Improving Senior High School Students' Mathematical Communication Ability Through Generative Learning In Bengkalis Regency

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Abstract: Mathematical communication ability (MCA) is an ability required by each individual to cope all life challenges. However, students' MCA has in fact not yet well-developed up to senior high school level. Generative learning (GL) is considered able to elicit the development of students' MCA. This research aims to examine students' MCA through the implementation of GL. The type of this research is quasi experiment with pretest and postest control group design. The research subject was students of grade X from three public senior in Bengkalis Regency i.e. Bengkalis SMAN-1, Mandau SMAN-1 and Pinggir SMAN-1. The research used a set of MCA test. Data analysis employed t-test (equal variences assumed). The research result shows that (1) GL could better achieve students' MCA compared to the control class sample with conventional learning method (CLM), Bengkalis: 10.58 > 8.47, Mandau: 9.47 > 8.18, Pinggir: 7.36 > 6.35, and (2) GL could better enhance students' MCA compared to the control class sample with CLM, Bengkalis: 0.79 > 0.61, Mandau: 0.69 > 0.58, Pinggir: 0.52 > 0.43. Improving of students' MCA throgh GL in Bengkalis was high, but for Mandau and Pinggir, both GL or CLM were moderate.

Keywords: enhancement, MCA, GL, Bengkalis regency

1. Introduction

The content standard of the school-based curriculum reveals that students must possess a set of mathematical competence manifested in their learning outcomes after learning process has taken place. The mathematical skill and competencies expected to be reached by primary and secondary students are: (1) concept understanding; (2) reasoning; (3) communicating; (4) problem solving; and (5) capable of appraising mathematical use in daily life (Depdiknas, 2006).

Mathematical communication ability (MCA) is an ability required by each students in mathematics learning. Through a communication, students will be able to: (1) mathematical ideas can be exploited in various perspectives, students' way of thinking can be shapened, understanding growth can be measured, students' thinking can be consolidated and organized, mathematical knowledge and problem development of students are constructed, students reasoning can be improved, and students communication can be formed (Kusumah, 2008).

MCA is important in learning mathematics, therefore MCA must be enhanced through learning efforts with approaches that can provide opportunities and encourage students to train their

MCA. One effort to increase students' MCA is through generative learning, because the steps in generative learning facilitate students to be more enthusiastic in constructing knowledge and therefore could improv students' MCA. In this case students are given the opportunity to practice expressing their ideas with various variations, such as: through pictures, writing or mathematical models (Osborne & Wittrock in Khalidin, 2005), and teacher play a role as a facilitator and mediator.

Bengkalis regency has an ares of 7.773,93 km2 consisting of eight sub-districts, in 2013 had 43 publish senior high school and 31 private senior high school (BPS Bengkalis Regency, 2014). This case to describe that Bengkalis district government is very concerned with education development. Education greatly influences the success or failure of the development of a nation, the more advanced education means that it will have a positive impact on the future of various fields of life, as well as mathematics education that concerning MCA, both oral or written.

Research result showed that senior high school students' MCA could be improved through generative learning on topic system of linear equations and inequality of one variable (Hutapea, 2012). Likewise research result Hutapea (2014), i.e: improving senior high school students' MCA who received generative learning was higher than improving senior high school students' MCA who received convensional learning on topic system of linear equations and inequality of one variable, in terms of sago plantation are (high, moderate, and low) in district of Meranti Island, and (2) there is no significant interaction effect between learning and sago plantation areas (high, moderate, and low) toward improving senior high school students' MCA. This case to show that generative learning innovation could improv senior high school students' MCA because the steps in generative learning can make studernts to be more enthusiastic in constructing their knowledge; for example, students are given the opportunity to practice expressing their ideas with various variations, such as: through picture, writing or mathematical models. Based on observations in the field, i.e. in Bengkalis regency that in general the learning activity is still dominated by teachers (conventional learning), the students have not yet actively involved in the learning, students are not given the opportunity to express ideas about something related to the context being discussed (the context given by the teacher), so that it is not uncommon for students to only accept what is said by the teacher without understanding what it means. This indicates that GL has not been well socialized. For it has done research with the title "Improving Senior High School Students' Mathematical Communication Ability Through Generative Learning In Bengkalis Regency", for the development students' MCA.

