



Research Article

Probing-Prompting Based on Ethnomathematics Learning Model: The Effect on Mathematical Communication Skills

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Abstract

Communication skills on mathematics should be mastered by students to involve them in mathematics learning process. This study aimed to determine the effect of the Probing-Prompting based on Ethnomatematics learning model PPBELM on mathematical communication skills. This research is an experimental study with simple random sampling technique. Experimental group and control group was randomly selected. There are fifty one students divided to 25 college students within the experimental group, while 26 students in the control group. This study performed two times semester of 2017-2018 instructional 12 months. The instrument used to collect data is a test of mathematical communication skills. Test trials include content validity, level of difficulty, difference in power, and reliability. For the normality test using the Lilliefors-test, the homogeneity test uses a similarity test of two variances. The hypothesis test used by t-test. The results show that there is an influence from the Probing-Prompting based on Ethnomathematics learning model on mathematical communication skills.

Keywords

probing-prompting, ethnomathematics, mathematical communication skill

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Introduction

In the biggest 21st century, the development of science and technology is increasingly rapid. Science and technology can be developed by systems, various systems also experience developments, be they economic, political, communication, education and other systems. The existing system is not only concerned with the development of technology and science, but also related to the various resources needed, both natural resources, time resources, human resources and other resources. The development of science needs to be followed by good management of resources, especially human resources and communication skills (Akbuber, Erdik, Guney, Cimsitoglu, & Akbuber, 2019).

Mathematics is an efficient and necessary tool for all sciences (Elida Nunun, 2012). However, the facts in the field show that students' mathematics learning outcomes are still relatively low, this is closely related to the assumption that mathematics is still considered as one of the subjects considered difficult, so that students generally do not like (Wahid Umar, 2012). To find out the extent to which students understand symbols, ideas and understanding concepts in mathematics learning, the need for mathematical communication skills is necessary and configuration of characters (Ratnasari, Tadjudin, Syazali, Mujib, & Andriani, 2018). Other words, learning mathematics is difficult to communicate because it is difficult to understand symbols and abstract (Supriadi & Damayanti, 2016).

Mathematical communication skill is an ability that can include and contain various opportunities to provide rational reasons for a statement, change the form of description into mathematical models, and illustrate mathematical ideas into relevant descriptions (Masykur, Syazali, & Utami, 2018). The lack of students' mathematical communication skills is influenced by more than one factors, for example the learning model in the classroom by teachers and local students activities (Haryani, 2017). To find out the improvement in mathematical communication skills, observations were made during learning and giving written tests of mathematical communication skills (Abdurrahman, Saregar, & Umam, 2018).

As parties directly involved in learning in class, mathematics teachers have an important role and have an obligation to conduct learning which can support students to develop of the mathematical communication skills of their students (Roseth, Johnson, & Johnson, 2008). Teachers are highly expected to be able to create learner-centered learning, arouse the activities of students in exploring knowledge with their own abilities (Abdurrahman, Nurulsari, Maulina, & Ariyani, 2019), because through education and training people experience changes in attitudes, behavior and ways of thinking (Abdullah, 2010).

However, the learning process that occurs still does not support students to actively build the knowledge and material learned. Formulating mathematical

concepts and strategies as an central force in mathematical communication (Lestari et al., 2019). The low ability of students to convey and describe what they understand has an impact on the low mathematical communication skills (D. K. Sari, Supahar, 2018). This is evident from several surveys that show that: if mathematical communication skills to students' mathematical problem solving are good then students' learning outcomes will also be good, and vice versa if mathematical communication skills are students' mathematical problem solving is low then student learning outcomes will also be low (Triarini, Degeng, & Toenlio, 2017).

In addition to this, another fact that also proves that there is still a low mathematical communication ability in solving mathematical problems of students in junior high schools in West Lampung, Indonesia, students do not understand the learning model used by teachers, do not combine math lessons with other things such as culture because most students are lazy to think about the problem, so the results of the midterm and final semester exams have not reached completion (Dina & Diyan, 1997). Other stakeholders, the low ability of mathematical communication is caused by the way the teacher teaches, which never changes or in other words the teacher still applies the direct learning model / lecture, does not understand students about mathematical functions both in society (Rufaidah, AtIrsyati, Saregar, & Umam, 2018) and culture, because teachers never combine values culture in mathematics learning so students do not know that mathematics can be learned with existing culture (Gull & Shehzad, 2015).

