Contextual Learning On The Basis of Coastal Culture to Enhance Students’ Competency in Mathematical Problems Solving

M A Kleden¹, Y Sugi² and U Gerardus³,*

¹,²Mathematic Department, Universitas Nusa Cendana Kupang, Indonesia.
(E-mail: maria.kleden@staf.undana.ac.id, yoseph.sugi@staf.undana.ac.id)
³ PGSD, Universitas Nusa Cendana Kupang, Indonesia

*Corresponding author: udagerardus@gmail.com

Abstract. Problem solving is one of the competencies in learning mathematics. It is expected that students have this competency to be able to solve problems in their life by using math. The aim of this research is to improve problem solving competence through contextual learning based on coastal culture. The research design used was pretest-posttest control group design. The population is junior high school students in East Flores District, East Nusa Tenggara Province. 119 students were chosen by random purposive sampling technique. Four classes from grade 8 from a Junior High School at Larantuka were randomly selected as experimental and control class. The experimental class students employ contextual learning based on coastal culture, whereas students in the control class use conventional learning. The instrument of this research is test of mathematical problem solving competence. The results showed that there was an enhancement in mathematical problem solving competence in students who received contextual learning based on coastal culture (CLBCC) and conventional learning approach (CLA). Improvement competence of mathematical problem solving on CLBCC group is higher than CLA group. This also happened to the achievement of mathematical problem-solving competency. There are differences in the improvement and achievement of mathematical problem-solving competency between CLCBB and CLA students.

1. Introduction

East Flores regency is one of the regencies in NTT province located on the eastern edge of Flores Island. The total area of East Flores Regency covers 17 islands, namely 3 inhabited islands and 14 other uninhabited islands with 1,812.85 km² (31%) and ocean area which covers 4,170.53 km² (69%). This regency consists of 19 districts living in coastal areas. As many as 90 percent of the people of East Flores are coastal communities so that the livelihoods of most people of East Flores are fishermen and farmers. Profile of East Flores Regency, 2016

The enrollment rate for coastal high schools is only 39%, which is below the Indonesian average rate of 80.49% (UNESCO, 2013). In addition, coastal communities are still having low awareness of culture...
safe guarding and preserving coastal environments. UNESCO further confirms that education for sustainable development should continue to focus on the importance of natural resource issues. Through education, it is expected that people will aware of human resources who realize the need for harmonization between human resources and natural resources to improve community’s welfare.

Establishing qualified human resources with good mathematical skills requires meaningful mathematics learning. Learning that utilizes the surrounding environment contextually will build a good understanding of the material learned as well as the behavior of maintaining the surrounding environment. Meaningful learning is needed to train ways of reasoning, communicating, connecting, and solving problems they face in their environment. In this learning, students were given opportunity to directly solve problems in everyday life using mathematical concepts.

This shows that learning mathematics is a very important activity. It cannot be denied that students’ mathematical ability is still quite inadequate. Low mathematical ability is not only found in elementary and high school students but also among all students. To the best of our knowledge, no research has been conducted to look at the student’s mathematical abilities in this area. Therefore, this work is the first study to assess the student’s mathematical abilities focusing on the coastal areas of district Flores Timur (East Flores). The lack of mathematical abilities is found in the students of the Mathematics Study Program [14]. This research reveals that after getting metacognitive learning there is improvement of mathematical communication ability and logical thinking mathematically, but the improvement is still classified in medium category.

Contextual learning based on coastal culture not only reinforces students’ understanding of the material learned but also leads to cultural awareness. Such learning integrates cultural and environmental contextual issues in mathematical concepts. The integration of culture and environment in mathematics learning is expected to improve students’ mathematical competency.

The above exposure indicates the importance of context in every learning implementation. Contextual learning is referred to contextual teaching and learning (CTL). In this learning, all student activities are related to relating the subject matter to the real-life context they find. This means that students seek the meaning of tasks in the form of finding interesting mathematical problems, seeking information and drawing conclusions, actively choosing the right strategy, composing, planning, investigating, questioning, and making conclusions about solving a mathematical problem, and linking mathematical concepts they studied with context in life situations[5]. Therefore, a research that analyze student problem solving ability is needed. This is in line with [2] who say that through problem solving, students can find mathematical concepts. The process of learning mathematics is not just transferring concepts or ideas from the teacher to students, but it is a process in which the teacher gives the opportunity for students to understand and construct ideas given for later use in solving various problems faced in accordance with the level of development. Based on this view, the problem solving ability is one of the essential and fundamental abilities in mathematics learning that must be possessed by every student (Rahayu & Afriansyah, 2015). Having a problem solving competency not only train students to solve mathematical problems but also make them able solve problem in everyday life.

