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Contribution of Mathematics and Science Research for Sustainable Life in Facing Global Challenge

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PROCEEDING

INTERNATIONAL CONFERENCE ON MATHEMATICS, SCIENCE, AND EDUCATION

" Contribution of Mathematics and Science Research for Sustainable Life in Facing Global Challenge"

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FACULTY OF MATHEMATICS AND NATURAL SCIENCES
SEMARANG STATE UNIVERSITY
2016

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PREFACE

Thanks to God Almighty this International Conference Proceeding could be completed. All articles in this proceeding are presented in International Conference On Mathematics, Science, and Education – Applied Research of Mathematics and Natural Sciences to Improve Its Usefulness for Knowledge and Society on September 3-4, 2016 at Grasia Hotel Semarang. This Conference is organized by Faculty of Mathematics and Natural Science. This proceeding has been reviewed of Mathematics and Science experts before it is published.

This conference is designed to improve the discussion and research scope in mathematics, science, and education area in the international level. Sub topics in this proceeding cover mathematics, applied mathematics, and mathematics education in accelerating character building. Enhancing biology and biology education research for a better life. Green chemistry in research and education. Physics and physics education for trending research.

Hopefully this publication of proceeding will be profitable for all of us.

Semarang, 23 December 2016

Regards
Committee of ICMSE 2016

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MESSAGE FROM THE DEAN OF FMIPA UNNES

Dear Participants of ICMSE 2016,

It is a pleasure to welcome all of you in the first International Conference on Mathematics and Science Educations (ICMSE 2016) held by Faculty of Mathematics and Natural Sciences, Semarang State University.

Faculty of Mathematics and Natural Science Semarang State University or more popularly known as FMIPA Unnes has 6 departments and 11 study programs of Mathematics and Natural Sciences education backgrounds and non education backgrounds. FMIPA Unnes has the mission of being an excellent and meaningful faculty by improving human resources through scientific activity.

One of efforts to result excellent and meaningful human resources through scientific activity is by performing discussion and knowledge sharing. To widen discussion of science and research development in mathematics and science educations scopes in national and international level, ICMSE 2016 was initiated as the medium of that discussion. I believe that ICMSE 2016 as the first international conference held by FMIPA Unnes can facilitate the knowledge sharing in mathematics and science educations area in order to establish a global cooperation among experts and researchers.

With the hope that this conference will be the medium to optimize the role of Mathematics, Science and Education in global cooperation, I am proud to welcome all of you and I wish you a pleasant sharing and discussion in this conference and enjoyable stay in Semarang, Indonesia.

Prof. Dr. Zaenuri S.E, M.Si,Akt
Dean of Faculty of Mathematics and Natural Sciences
Semarang State University

PREFACE

We welcome you to the Third International Conference of Mathematics, Science, and Education (ICMSE) 2016 on 3-4 September 2016 in Semarang Indonesia. ICMSE 2016 is the third conference organized by Faculty of Mathematics and Natural Science, Universitras Negeri Semarang. ICMSE 2016 provides a platform to the research institutes, and industries to meet and share cutting-edge progress in the fields of mathematics and natural science as reflected in this year's theme "Contribution of Mathematics and Science Research for Sustainable Life in Facing Global Challenge".

This conference provides an opportunity to enhance understanding of the relationships between knowledge and research related to mathematics and science. The conference accepted 234 papers from 7 countries, 8 region and from 35 universities. The conference program represents the efforts of many people. We want to express our gratitude to the members of the Program Committee, and the reviewers for their hard work in reviewing submissions. We also thank to keynote speakers Prof. Intan Ahmad, Ph.D., Mr. Robby Gunawan, Prof. Takeshi Sakurai, Prof. Roberta Hunter, Dr. Anuradha Mathrani, Dr. Arramel, and Prof. St. Budi Waluya, also the invited speaker all the participant. Finally, the conference would not be possible without the excellent papers contributed by authors. We thank all the authors for their contributions and their participation in ICMSE 2016. We hope that this program will further stimulate research in Mathematics and Science Education, share research interests and information, create a forum of collaboration and build trust relationship. We feel honored and privileged to serve the best recent developments in the field of Mathematics and Science Education to you through this exciting program.

Wish you have great memorable event and enjoyable stay in Semarang.