In addition, it is based on the activity that the fear of learners towards a mathematics teacher, the difficulty of mathematics subjects felt by students, and the condition of students who always consider math subjects easily and students who are wrong about mathematical functions who are considered not used in community life (Agus Slamet Susanto, Haninda Bharata, 2018). So that it affects the mathematical communication skills learned in school (Haq, Najmonnisa, & Saad, 2015).

Based on these data, it is necessary to improve the learning of mathematics. Improvement can be started from the application of learning models, strategies, methods and approaches used in learning (M. Syazali et al., 2019). The selection of the right learning model is an important problem for educators to overcome problems in mathematics such as students' low mathematical communication skills (Kusumawati & Nayazik, 2018). One learning model that is expected to overcome problems and explore the ideas of students, so that students are able to express new knowledge and experience in mathematics, namely probing-prompting learning models (Imswatama, & Lukman, 2018).

The probing-prompting learning model can be defined from several experts including those based on Suherman's theory in Miftahul Huda, probing-prompting

learning which learning by presenting a time series of questions that characterize and explore students' ideas so that they can jump-start thinking processes that link students' knowledge and experience with new knowledge that is being studied (Miftahul Huda, 2014).

Probing-prompting learning is very closely related to questions. The questions raised during this learning are called probing questions. While prompting question is a question that is digging to get deeper answers from students who intend to develop the quality as well as answers (Andini & Yuniarta, 2018), so that the answers raised by students in subsequent learning are clearer (Muhamad Syazali, 2015), more accurate and reasoned (Syahrir et al., 2018). The question and answer process is conducted by randomly pointing students so that students can be active and participate in the learning process. Students cannot avoid the mathematics learning, contrastly students can be involved in the question and answer process every time (Sulisworo & Suryani, 2014).

Various studies have proven that probing-prompting learning can improve cognitive abilities (Putra, Nur Kholifah, Subali, & Rusilowati, 2018). Some of them are that probing-prompting type cooperative learning can achieve learning completeness (Himatul Ulya, 2012), Metacognitive abilities of students are better after being given learning by probing techniques (Siregar, N. H., & Amin Fauzi, 2016), students are able to present mathematical statements verbally, written, drawings, and diagrams correctly after being given probing-prompting learning (Yayuk Kurniasari, 2013).

Based on the description above there are differences in this study, namely this study uses a probing-prompting learning model that will be combined with the knowledge and experience of students in the local culture (Sagala, Umam, Thahir, Saregar, & Wardani, 2019). One way to integrate probing-prompting learning with local culture is ethnomathematics (Andini & Yuniarta, 2018). Ethnomathematics is a form of mathematics that is influenced or based on culture (Sumiyati, Netriwati, & Rakhmawati, 2018). One approach that can provide opportunities for students to increasingly of the mathematical communication skills is use culture-based learning (Wahyuni, 2013). Learning with ethnomathematics has proven to be effective in improving mathematical problem solving skills and critical thinking skills (Imswatama, & Lukman, 2018). Ethnomathematics can be considered by groups of certain cultural, farmers, as well as children from certain classes of society, classes of professional, emphasis in modeling can be thought of as performance etc (Elida Nunun, 2012). Ethnomathematics and Culture-based education are parts of the biggest culture era that has a vital role of communities and individuals to achieve progressivity in the world and all aspects of life (Rakhmawati, 2016; Sumiyati et al., 2018). The probing-prompting model based on

ethnomathematics and the love of local culture can make students become motivated and take active role in the learning process (Hartinah et al., 2019).

With the existence of probing-prompting learning based on ethnomathematics, it is expected to be a solution to the problem of low mathematical communication skills (Cetin & Tortop, 2018).