Based on the above background, the research problems are formulated as follow: (1) is there any difference of problem solving competencies between groups of contextual learning students based on the coastal culture approach and group of students from conventional learning approach?. (2) Is there any difference of problem-solving competencies between groups of contextual learning students based on coastal culture approaches and groups of students with conventional learning approaches?

The purpose of this study were to identify: (1) differences of problem-solving competencies between contextual learning group of students based on coastal culture approach and group of students who acquired conventional learning approach; (2) the differences of problem-solving competencies between
contextual learning group students based on coastal culture approach and group of students from conventional learning approach;

2. Literature Review

2.1 Problem Solving Competency

Solving a problem is part of human life. Humans always get in touch by both social and personal issues. For that reason, human should have ability and skill to solve every problem. Dahar [3] says that problem solving is a human activity to combine concepts and rules that have been obtained before and not as generic. Further [7] discloses that problem solving is an attempt to find a solution or solution of a situation to achieve certain goals. To measure problem solving competency some mathematics indicators are required. These indicators are used as a reference to assess student’s ability in problem solving. The steps used refer to Polya's troubleshooting steps. The problem-solving indicators in this study refers to the indicators of problem-solving capabilities summarized by[10], they can be stated as follows: 1) identifying what is known, questioned, and elemental elements; 2) create a mathematical model; 3) implementing problem solving strategies in/outside mathematics; 4) explain or interpret the results; 5) solve mathematical models and real problems; 6) using mathematics meaningfully.

Based on the description of problem solving competency above, it can be concluded that in solving problem, students is not only required to have the knowledge of mathematical procedures but students should have confidence in solving problems encountered. Thus it will generate motivation and willingness to find solutions to problems with strategies used. Polya [7] defines problem solving as an attempt to find a way out of a difficulty to achieve a goal that is not so immediately achieved. In other hand, Sujono (1988) describes a mathematical problem as a challenge when the solution requires creativity, understanding and original thought or imagination. In sum, the problem solving ability is the ability to understand problems and find solutions to mathematical problems related to coastal culture in junior high school students. Indicators of problem solving abilities include identifying problems, planning solutions, solving problems, and interpreting results.

2.2 Contextual Learning Based on Coastal Culture

Contextual learning is learning using a contextual approach that occurs naturally in the form of work and experience. In this learning, students are trained to experience a process of learning-related materials with the daily real-world context. In contextual learning there are seven main components: (1) constructivism; (2) questions; (3) inquiry; (4) learning community; (5) modeling; (6) reflection, and (7) authentic assessment. In this case, constructivism means building new knowledge based on initial knowledge through a process of social interaction and assimilation accommodation. The first stage in learning is learning community. Students are divided into groups of three to five. The division of this group aims to motivate students to share information, discuss, and work together in groups.

Asking questions is one of the activities undertaken by teachers and students in CTL. Questions posed by teachers aim to encourage, guide, and assess students' thinking abilities. While the question posed by students is related to the lack of understanding of concepts being studied. Blakey and Spence [11] states that learners should ask themselves what they know and what they do not know at the beginning of the learning activities. Question is one indicator to know how far students understand the concept being studied.

In mathematics learning, modeling is an important aspect. Modeling is helpful in solving a problem. Various phenomena of everyday life can be expressed in mathematical models. However, it is realized that the ability of learners in translating the everyday phenomena in mathematical models is still low. Muijs & Reynolds, Killen, [11] states that modeling occurs when teachers show the processes involved in performing difficult tasks, or when teachers tell students about their thinking and are motivated to choose
specific strategies when solving problems. Modeling and discussion enhance learners' thinking and talk about their own thinking [11].

Inquiry is a process of discovering concepts, principles, knowledge that begins with the giving of contextual problems. Inquiry process can be done in group discussion or after discussion. Ruseffendi [9] asserts that one of the learning objectives with the question is that students learn scientific method through discovery and its application in other situations. Self-discovery gives students a great deal of satisfaction and can encourage them to get new findings. This process has an impact on increasing motivation to learn. After that, students are directed to reflect through activities of recording what has been studied, asked, reported.