From the background described above, the problem in this study i.e. How is the achievement and improvement senior high school students' MCA who received generative learning (GL) compared to students' who received conventional learning (CVL) in Bengkalis regency?; and the purpose of the research are to (1) find out the achievement senior high school students' MCA through GL, and (2) improve senior high school students' MCA through GL; with output improving students' MCA through GL. One of the goals to be achieved in learning mathematics is to provide the widest opportunity for students to develop and integrating communication skills through oral and written, modeling, speaking, writing, talking, drawing, and presenting what they have learned (Huinker & Laughlin in Hulukati, 2005).

Baroody (Hulukati, 2005) states that there are two reasons for mathematical communication in learning mathematics to be important, i.e: (1) mathematics as language; mathematics was not just thinking tools, tools to find patterns or solve the problem, but mathematics is also an invaluable tool for communicating ideas clearly, precisely and carefully, and (2) mathematics learning as social activity: as a social activity in learning mathematics, as well as interaction

between students, teacher communication with students is an important part of maintaining and developing students' mathematical potential.
To develop students' MCA need a learning that can activate students, i.e. learning that can actively improv students' skills in the learning process is GL, because through GL steps, students can learn to be active in constructing their knowledge. Besides that learning is a good way to know students' thinking patterns, how students understand and solve problems well so that in later learning the teacher can develop strategies in learning, for example, how the strategy teaches mathematical concepts that are in accordance with students' abilities, how to create a pleasant learning atmosphere (Osborne & Wittrock in Hulukati, 2005).

2. Methodology

This research is a quasi experiment with pre-test and post-test control group design, illustrated as follows:

O X O
O O (Ruseffendi, 2005).

There were three school in this research; Bengkalis SMAN-1 in Bengkalis sub-regency, Mandau SMAN 1 in Mandau sub-regency, and Pinggir SMAN 1 in Pinggir sub-regency. Determination of school was taken by using purposive sampling: school qualification, distance to school location, readiness from school, and information from relevant agencies. Of each school, two classes were chosen; one class for the experiment, and another class for control. The experimental group was treated as (X), which is generative learning, while the control group receives no special treatment. Every experimental class was given pre-test and post-test (O) to gauge students' MCA acievement and enhancement. The scores of both tests are research data used to test the proposed hypotesis.

The location sample were determined based on purposive one school in Bengkalis city (Bengkalis sub-regency), one school in the most place (Mandau sub-regency) and one school located on the outskirts of city (Pinggir sub-regency). The sample were determined base on stratified sampling. In Bengkalis sub-district, school where research was conducted was SMAN 1 Bengkalis with students in class X.7 as a experimen group (32 students) and students in class X.6 as a control goup (33 students); Mandau sub-regency, school where research was conducted was SMAN 1 with students in class X.3 as a experimen group (39 students) and students in class X.4 as a control goup (40 students) and Pinggir sub-regency, school where research was conducted was SMAN 1 with students in class X.4 as a experimen group (32 students) and students in class X.3 as a control goup (34 students).

In data and information collection, a set of teaching and learning tools used were: lesson plan, students' activity sheets, media, syllabus, and teaching and learning instruments: MCA test and observation sheets of students' and teachers' activity. The whole teaching and learning instrumens were validated and tested prior to the experiment.

After being tested, instrument reliability and item validity were calculated. The enumeration of reliability of 6 items MCA test (Cronbach's Alpha = 0,66, moderate, $\alpha = 0{,}05$, $N = 40$, $r_{tabel} = 0{,}31$), obtained 5 MCA test items were declared valid (tests used only 3 items because of the limited funds available). Thus, MCA test can be used for the research. Data were analyzed using t-test (*equal variences assumed*) and the

normalized Gain formulation (N-Gain) is: $g = \frac{post\ test\ score - pre\ test\ score}{ideal\ maximum\ score - pre\ test\ score}$ (Meltzer, 2002), whose result is interpreted based on classification from Hake (1999); to find out the magnitude of students' MCA increase average.