Method

Research Problem

The probing-prompting learning model is learner-centered learning with a series of questions that guide and explore students' ideas so they can actively learn whose thinking processes are able to link students' knowledge and experience with the new knowledge they are learning (Muhamad Syazali et al., 2019). The learning model certainly cannot overcome all aspects of learning problems (Yuniasti & Wulandari, 2018). A learning model must have advantages and disadvantages, as well as the probing-prompting learning model (Ramadhani, Umam, Abdurrahman, & Syazali, 2019). Shoimin in Mohamad Abdurokhim said that the probing-prompting learning model can encourage students to think actively, giving students the opportunity to ask for explanations from the teacher, differences of opinion between students can be directed by the teacher (Saregar, Latifah, & Sari, 2016), questions can focus students' attention, train students' courage, communication can occur in multiple directions, and students can learn independently (Mohamad Abdurokhim, 2014).

Research design&Participants

The type of research in this study is the Quasi Experimental design. This study was conducted with 51 students in couple intact classes in Junior High School 2 Way Tenong, West Lampung (Indonesia). Experimental group and control group was randomly selected. There are fifty one students divided to 25 college students within the experimental group, while 26 students in the control group. This study was performed two times within semester of 2017-2018 instructional 12 months. Students have been matched are based on posttest-only and teacher consideration by mathematics scores (Syazali et al., 2019). The research was carried out for total 15 hours. During the process of learning activities, 3 activities were prepared to post-test questions Indonesia junior high school curriculum. In the experimental class activities were used by using probing-prompting based on ethnomathematics learning model. Contrastly, the curriculum was followed by control group normal teaching (Kalfa & Alkar, 2019).

Data Collection and Analysis

The relevant data were collected with essay test as amathematical communication skills.The format of the assessment was arranged based on many considerations, including the form of test often used by educators in Indonesia.

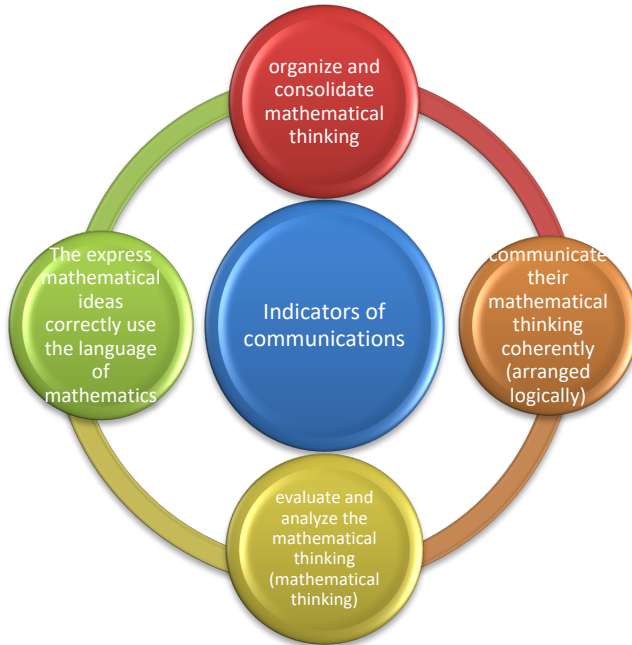


Figure 1.
Indicators of Communications Under NCTM

These indicators were needed to be developed and to facilitate the analysis of mathematical communication skills, the indicators used in the table below:

Table 1.
Indicators of the Mathematical Communication and Student Competency in Mathematical Communication

Indicators Mathematical Communication Skills	Student Competency in Mathematical Communication Skills
communicate mathematical thinking are coherently and clear	<ol style="list-style-type: none"> 1. Coherently on the communicate mathematical thinking 2. Clearly on the mathematical thinking communicate with friends, teachers and others
Oanize and consolidate mathematical thinking themthrough communication	<ol style="list-style-type: none"> 1. Organize mathematical thinking through communication 2. Communication was consolidated by mathematical thinking
The strategies to to express	<ol style="list-style-type: none"> 1. The express of mathematics idea correctly

Indicators Mathematical Communication Skills	Student Competency in Mathematical Communication Skills
mathematical ideas correctly are analyze and evaluate the language of mathematical thinking	used by language of mathematics 2. Analysis used by others such as mathematical thinking and strategy 3. Evaluate the expression mathematical thinking and the strategies employed

