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The Role of Cooperative Learning Type Team Assisted Individualization to Improve the Students' Mathematics Communication Ability in the Subject of Probability Theory

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Abstract
The importance of learning mathematics can not be separated from its role in all aspects of life. Communicating ideas by using mathematics language is even more practical, systematic, and efficient. In order to overcome the difficulties of students who have insufficient understanding of mathematics material, good communications should be built in a learning process. Communication in general can be interpreted as a way to convey a message from the messenger to the receiver to inform opinions or behaviors either directly (oral) or indirectly through the media. In the communication process, we need to think on how to make the message can be understood by others. In order to develop the ability to communicate, people can communicate with a variety of languages including mathematical language. One of the subjects in the Statistics study program which requires mathematics communication ability is the Theory of Probability, which is categorized as a general skill subject that must be taken by all students of mathematics. Improving the students' mathematics communication ability should be hand in hand with the learning process. We can optimize the ability by implementing a learning model which gives chance for the students to discuss and to interact each other so that their mathematics communication ability improved, that is by using cooperative learning type Team Assisted Individualization (TAI).
Keywords: Mathematics communication ability, Cooperative learning type TAI.

1. Introduction

1.1 Background

Mathematics learning at school does not only aim to make students understand the material. There are various objectives such as improving the mathematics reasoning ability, the mathematics communication ability, the connection of mathematics, the mathematics representation, and the mathematics problem solving, as well as some particular behaviors that should be internalized by students after they studied mathematics (Sabandar, 2009). The mathematics communication ability is very important for the students so that they can solve mathematics problems by using good reasoning, illustrate the mathematics ideas into a mathematics model, and then connect the process into various mathematical concepts, into everyday life context, as well as into the other disciplines. In studying the mathematics communication ability, the learning model which is predicted to be able to facilitate the study is the cooperative learning model type Team Assisted Individualization (TAI). This model is a group learning which puts the students in small groups consisting of two or more heterogeneous students to help each other in learning the material. This model also emphasize on the positive interdependence among students, their individual responsibility, face to face meeting, intensive communication, and group evaluation process so that the classroom management becomes more effective.

The cooperative learning type TAI is a learning which address students to solve problems given by the lecturer in small groups. This type of learning requires students to participate actively in the classroom. On the other hand, students are also taught to accept differences which might appear in the group. One of the efforts to overcome these problems is the cooperative learning model type TAI. The purpose of this study is to develop the students' understanding to communicate the concept of probability by using the cooperative learning model of TAI.

1.2 Problem

The problem of this study is: Is there any correlation between the implementation of cooperative learning model type Team Assisted Individualization and the improvement of the students' mathematics communication ability?

1.3 Urgency of the Problem

The mathematics communication ability has not currently appeared within the students yet during the learning process. Thus, they tend to give up the tasks when they experience difficulties. This study is expected to be a reference and discourse for practitioners of mathematics education to understand more about the role of cooperative learning model type TAI in improving the mathematics communication ability.

2. Material and Method

2.1 Mathematics Communication Ability

In mathematics, communication plays an important role. Communication becomes an essential part of mathematics and mathematics education. Berelson and Steiner in Vardiansyah (2005) argue that communication is a process of delivering information, ideas, emotions, skills, and others through the use of symbols such as words, pictures, numbers, and others. Communication is the effort to deliver message, idea, or information from the communicator to the communicant and vice versa. Communication plays an important role in the learning process, including the mathematics learning. A broader sense of mathematics communication is presented by Romberg and Chair (Sumarmo, 2000), namely: (a) connecting the concrete objects, figures, and diagrams into mathematical ideas; (b) explaining the ideas, situations and mathematical relationships orally or written by using concrete objects, pictures, graphs and algebraic expressions; (c) expressing daily life situations in mathematics language or symbol; (d) listening, discussing, and writing about mathematics; (e) reading with understanding a written mathematical presentation, making conjecture, making argument, formulating definitions and generalizations; (f) explaining and making inquiries about mathematics that have been studied.