Table 1. Gain classification (g) according to Hake

g scale	Interpretation
$g > 0{,}7$	High
$0{,}3 < g \leq 0{,}7$	Average
$g \leq 0{,}3$	Poor

3. Result And Discussion

3.1. Achievement Students' MCA

The results of data analysis of students' MCA achievement in each research location base on learning group (GL and CVL), it was found that students' MCA posttest average who obtained GL was higher than students' MCA posttest average who obtained CVL, for detailes it is presented in Figure 1.

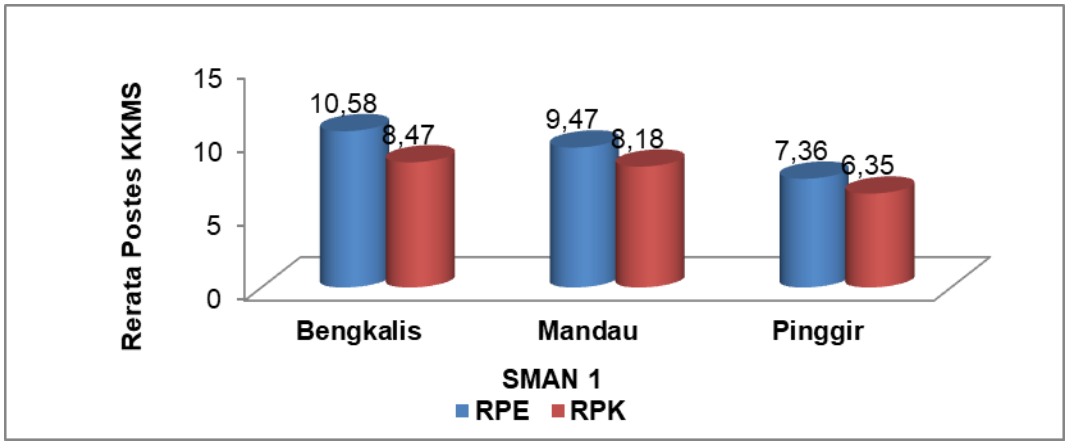

Figure 1. Students' MCA posttest average of experiment (RPE) and control (RPK) Class in each of SMAN 1, Bengkalis Regency 2015.

Figure 1 shows that students' MCA achievement (posttest) average in SMAN 1 Bengkalis in the experiment class was higher (2.11) compared to the control class. Students' MCA achievement average in SMAN 1 Mandau in the experiment class was higher (1.29) compared to the control class and students' MCA achievement average in SMAN 1 Pinggir in the experiment class was higher (1.01) compared to the control class. In SMAN 1 Bengkalis had students' MCA achievement of difference average was higher compared to students' MCA achievement average in SMAN 1 Mandau and Pinggir. This is supported by the location (position) of SMAN 1 in the capital city of Bengkalis regency, It's mean that SMAN 1 Bengkalis has first access to the development or development education and faster access in the learning process, especially mathematics learning process. While in SMAN 1 Mandau and Pinggir, the geographical location of the school is on land and the distance is far from the capital city of Bengkalis regency which is located in the island, in the sense that access and control of changes or development of education is less rapid (takes time).

3.2. Improving Students' MCA

The result of data analysis of students' MCA enhancement (N-Gain) showed that students' MCA enhancement average through GL in SMAN 1 Bengkalis sub-regency for 0.79, Mandau sub-regency for 0.69, Pinggir sub-regency for 0.52 and through CVL in SMAN 1 Bengkalis sub-regency for 0.61, Mandau sub-regency for 0.58 and Pinggir sub-regency for 0.43, for detailes it is presented in Figure 2.

