Hayashi, Y., et al. (Eds.) (2017). Workshop Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

The Effect of Think-Pair-Share Cooperative Learning Model Assisted With ICT on Mathematical Problem Solving Ability among Junior High School Students

Khoerul UMAM*, SUSWANDARI, Nur ASIAH, Indri Trisno WIBOWO & Syaiful ROHIM
University of Muhammadiyah Prof DR HAMKA, Indonesia
* khoerul.umam@uhamka.ac.id

Abstract: The main purpose of this research examines the effectiveness on how mathematics teachers have begun to Integrate Information and Communication Technology (ICT) with Think Pair Share Cooperative Learning Model to improve students' mathematical problem solving ability in junior high school classroom practice. This study was experimental research with a quasi-experimental design. The samples of the study are 36 students for classroom experiments and 36 students for classroom control. The instruments employed in this study were pre-test and post-test. The instruments are made in essays forms which design to measure students' mathematical problem solving ability. The data were analyzed by using descriptive and inferential statistics. Our finding has shown us that (1) Think Pair Share Cooperative Learning model assisted with ICT had a positive impact on student's mathematical problem solving ability; (2) there is a statistically significant mean difference in students' mathematical problem solving ability between experiment class and control class.

Keyword: Think Pair Share Cooperative Learning, Mathematical Problem Solving Ability.

1. Introduction

Mathematics learning is not only oriented toward students' mathematics learning outcomes, but it needs to accommodate the various abilities that must be possessed by students in the mathematical learning process. One of the abilities developed in the learning of mathematics is a mathematical problem solving ability. This ability can assist students in solving many complicated or simple mathematical problems. The research findings facts in Jakarta schools show that students' mathematical problem solving skills are still not satisfactory (Septiany,Purwanto & Umam,2015; Slamet & Samsul,2014). To improve student's mathematical problem solving ability, we need to enrinch our learning process by using various media such as ICT. According to Alim, Umam, & Rohim (2015), teaching and learning process which is used ICT will improve learning quality. Improving learning quality will encourage students to more engaged and enjoyable in learning process (Alim, Umam & Wijirahayu,2016). One of the learning models that can be used to improve learning quality and students' mathematical problem solving ability is Cooperative Learning Model.

In applying cooperative learning model, the researchers chose Think-Pair-Share Cooperative Learning Model because it offers a learning process to more challenging activity which is started by involving students to think about a problem given by a teacher. Lie (2005) believes that pair exchange techniques give students more opportunities to engage themselves and work collaboratively with other students. Furthermore, students are also created in pairs so that students can discuss the information presented from the problems given by the teacher and then share with the whole class they have been talking about. Wena (2009) said that cooperative learning seeks to use peers as a resource for learning. Think-Pair-Share cooperative learning model steps that begin with thinking, pairing and sharing which is integrated with ICT media are designed to improve students' mathematical problem solving skills.

2. Literatures

2.1. Think Pair Share Cooperative Learning Model assisted with ICT

According to Wena (2009), Cooperative Learning is a learning system that seeks to use peers (other students) as a source of learning in addition to teachers and other learning resources. Cooperative learning is a learning approach that focuses on the use of small groups of students to work together in maximizing learning conditions to achieve learning objectives (Junaedi, 2008).

Think-Pair-Share Cooperative Learning Model is a cooperative learning model first developed by Frank Lyman of the University of Marykand in 1985 (Rahmatun, 2014). Learning model is oriented to students, students are asked to process the problems presented by the teacher. Lie (2005) believes that pair exchange techniques give students the opportunity to engage themselves and work with others.

Think-Pair-Share cooperative learning model gives students more opportunities to think for themselves, to discuss, to help each other in groups, and to be given opportunities to share with other students.