Reflection aims to check how students understand the mathematical concepts learned. The ability to reflect is a prerequisite for articulation and articulation itself requires identification of the essentials of an action. Students can reflect on what they have done based on important aspects of their thinking and actions.

3. METHODS

This research undertaken a pretest-posttest control group design [1] Group of experiment are treated with a contextual learning based on coastal culture approach, whilst group of control are treated with conventional learning approach.

The population of this study is all 8th grade students in East Flores District. The sample of research was chosen from two classes from four classes through purposive sampling technique. 119 students became the object of this study. The initial competence of both groups is homogeneous. The research instrument was a test of competence of mathematical problem solving that has been tested on 9th grade students. The test consists of five valid questions with a high reliability category that is 0.77.

Quantitative data in the form of improvement and achievement of problem solving ability are analyzed through descriptive and inferential approach. Hypothesis testing performs parametric and non-parametric statistical analysis. The t-test used for data was normally distributed, whereas the Mann Whitney test was used in data that are not normally distributed.

4. RESULT AND DISCUSSION

4.1 Achievement of Mathematical Problem Solving Competency

The data of Mathematical problem solving achievement was not normally distributed. To test the difference in achievement of mathematical problem-solving ability among students who received CLBCC and who received conventional learning, it was used Mann Whitney U-test.

Hypothesis of difference tests upon achievement of mathematical problem solving competency outcomes are as follows:

H₀: There is no different achievement of mathematical problem solving competency amongst groups of different learning approaches.

H₁: There is different achievement of student mathematical problem solving competency amongst groups of different learning approaches.

Table 1 presents the results of different test data achievement of mathematical problem solving abilities between CLCB students and conventional learning students.

| Learning Method | N | Avg. | Mann- | Wilcoxon | Z | Sig. | Declaration |
|-----------------|---|------|-------|----------|---|------|-------------|

Table 1. Difference Test of Mathematical Problem Solving Competency Outcomes Between 2 Test Groups
Based on the t-test results presented in Table 1, value of probability (sig.) is smaller than α = 0.05. Therefore H₀ is rejected. This signifies that group of students being taught through contextual learning based on coastal culture approach yield higher outcomes in terms of mathematical problem solving competency than students of conventional learning approach group.

### 4.2 Mathematical Problem Solving Competency Enhancement

In contrast to achievement data, mathematical problem-solving data are normally distributed and homogeneous. For that reason, test difference of problem solving competency used $t$ test. The analysis results are presented in Table 2. The hypothesis used in this test is:

- $H₀$: There is no different enhancement upon mathematical problem solving competency between two groups of different learning methods.
- $H₁$: There is different enhancement upon mathematical problem solving competency between two groups of different learning methods.

#### Table 2. Difference Test of Mathematical Problem Solving Competency Enhancement Between 2 Test Groups

| Learning Method | N  | Avg. | Avg. Dif. | $t$  | dof | Sig. | Declaration     |
|-----------------|----|------|-----------|------|-----|------|-----------------|
| CLBCC           | 59 | 17.525 |          | 6.517 | 111 | 0.000 | H₀ is rejected   |
| CLA             | 60 | 12.083 | 5.461     | 0.000 |     |      |                 |

Table 2 shows significant smaller values than α, so H₀ is rejected. This shows that there are differences in the ability to solve mathematical problems between CLBCC students and conventional learning students. Based on the average value, it appears that the average value of CLBCC class problem-solving enhancement is higher than CLA students. This means that CLBCC is better to improve mathematical problem solving compared to CLA.

Enhancement in mathematical problem solving competency for both test groups generally relies on the average scale, however enhancement for contextual learning based on coastal culture group were higher than the conventional learning group. In a contextual approach, students are habituated to understand the concept of mathematics through problems in everyday life. Students explore and study of various learning resources, identify constraints, build questions, answer questions and express ideas. These special activities trigger students to solve their daily problems using mathematical concepts. In addition, students can explore various strategies in solving problems.

Contextual learning based on a coastal culture approach encourages students to not only understanding mathematical concepts being studied but it also aims to understand coastal culture. Understanding the coastal culture is needed to preserve environment. In this class, the students are given various problems
related to the lives of coastal communities such as the number of fish caught, the fishing process, the use of the beach for drying fish, wind direction and boat speed, planting and mangrove functions, ocean currents and marine biota. Students discussed in small groups to solve problems in student worksheets and presented the solved problem. Students are given the opportunity to link their understanding of coastal culture and the concept of two-variable linear equations. This activity encourages students to use their current knowledge in solving mathematical problems as well as other problems and expressing situations.