2.2 Cooperative Learning type Team Assisted Individualization (TAI)

Cooperative learning model is a model of learning which emphasizes the use of students groups. The principle that should be upheld related to the cooperative groups is that every student is in a group should have the heterogenous level of ability (high, intermediate, and low) and if necessary, they must come from different races, cultures, and ethnic groups as well as considering the gender equality (Posamentier, 1999: 12).

The cooperative learning type TAI has learning steps which foster the aspects of mathematics communication ability. The following steps are the steps of the cooperative learning modl type TAI:

Placement Test

In this step, the lecturer gives a pretest to the students. This method could also be replaced by observing the test result of the previous material or the average score that the students earned during certain duration of study. This step enables lecturer to figure out the students' weakness in particular topics.

Teams

This is recognized as an important step in the cooperative learning of TAI. In this step, the lecturer groups the students into some heterogenous groups consisting of 4-5 students each.

Teaching Group

The lecturer explains the material briefly before the tasks given.

Student Creative

The lecturer needs to emphasize and to create the students' perception that the individual success is determined by the success of their group.

Team Study

The students learn by using the students' worksheet. The lecturer also gives assistant to the students who need help individually. This step could also use the students who have good academic record to help the other members of the group as the peer tutor.

Fact test

The lecturer gives small test based on the facts got by the students, for instance, by delivering a quiz.

Team Score dan Team Recognition

The next step is that the lecturer gives score to the group's work and gives "salutation" reward towards the group which can pass the tasks well and also towards the group which still fails the tasks, for instance, by recognizing them as "the BEST group" or "the OUTSTANDING group", etc.

Whole-Class Units

The final step is that the lecturer re-presents the material in the end of the chapter by using problem solving strategy for all the students in the classroom.

Each component of cooperative learning model type Team Assisted Individualization brings benefit to the lecturer, students, top groups and bottom groups who work together completing the academic tasks, namely: the clever students take the responsibility to help the weak group. Thus, they can develop their abilities and skills. The weak students will be assisted in understanding the subject matter, since there is no competition among the students because they work together to solve problems in dealing with different ways of thinking. Students do not only expect assistance from the lecturer, but also motivated to learn fast and accurately in all material. The lecturer could use only half of his/her teaching time so it will be easier to give individual assistance to the students.

2.3 Method

The method used in this study was a mixed method. The design was embedded concurrent design (Sugiyono, 2011). In this mixed method, the quantitative method became the primary method while the qualitative method

became the secondary method. The subject in this study was students of Statistics Study Program in one of state higher education institution in Makassar in the subject of Theory of Probability. The sampling technique used was purposive sampling. The sources of data in this study came from the students as research subjects. The instruments used were in the form of mathematics communication ability test, observation sheet, interview guide, documentation, and the researcher.

The data collection method used was the test (quantitative data) and the triangulation (qualitative data). The data analysis technique for quantitative data used correlation analysis, while the qualitative data were analyzed descriptively to support, clarify, and refine the results of the quantitative analysis in answering the problems. The test of mathematics communication ability has been validated so it is appropriate to be used in the study.

3 Results and Discussion

A. Quantitative Data Analysis

Before the correlation analysis is conducted, the score of mathematics communication ability should be tested by the normality test of *Kolmogorov-Smirnov* (*K-S*). The test was conducted by using *SPSS* 22.0 program. The result of the test is as follows.

Table 1. Test of Data Normality

Variable	Value of *K-S*	*Sig.*	H_0
Mathematics Communication Ability	0.096	0.06	accepted

H_0: The data is normally distributted

Based on the Table 1, we can see that the value of significance (*sig.*) for mathematics communication ability is more than 0.05. Hence, the null hypothesis is accepted. It means that the data is normally distributted. Therefore, the correlation testing should use the Spearman Rank Correlation to determine the correlaton coefficient and its significance value. By using the *SPSS* 22.0 program, it gives the following result.

Table 2. Correlation Testing and Its Significance

Correlation	r_{xy}	*Sig.* (2-*tailed*)	H_0
Mathematics Communication Ability *Cooperative Learning TAI	0,421	0	Rejected

H_0: There is no correlation between the two variables

The Table 2 shows the value of significance (*sig.*) for the correlation is less than 0.05 so the null hypothesis is rejected. It means that there is a significance correlation between the Mathematics Communication Ability and the Cooperative Learning type TAI. Besides, the correlation coefficient gives positive result which means the correlation between the two variables is positive though the value is not high. Thus, the category of the correlation is medium (Sugiyono, 2011).