In Think-Pair-Share Cooperative Learning Model there are 3 steps, namely thinking, pairing and sharing. According to Trianto "Master uses the following steps: (1) thinking; (2) in pairs; (3) share (Trinoto, 2009). The first stage is thinking, at this stage the teacher asks a question or problem associated with the lesson using ICT, and ask students to use a few minutes to think for themselves. The second stage is pairing, at which point the teacher asks the students to pair up and discuss what they have gained. The third stage is sharing, at this stage the teacher asks the pairs of students to share their work using ICT with whole class and other students give feedback from their friend's performance. The stages in Think-Pair-Share Cooperative Learning Model techniques are:

1. Thinking, the teacher asks questions and gives the opportunity to think before the students answer the proposed submission.
2. In pairs, the teacher asks students to answer the problem.
3. Sharing, teachers ask pair of students to present their work in front of class while other students give feedbacks for their friends' performances (Trianto, 2009)

2.2. Student's Mathematical Problem Solving Abilities

Mathematical problems ability is the ability to find a way to solve mathematical problems by using the relationship between mathematical conceptual and logics (Schoenfeld, 2014). The ability to solve mathematical problems is an attempt to translate mathematics that includes the ability to apply mathematical ideas to the context of problems and the ability to work together to develop and solve problems. Thus, the ability to solve mathematical problems is the ability of students in finding solutions to mathematical problems in accordance with the ability to think logically by applying mathematical ideas in solving problems. In solving the problems, each individual needs a different time based on their mathematical knowledge and skills. According to Siswono (2008), there are several factors that affect the problem-solving ability, namely:

1. Initial experience.
   Experience on tasks to solve the story or application problem. Early experiences such as fear (phobia) towards mathematics can hinder students' ability to solve problems.
2. Mathematical background.
   Students 'ability to varying degrees of mathematical concepts can lead to differences in students' ability to solve problems.
3. Desire and motivation.
   Strong internal impulses, such as cultivating my "CAN" and external beliefs, such as being given interesting, challenging, contextual problems can affect the outcome of problem solving.
4. Problem Structure.

The structure of the problem given to the students (problem solving), such as verbal or image formats, complexity (degree of difficulty), context (story or theme background), language problems, or problem patterns.

Siswono (2008) also mentioned that in solving the problem necessary skills that must be possessed, namely: (1) empirical skills (calculation, measurement); (2) applicative skills to deal with common situations (setting occurs); (3) thinking skills to work on an unfamiliar situation.

3. Methods

This research is a quantitative research with quasi experimental design. This research was conducted in two classes which has the same characteristics. Firstly, an experimental class which is taught by using Think Pair Share Cooperative Learning Model assisted with ICT, whereas a control class which is taught by using conventional learning. Population in this study are all students of class VII which is approximately about 72 students Junior High School consisted of 36 students in experiment class and 36 students in control class. The instruments are made in essays forms which design to measure students' mathematical problem solving ability. Problem solving instruments was developed through a series of daily life around students environments and instructed students to think carefully in applying an appropriate mathematical concept for given problems.

In the experimental class, the teacher sets the classroom for students to sit in groups. The teacher presents open-ended mathematics problems with the help of ICT media, then the students are asked to think about solving the problem. In groups, students begin to think about choosing relevant information and appropriate mathematical concepts to solve the problem. Once students are grouped to solve a given problem, each group is asked to present the outcome of the problem given with the help of ICT media while other students will give feedbacks for their friends' performances.

While in the control class, teachers do not design student seats in groups. The teacher explains the mathematical material directly with lecture method and teacher-oriented learning tendency so that the student only as the listener.

4. Results

4.1. Student Mathematical Problem Solving Abilities

The statistical description show that problem solving ability in experiment class by using Think Pair Share Cooperative Learning assisted with ICT as follows:

Table 4.1 Students' Mathematical Problem Solving Ability for Experiment Class

Mathematical Problem Solving Ability	Achievement Indicators	Student Outcomes	
		Pre-test	Post-Test
Students ability to understand the problem	≥ 75 %	14 students 47 %	25 students 83 %
Students ability to design the plan for solving the problem	≥ 60 %	10 students 33 %	20 students 67 %
Students ability to solve the problem	≥ 50 %	8 students 27 %	14 students 47 %
Students ability to look back on solution	≥ 30 %	5 students 17 %	10 students 33 %

From table 4.1 shows that students' mathematical problem solving ability in experimental class is improved. The most significant student ability was seen in students' ability to understand the problems of 14 students (47%) to 25 students (83%). Problems presented with the help of ICT and learning materials using ICT can improve students' mathematical problem solving ability.