Instruments used in this learning activity are lesson plans, test items, syllabus, and student worksheets. The instruments had been previously validated by two education practitioners (mathematics teachers) and two experts/science education experts (Prastowo et al., 2019). Based on the validation, the instrument was valid for the 6 test items. Mathematical communication skills also used by reliability test. The reliability test involved 25 students who were asked to finish 8 questions that had previously been validated. Mathematical communication skills essay test are finished by 25 students who were asked to finish 8 questions to tackle of reliability test using Cronbach's Alpha. The reliability test showed that the score was 0.404 (high reliability and acceptable). The level of difficulty scores and difference in power for test showed the following scores between 0.173–0.928 (lowest – high) and 0.107 - 0.750 (poor – very good) respectively (Ramadhani et al., 2019).

The posttest scores of mathematical communication skills were converted into range of 0–100. Then, the normality test using the Liliefors-test, the homogeneity test uses a similarity test of two variances (Ozsoy, 2019). Hypothesis testing was done on the condition that data distribution was normal and homogeneous. The t take a look at was used to research the outcomes at .05 level of significance.

Result and Discussion

Based on the research conducted, in addition trial of the instrument. For the purposes of the balance test, a prerequisite test was conducted on the first data come from the control classroom and the experimental classroom using the Liliefors method and the variance homogeneity test using the two variance similarity test method (Sriyakul, Umam, & Jernsittiparsert, 2019). Following are the study, will be showed the calculation of the normality test of mathematical communication skills in the two group classroom (Table 2).

Table 2.

Results of Calculation of Normality Test for Mathematical Communication Skills

Class	Total of samples	$L_{count}(L(\alpha, n))$	L_{table}	Information
Experiment	25	0,142	0,172	Normal
Control	26	0,120	0,169	Normal

To find out whether the two scores have the same or different characters, an F-test is needed. It is clear that the variance test results with a significant level of $\alpha = 5\%$ in the following table 3:

Table 3.

Results of the Similarity Test for Two Variances of Mathematical Communication Capabilities

Class	Total of samples	Variances	F_{count}	F_{table}	Information
Experiment	25	0,040	1,041	1,960	Homogeneous
Control	26	0,040			

To test the differences in mathematical communication skills of students used t-test. The calculation results can be explained in the following table 4:

Table 4.

Results of Calculation of Tests for Mathematical Communication Ability Differences

Class	Total of samples	Average(\bar{x})	$t_{table}(t_{(\alpha,db)})$	t_{count}	Information
Experiment	25	57,640	1,677	12,489	H_1 be
Control	26	42,461			accepted

Based on the data of interviews, it is clear that there are several problems related to the application of mathematical learning models and the low mathematical communication skills of students. Furthermore, from these problems, a solution will be given, namely by giving a treatment about mathematical learning models that can influence students' mathematical communication skills. From the treatment, then the influence activity of the learning model will be sought on students' mathematical communication skills (Syed, Alvina, & Amnda, 2017).

The first meeting was held in the experimental class with ethnomathematics based probing-prompting learning model that conveyed the learning objectives to students for learning today. The material conveyed by a flat building correspondence determines the comparison between the size of the model and the actual size (Diani, Herliantari, Irwandani, Saregar, & Umam, 2019). However, it is constrained that students do not understand the learning model that is delivered because students only understand that the teacher explains and the students listen so that the class conditions are less conducive because students are noisy themselves and pay little attention to and assume that today's learning is playing, caused by lack of attention a teacher and the learning model used does not change (Diani, Irwandani, et al., 2019). So that the researchers tried to convey the material using probing-prompting ethnomathematics-based models to add insight to teachers

and make students more like mathematics. At the end of the teaching activities the researcher gave an evaluation of the students (Tran, Giang, & Giang, 2014).

The next meeting that students begin to understand and begin to be interested in learning models that researchers use so students begin actively asking questions and answering questions raised by researchers. At this meeting, ethnomathematics-based probing-prompting models began to be recognized by students and teachers so students and teachers began to have the knowledge that mathematics learning can be learned through environment, one of them through culture as in congruence material in flat fields. However, there are still students who are not yet shy but are lazy to ask for reasons of shame and others. So his friend who has understood and has more knowledge and information should tell so that learning can be maximally achieved (Habibi et al., 2019).