Based on the explanation above, we can understand that the higher mathematics communication ability that the students have, the more score they get in the cooperative learning type TAI.

Qualitative Data Analysis

Based on the results of observation and interview towards some students, we found that the mathematics communication needs crative ideas. For instance, the following specimen is the problem of mathematics communication in the subject of Theory of Probability developed by the researcher.

Let the waiting time of a patient to get health service is denoted by T and having p.d.f gamma with $\alpha = k$ and $\beta = 1/\lambda$.

Determine the expectation value of the waiting time of the patient.

In order to solve the problem, student needs ideas to start. One of the alternatives is solving it directly. To start this method, student can use the definition of expectation value. The following is the sample of the solution process:

the expectation value of the waiting time of the patient is:

$$E(W) = \alpha\beta = k/\lambda$$

If k=1 ➔ then $E(W) = 1/\lambda$. It means that the waitng time for a patient is $1/\lambda$

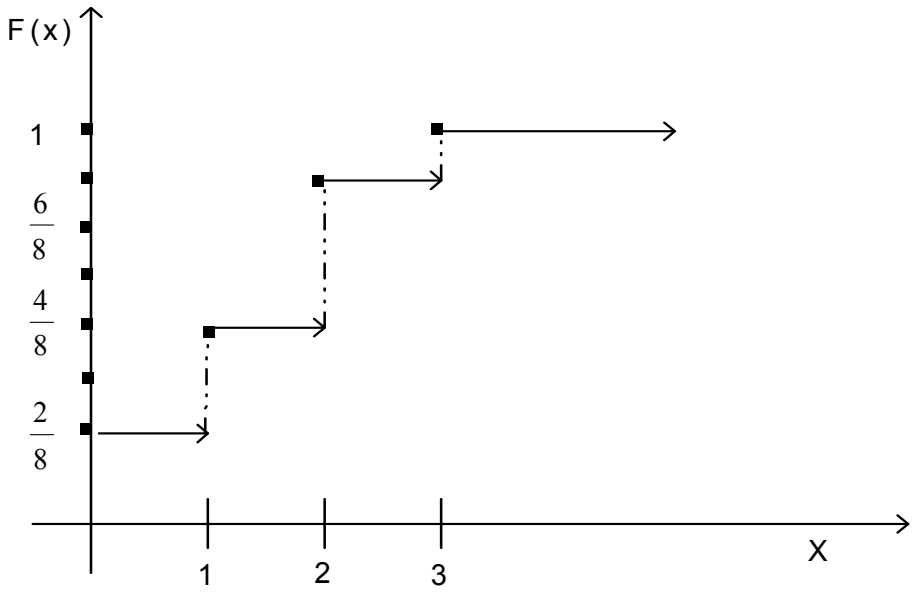
The other sample is as follows:

Siti, a student of Statistics Study Program of Hasanuddin University, is doing a trial of throwing a balance coin 3 times, with the distribution function F(x) as follows:

$$F(x) = \begin{cases} 0, & x < 0 \\ 1/8, & 0 \le x < 1 \\ 4/8, & 1 \le x < 2 \\ 7/8, & 2 \le x < 3 \\ 1, & x \ge 3 \end{cases}$$

Determine the cumulative distribution of the discrete variable and graph it.
Solution:
From the throwing of the balance coin 3 times:

$$F(x) = \begin{cases} 0, & x < 0 \\ 1/8, & 0 \le x < 1 \\ 4/8, & 1 \le x < 2 \\ 7/8, & 2 \le x < 3 \\ 1, & x \ge 3 \end{cases}$$



The cumulative distribution discrete variable

In completing the two questions above, students discussed so that they engaged in a good mathematics communication to find or to understand the concepts. Each member of the group can work on a single problem as a form of shared responsibility. The implementation of cooperative learning model type Team Assisted Individualization emphasis moreon group awards, individual responsibility, and equal opportunities to share the results for each group member. Most of the students also admit that when they apply the learning model which emphasizes the utilization of student groups, the difficult problem will be easier to solve. This is because of the principles that must be upheld related to the cooperative groups that every student in a group must have the heterogeneous ability levels (high, intermediate, and low) and refers to a wide variety of teaching methods in which students work in small groups to help each other in learning the material. In addition, implementing cooperative learning type TAI requires the student to write down the steps in detail. Therefore, students need to understand the mathematics communication ability to understand the given problem.