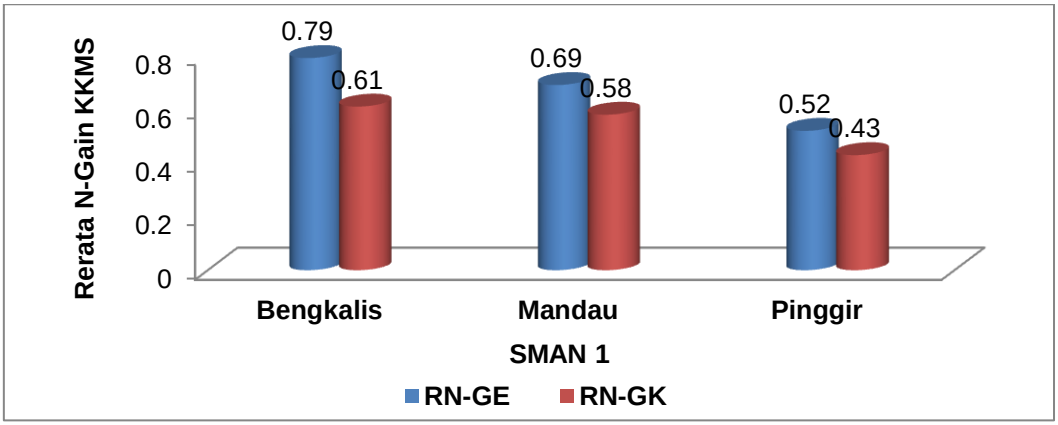

Figure 2. Students' MCA enhancement (N-Gain) average of experiment (RN-GE) and control (RN-GK) Class in each of SMAN 1, Bengkalis Regency 2015.

Figure 2 shows that students' MCA enhancement (N-Gain) average in SMAN 1 Bengkalis through GL was higher compared to students' MCA enhancement (N-Gain) average through CVL. Likewise by students' MCA enhancement average in SMAN 1 Mandau and students' MCA enhancement average in SMAN 1 Pinggir. Figure 2 also shows that students' MCA enhancement average who obtained GL in SMAN 1 Bengkalis (0.79 = high) was higher compared to students' MCA enhancement average who obtained GL in SMAN 1 Mandau (0.69 = moderate) and students' MCA enhancement average who obtained GL in SMAN 1 Pinggir (0.52 = moderate). This indicates that the position of a school (SMAN 1) in the capital city of Bengkalis regency is positively correlated to students' MCA enhancement, It's mean that senior high school students' (SMAN 1) who are domiciled in the regency (Bengkalis) through GL with existing facilities (both physical facilities and infrastructure and development of education) can more quickly (easily) receive (digest) the learning material provided compared to students who taught through CVL; it's mean that through GL can increase of students' MCA.

The result of the Levene's test are obtained that the data variance enhancement of students' MCA in SMAN 1; Bengkalis, Mandau and Pinggir in groups of learning are homogeneous (sig.2-tailed = 0.14 > 0.05). To examine the difference enhancement of students' MCA in SMAN 1: Bengkalis, Mandau and Pinggir in the learning group; it was used t-test or independent sample test (Equal variances assumed) with results were obtained: (1) there is a significant difference in the enhancement of students' MCA in both learning groups, and (2) students' who obtained GL had a higher MCA enhancement average compared to students'who received CVL. This can be seen from the average increase in students MCA in both learning groups having an average difference of 0.18. Based on Hake criteria (1999), it was found that the average increase in students' MCA at SMAN 1: Bengkalis through GL was high categorized (gain = 0.79), but Mandau (gain = 0.69) and Pinggir (gain = 0.52) through GL were moderate categorized; while through CVL, both in SMAN 1 Bengkalis (gain = 0.61), SMAN 1 Mandau (gain = 0.58), and in SMAN 1 Pinggir (gain = 0.43) were moderate categorized.

4. Conclusion And Suggestion

From the research result and discussion, it is concluded that students who obtained generative learning had achievement and improvment average of mathematical communication ability were higher compared to students who obtained conventional learning in SMAN 1 sub-regency: Bengkalis, Mandau and Pinggir, Bengkalis regency. On the basis of Hake standard criteria improving students' mathematical communication ability who received generative learning in SMAN 1: Bengkalis was high categorized, Mandau and Pinggir were moderate categorized, and improving students' mathematical communication ability who received conventional learning, both in SMAN 1 Bengkalis, Mandau or Pinggir were moderate categorized.

It is recommended to Mathematics teachers and policy makers that generative learning can be used as an alternative learning that significantly increases students' mathematical communication ability, especially on the topic of the system of linear equations two and three variables and generally on topics that contain story problems related to daily life that are contextual.

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