The third meeting that has been held is that students have understood the model used by the researcher so that learning is active and conducive. The material presented at this meeting is the traits of congruent and congruent triangles. Students are required to play an active role and think more and have responsibility for themselves, so that students are able to understanding the material and be able to answer questions that the teacher poses suddenly to him (Sagala et al., 2019). The probing-prompting learning chassis ethnomathematics delivered at the third meeting can be understood and liked by educators and students based on the statements of some students who revealed that they understand the material more easily, and the statement from the math teacher stating that the model used can make students are more active (Rahim, Adyaraka, Sallu, Sarimanah, Hidayat, et al., 2018).

Based at the above studies, mathematical communication skills of students with the treatment of ethnomathematics based probing-prompting learning models are better than direct learning models, this is because ethnomathematics-based probing-prompting learning requires active students within the gaining knowledge of system, students are required to be active in solve a mathematical problem that exists in the environment such as culture so that students are more interested and make students able to communicate mathematics to culture so that mathematical communication skills in students increase both verbally and in writing. While the direct learning model is more teacher-centered so that the involvement of students is still very lacking so that the mathematical communication abilities of students are still very lacking (Rahim, Adyaraka, Sallu, Sarimanah, Rahman, et al., 2018).

Conceptually the probing-prompt learning model based on ethnomathematics is better because it can directly be possible to identify some practices that are basically mathematical in nature. The concept of ethnomathematics is broad, depending on the model of individual behavior based Figure 2. The best understanding of the mathematical aspects will increase if using of the role of

ethnomathematics with clear objectives in terms of educational activities. Implementation and implantation of ethnomathematic perspectives in the classroom can be done by preceding the investigation of mathematical ideas, procedures as well as practices which are then developed by each student in his group members. Ethnomathematics can help in building concept awareness about the contribution of mathematical knowledge in public society. Therefore, ethnomathematics is a reciprocal program because it's far possible to creat of mathematics in the global academic and its role in community groups. This reciprocal relationship is an an important aspect of ethnomathematics (Alangui, 2017).

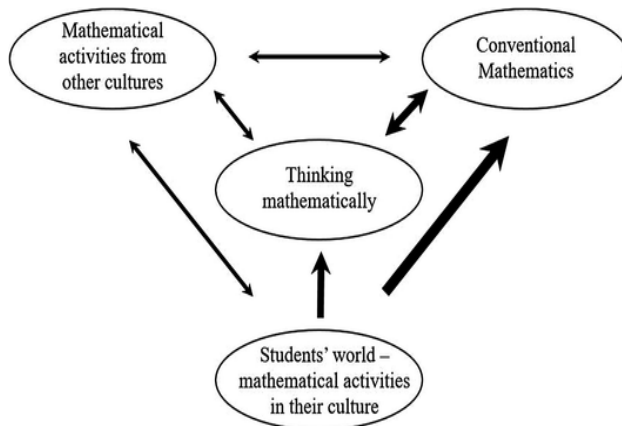


Figure 2

Mutual Relations in Ethnomathematics

From the research above, ethnomathematics based probing-prompting learning model has an influence on mathematical communication skills compared to direct learning models because the direct learning model is more teacher-centered and students become lazy. Although there are weaknesses in the direct learning model, students only receive material that the teacher just delivers while students are not followed to be students of active and creative in finding the material, the subject matter seems to have been made.

Conclusion

Based on the study it is to sum up that there is an influence of the ethnomathematics based probing-prompting learning model on mathematical communication skills. It is hoped that in carrying out further learning if the number of students is large then it takes a long time in the learning activities, besides, in other word to be minimized by the teacher's carrying out learning so students are not too tense, the teacher can anticipate jokes or jokes that can melt the classroom atmosphere. Whereas to make the time effective, the teacher can simplify the learning model by applying a one-seat group, so that not all students

have to get questions. In addition, so that learning can achieve the desired goals, the teacher must plan learning well.

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