4 Conclusion and Recommendation

1. Conclusion

The mathematics communication ability has a significant correlation with the cooperative learning type TAI, because in the class using the cooperative learning, the students are expected to help each other, to mutually discuss and argue, to sharpen the knowledge they have at the current time, and to overcome the gap in the understanding among students. Thus, the mathematics communication could be well done.

2. Recommendation

We suggest that the role of cooperative learning type TAI could be studied further related to the other

mathematics abilities (cognitive aspect) and attitude (affective aspect)

References

Fatimah, F. (2012). Kemampuan Komunikasi Matematis Dalam Pembelajaran Statistika Elementer Melalui Problem Based Learning. *Jurnal cakrawala pendidikan No 2*

Gagne, R.M. (1992). *The Condition of Learning and Theory of Instruction*. New York: Rinehart and Winston.

Gall, Meredith Dengan, Gall, Joyce Produk, and Borg, Walter R. (2003). *Educationa: Research an Introduction.* Seventh Edition. United Sates of America.

Heckler, Andrew F. (2004). *Measuring Student Learning* by Pre and Post testing: absolute Gain normalized Gain. *American Journal of Physics*.

Herdian (2010). *Kemampuan Komunikasi Matematika.* Tersedia: http://herdy07.wordpress.com/2010/05/27/kemampuan-komunikasi-matematis/ [22 Mei 2012].

Herman, T. (2006). *Pembelajaran Berbasis Masalah untuk Meningkatkan Kemampuan Berpikir Matematis Tingkat Tinggi Siswa Sekolah Menengah Pertama (SMP)*. Dissertation at the Postgraduate School of UPI. Bandung: Not published.

Herman, Tatang. 2011. *Tren Pembelajaran Matematika Pada Era Informasi Global*. (Online). (http://file.upi.edu/Direktori/fpmipa/jur._pend._matematika/196210111991011-Tatang_Herman/Artikel/Artikel18.pdf, accessed at 1 Juni 2013).

Hudojo & Herman. (2001). *Pengembangan Kurikulum dan Pembelajaran Matematika*. Jurusan Pendidikan Matematika Universitas Negeri Malang

Hulukati, E. (2005). *Mengembangkan Kemampuan Komunikasi dan Pemecahan Masalah Matematika Siswa SMP melalui Model Pembelajaran Generatif.*. Dissertation at the Postgraduate School of UPI. Bandung: Not published.

http://www.analyzemath.com (accessed at 5 Februari 2013)

Ibrahim, Muslimin. (2000). *Pembelajaran Kooperatif*. Surabaya: University Press. Introduction Four Stages of Problem Solving Scientific Approach

Isrok‟atun (2006). Pembelajaran Matematika dengan Strategi Kooperatif Tipe STAD untuk Meningkatkan Kemampuan Pemecahan Masalah dan Komunikasi Matematik Siswa. Bandung: Thesis at the Postgraduate School of UPI. Bandung: Not published.

Kadir (2010). *PenerapanPembelajaran Kontekstual Berbasis Potensi Pesisir sebagai Upaya Peningkatan Kemampuan Pemecahan Masalah Matematik, Komunikasi Matematik, dan Keterampilan Sosial Siswa SMP*. Dissertation at the Postgraduate School of UPI. Bandung: Not published.

Kantowski, M.G. (1981). "*Problem Solving*". Mathematics Education Research: Implications for the 80‟s. Virginia: NCTM.

Kartini. (2009). *Peranan Representasi dalam Pembelajaran Matematika*. Seminar Nasional Matematika dan Pendidikan Matematika : FMIPA Universitas Negeri Yogyakarta.

Kenney. (Eds.). 1996 Yearbook.*Communication in Mathematics.K-12 and Beyond.Reston, V A: NCTM*