the *Direct Instrection Model*, and had increased in the high category.

In addition, the results of quantitative data analysis also obtained the average value of students' mathematical communication skills in WhatsApp-assisted Knisley model learning and teaching book supplements better than the average score of students' mathematical communication skills in WhatsApp-assisted Knisley model learning without a teaching book supplement. The proportion of students who were able to achieve BLA in WhatsApp-assisted Knisley model learning and teaching book supplements was better than the proportion of students who were able to achieve BLA in WhatsApp-assisted Knisley model learning without teaching book supplements. The difference in results is caused by the help of teaching book supplements. Hidayati, P. (2013) in her research also stated that the improvement in the mathematical communication skills of students who get math learning with the Knisley Model learning model is higher than the improvement of the mathematical communication skills of students who use expository methods.

Kelas control given Knisley model learning assisted WhatsApp without teaching book supplements, learning is implemented using *powerpoint* but students are still less responsive because it is constrained in some ways one of them is *gadgets and* networks. As well as the lack of adequate applications to unlock *powerpoints* in their respective *gadgets.* This resulted in students testing the mathematical communication skills of the learners in the control class lower when compared to the results of the test of the mathematical communion ability of the learners in the experiment class.

Factors that make up the difference in the results of the test of mathematical communication skills of students who obtained Knisley model learning with the help of WhatsApp and teaching book supplements and students who obtained Knisley model learning with the help of WhatsApp without teaching book supplements include (1) students carrying out learning enthusiastically and without any pressure, so that the material studied can be accepted and understood; (2) in Knisley model learning with the help of WhatsApp and teaching book supplements, the teacher provides assistance in the form of teaching book

supplements loaded as often as possible without much writing so that students easily understand and remember the material learned.

4. Conclusion

Based on the explanations above, it can be concluded that the Knisley's learning model assisted by textbook supplements is effective in achieving students' mathematical communication ability. It is stated to be effective because it fulfills the criteria (1) the proportion of the student's mathematical communication ability reaches more than 75% classical completeness, and (2) the average test results of the students' mathematical communication ability who follow Knisley's learning model assisted by textbook supplement are better than the students' mathematical communication ability who follow Knisley's learning model without textbook supplement.

Thus, it means that the application of Knisley's learning model assisted by textbook supplements is effective in improving students' mathematical communication ability towards mathematical communication ability of Knisley's learning model assisted by textbook supplements.

References

Afriyani, A. D. N., Chotim, M., & Hidayah, I. 2014. Keefektifan pembelajaran TTW dan SGW Berbantuan Kartu Soal Terhadap Kemampuan Pemecahan Masalah. *Unnes Journal of Mathematics Education, 3(1): 49-55.*

Asikin, M. & I. Junaedi. 2013. Kemampuan Komunikasi Matematika Siswa SMP dalam Setting Pembelajaran *RME (Realistic Mathematics Education). Unnes Journal of Mathematics Education Research*, 2(1): 204-212. Tersedia di journal.unnes.ac.id/sju/index.php/ujmer/article/view/1483 [diakses 10-12-2019]

Departemen Pendidikan Nasional. 2003. *Undang-Undang Republik Indonesia No.20 Tentang Sistem Pendidikan Nasional*. Jakarta: Departemen Pendidikan Nasional Republik Indonesia.

Depdikbud. 2014. *PERMENDIKBUD No.58 Th. 2014 tentang Kurikulum 2013 Sekolah Menengah Pertama/Madrasah Tsanawiyah.* Jakarta: Departemen Pendidikan dan Kebudayaan Republik Indonesia.

Cresswell, J. W. 2012. *Research Design Pendekatan Kualitatif, Kuantitatif, dan Mixed.* Yogyakarta: Pustaka Pelajar.

Hidayati, P. 2013. Penerapan Model Pembelajaran Knisley untuk Meningkatkan Kemampuan Komunikasi Matematik Siswa SMP. Bandung: Universitas Pendidikan Indonesia.

Huda, M. 2013. *Model-model Pengajaran dan Pembelajaran.* Yogyakarta: Pustaka Pelajar.

Kemendikbud. (2010). *Pengembangan Pendidikan Budaya dan Karakter Bangsa*. Jakarta: Kemendikbud.

Knisley, J. 2002. *A Four-Stage Model of Mathematical Learning, The Mathematics Educator.* 12(1): 11-16. Tersedia di http://tme.journals.libs.uga.edu/index.php/tme/article/view/105/96 [diakses 10-12-2019]

Mulyana, E. 2009. *Pengaruh Model Pembelajaran Matematika Knisley terhadap Peningkatan Pemahaman dan Disposisi Matematika Siswa Sekolah Menengah Atas Program Ilmu Pengetahuan Alam.* Disertasi. Bandung: FMIPA UPI.

National Research Council. 1996. *National Science Education Standard.* Washington: National Academy Press.

NCTM. 2000. *Principles and Standards for School Mathematics*. USA.

OECD. 2013. *PISA 2012 Result in Focus What 15-year-olds Know and What They Can Do with What They Know.*

Permendikbud.2014a. *Pedoman Mata Pelajaran Matematika SMP Kurikulum2013*. Jakarta: Depdikbud.

Permendikbud.2014b. *Standar Penilaian*. Jakarta: Depdikbud.

Sefiany, N, Masrukan, & Zaenuri. 2016. Kemampuan Komunikasi Matematis Siswa Kelas VII Pada Pembelajaran Matematika dengan Model Knisley Berdasarkan *Self Efficacy*. *Unnes Journal of Mathematics Education Research*, 5(3): 228-233. Tersedia di http://journal.unnes.ac.id/sju/index.php/ujme [diakses 10-12-2019]

Sugiyono. 2015. *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.

_____. 2016. *Metode Penelitian Kuantitatif, Kualitatif, dan Kombinasi (Mixed Methods)*. Bandung: Alfabeta.