In contextual learning based on coastal culture, students are guided to identify math concepts through coastal community habits. After identifying concept, students further understand the concepts that have been identified through questions being asked. This method encourages students to understand mathematical concepts and to understand and preserve the culture of coastal communities.

There is no doubt that there are still difficulties encountered. Some students have difficulty translating the story into a mathematical sentence. There are even some students who have difficulties writing what concepts are known and what funds are being asked. In addition, they obtain a reference in one of the obstacles experienced by students. They only rely on books shared from schools which are also limited. Reference access from internet is unlikely to be experienced by students due to inadequate internet connection.

Contextual learning based on coastal culture encourages students to be actively involved in discussions. Students are free to ask, answer and refute from friends who different point of view. Interviews showed that in this kind of learning, students feel very close to the problems they face in their daily lives. This helps them understand the concept of math. The classroom’ atmosphere is created to find their own answers in the discussion and it makes the students feel the usefulness of the mathematic. Students have a higher curiosity about the next concept because they feel that the concept is meaningful to their lives.

5. Conclusion And Suggestion

5.1 Conclusion

Referring to research results and discussions in the previous section, a conclusion is drawn as follows: (a) There are differences in achievement and enhancements of students mathematical problem solving competency in general; (b) The enhancements of mathematical problem solving competency for both groups lie on an average scale, however, enhancements found upon the BLBCC group was higher than those of the CLA group; (c) Contextual learning based on coastal culture encourages students to more actively solve the problems they face in their daily lives.

5.2 Suggestion

Based on the results of the research and the conclusion above, some suggestions are stated as follows: Contextual learning based on a coastal culture approach in mathematics improves students’ competence in math problem solving. Therefore contextual learning based on coastal culture approach should be considered as an alternative learning approach for coastal area students.

6. References

[1] Cresswell, J. W. (2005). Educational research: Planning, conducting and evaluating qualitative and quantitative research. Upper Saddle River, NJ: Merrill & Prentice Hall.
[2] Hendriana, H., & Soemarmo, U. (2014). Penilaian pembelajaran matematika. Bandung: Refika Aditama.
[3] Herlambang 2013 Analisis Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII-A SMP Negeri 1 Kepahiang Tentang Bangun Datas Ditinjau Dari Teori Van Hiele (Bengkulu: Pascasarjana Universitas Bengkulu).

[4] Kleden M A 2015 Meningkatkan Kemampuan Berpikir Logis Matematis, Komunikasi Matematis dan Self Directed Learning Mahasiswa Melalui Pembelajaran Metakognitif (Bandung: Disertasi Sekolah Pascasarjana UPI).

[5] Kleden M A and Geradus U 2018 Enhancement of Mathematical Communication Competency Upon Students of Junior High School Through Contextual Learning Based on Coastal Culture. *Education Quarterly Reviews* 1(1) 9-17.

[6] National Council of Teachers of Mathematics (NCTM) 2000 *Professional Standards for Teaching Mathematics*. (Reston, VA : NCTM)

[7] Polya G 1985 *How To Solve It* 2nd ed (New Jersey: Princeton University Press)

[8] Rahayu D V and Afriansyah E A 2015 Meningkatkan Kemampuan Pemecahan Masalah Matematik Siswa Melalui Model Pembelajaran Pelangi Matematika *Jurnal Pendidikan Matematika* 5 (1) 2086-4299

[9] Russeffendi E T 2006 Pengantar kepada Membantu Guru Mengembangkan Kompetensinya dalam Pengajaran Matematika untuk Meningkatkan CBSA (Bandung: Tarsito)

[10] Sumarmo U 2014 *Berpikir dan Disposisi Matematik serta Pembelajarannya* (Bandung: UPI)

[11] Toit S and Kotze G 2009 [online] Metacognitive Strategies in the Teaching and Learning of Mathematics
http://ww.google.com/url?sa=t&rct=j&q=metacognitive+strategies+in+math&source=web&cd=6&cad=rja&ved=0CFEQFjAF&url=http%3A%2F%2Fwww.pythagoras.org.za%2Findex.php%2Fpythagoras%2Farticle%2Fdownload%2F39%2F30&ei=4LImUbzEouMrgf4t4DYAQ&usg=AFQjCNHVj8Pc5sv12XID57q2yXObEkvikA&bvm=bv.42768644,d.bmk