The data of statistical description show that the problem solving ability in the control class is as follows:

Table 4.2 Students Mathematical Problem Solving Ability for Control Class

Mathematical Problem Solving Ability	Achievement Indicators	Student Outcomes	
		Pre-test	Post-Test
Students ability to understand the problem	≥ 75 %	14 students 47 %	17 students 57 %
Students ability to design the plan for solving the problem	≥ 60 %	10 students 33 %	14 students 47 %
Students ability to solve the problem	≥ 50 %	6 students 20 %	10 students 33 %
Students ability to look back on solution	≥ 30 %	3 students 10 %	7 students 23 %

4.2. T-test Results

To find evidence of a significant difference between experiment and control class, we use T-test. Based on T-test performance, we can see the result as follows:

Table 4.3 Results of T-test for Students' Mathematical Problem Solving Ability between Experiment and Control Class

	N	Mean	Std. Deviation	T-test
Experimental Class	36	14,910	4,523	2,662*
Control Class	36	12,032	4,102	

*p > 0.05

The T-test results show that there is a statistically significant mean difference in Students' Mathematical Problem Solving Ability between experiment class and control class. It appears that students in an experiment class perceived that Think-Pair-Share Cooperative learning using ICT was very helpful to improve their mathematical problem solving ability.

5. Conclusion

The results have shown that the low ability of problem solving mathematical students caused by some factors that affect problem solving ability which is rarely not built in class. By using Think-Pair-Share cooperative learning model integrated with ICT can be concluded that there is an improvement of students' mathematical problem solving abilities. Especially in experimental class, students are able to solve problems with creative solutions. The result of this research can be concluded that Think Pair Share Cooperative Learning model assisted with ICT had a positive impact on student's mathematical problem solving ability. Data also have given us that there is a statistically significant mean difference in students' mathematical problem solving ability between experiment and control class.

Acknowledgements

We would like to thank to University of Muhammadiyah Prof. DR. HAMKA and LPDP (Lembaga Pengolola Dana Pendidikan) Finance Ministry, Indonesia for supporting this study. We hope that this paper can give a great contribution especially for STEM education.

References

Alim, E. S., Umam, K., & Rohim, S. (2015). Integration of Reciprocal Teaching-ICT Model To Improve Students' Mathematics Critical Thinking Ability. Proceedings of the 23rd International Conference on Computers in Education ICCE (pp 483-487).

Alim, E. S., Umam, K., & Wijirahayu, S. (2016). The Implementation of Blended Learning Instruction by Utilizing WeChat Application. Proceedings of the 24th International Conference on Computers in Education ICCE (pp 100-107).

Junaedi, et. al. (2008). Strategi Pembelajaran. Edisi Pertama. Surabaya: LAPIS-PGMI.

Lie, A. (2005). Cooperative Learning. Mempraktikan Cooperative Learning di Ruang-Ruang Kelas. Jakarta: Grasindo.

Rahmatun Nisa, et al.(2014). Penerapan Pembelajaran Kooperatif Tipe Think-Pair-Share pada Pembelajaran Matematika di Kelas IX IPS SMA Negeri 2 Padang Panjang. Jurnal Pendidikan Matematika, 3(1), 25-32.

Schoenfeld, A. H. (2014).Mathematical problem solving. Florida: Academic Press Inc.

Septiany, S., Purwanto, S. E., & Umam, K. (2015). Influence of Learning on Realistic Mathematics ICT-Assisted Mathematical Problem Solving Skills Students. Proceedings of the 23rd International Conference on Computers in Education ICCE (pp 29-31).

Siswono. (2008). Model pembelajaran matematika berbasis pengajuan dan pemecahan masalah untuk meningkatkan kemampuan berpikir kreatif. Surabaya: UNESA Press.

Slamet, S. & Maa'rif, S. (2014). Pengaruh bentuk tes formatif assosiasi pilihan ganda dengan reward dan punishment score pada pembelajaran matematika siswa SMA. Infinity Journal. 3(1), 59-80. DOI: http://dx.doi.org/10.22460/infinity.v3i1.39.

Trianto. (2009).Mendesain Model-Model Pembelajaran Inovatif-Progresif Konsep, Landasan, dan Implementasinya pada Kurikulum Tingkat Satuan Pendidikan (KTSP). Jakarta: Kencana.

Wena, M. (2009). Strategi Pembelajaran Inovatif Kontemporer: Suatu Pendekatan Konseptual Operasional. Jakarta: Bumi Aksara.