Dr. Margareta Rahayuningsih S.Si, M.Si.
Chairperson of Conference Commitee

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The Analysis Of Mathematical Literacy And Self-Efficacy Of Students In Search, Solve, Create, And Share (SSCS) Learning With A Contextual Approach

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ABSTRACT

Mathematical literacy is one of the important skills that should be owned by the students, because it is help students to understand mathematics and use it in the real world. Students can develop their mathematic skills if they have high self-efficacy toward mathematics. This study aims to analyze the mathematical literacy skills and self-efficacy of students using SSCS learning with contextual approach. The study show that the mathematical literacy of students achieve completeness criteria in classical, mathematical literacy of students are taught using SSCS learning with contextual approach is better than the students who are taught using conventional learning, and SSCS learning with contextual approach can improve student's self-efficacy.

Keywords: *Contextual Approach, Mathematical Literacy, Search, Solve, Create, And Share (SSCS), Self-Efficacy*

INTRODUCTION

Mathematics is a universal science that underlies the development of modern technology, have an important role in a variety of disciplines and develop the power of human thought. Mathematics courses should be offered to all students from primary schools to equip students with the ability to think logically, analytical, systematic, critical, and creative, as well as the ability to cooperate (BSNP, 2006). The ability is necessary so that students are able to process, manage, and use information in order to survive in a state that is always changing, uncertain and competitive. That makes mathematics as part of a curriculum that can improve the quality of Indonesian human resources and supporting the development of other disciplines. However, mathematics ability of Indonesian student is still low when compared with other countries. This can be seen from the results of PISA 2012 show that math scores in PISA 2012, Indonesia was ranked 63rd out of 64 countries (OECD, 2014).

Mathematical literacy is defined as an individual's capacity to formulate, implement and interpret mathematics in various contexts (OECD, 2006). Furthermore, PISA defines the literacy skills of mathematics as an individual's ability to formulate, use and interpret mathematics in various contexts, including the ability to reason mathematically and use the concepts, procedures, facts, as a tool to describe, explain and predict phenomena or events (OECD, 2013). Mathematical literacy is an important thing that should be owned by the community in this time that covers the troubleshooting process, assess, communication, and critical and creative thinking (Taskin & Belma, 2014). From the above, it can be concluded that the mathematical literacy is an important thing that can help people to understand the math and can then be used to make decisions on real-world problems.

Mathematical literacy is the ability to identify, understand, and engage in mathematics, as well as the ability to analyze the role of mathematics in everyday life (Guzel & Giray, 2005). It is more convinced that math literacy skills are essential to be owned by the students for their use in everyday life and to help them face the challenges of the future.

Mathematics literacy skills of students in Indonesia is still very low. It can be seen from the average value of the OECD (Organization for Economic

Corporation and Development)and also from some of the countries participating in the PISA (Programme for International Student Assssment) (Stacey, 2011). Based on the research results Mahdiansyah and Rahmawati (2014) showed that the level of mathematical literacy of high school students is still low. It shows students are less able to provide a description or arguments to the math problems.

Based on interviews researchers with a mathematics teacher at SMAN 1 Kendal obtained by the fact that students have difficulty in solving the main problem for the problems related to everyday life and about the story, there are still many students who have not been able to write the completion of math problems correctly, and do not use steps to resolve appropriately.Students are still experiencing difficulties in writing and portray the problems in the form of mathematical modeling. These reasons encourage researchers to conduct research related to the students' mathematical literacy skills.

Hard skills and soft skills, including mathematical values in the culture and character education should be developed simultaneously and balanced through learning with a scientific approach. One mathematical soft skills are self-efficacy. Self-efficacy is the belief of individuals about their ability to produce a performance that affect their lives (Bandura, 1977). The ability of self-efficacy or confidence in doing of a person can affect a person's ability to complete these tasks (Aremu & Adedeji, 2009).

Students of SMA N 1 Kendal still regard mathematics as a difficult subject. Interviews showed that mathematics teachers have implemented several models of learning in the classroom, but still dominated in expository. Based on observations, it appears that there are still many students who do not dare to do the problems in front of the class, did not dare to answer questions from teachers and express their opinions. Teachers also stated that while working on math quiz or exam should be done alone, but the teacher still found students working together. This shows thatself-efficacy in mathematics learning implementation is still lacking.

To improve the literacy skills of mathematics, teachers should make changes to the learning. Innovation mathematics required to choose a learning model that corresponds to the characteristics of the material and students in order to improve the activity and self-efficacay students so as to improve the literacy skills of mathematics.

One model of learning that can improve the literacy skills students are learning math search, solve, create, and share (SSCS) with a contextual approach. SSCS through learning by students are given a contextual approach to issues relating to everyday life, then the students with discussions to resolve the issue. Giving issues related to real life can be an alternative to improve the literacy skills of mathematics students. As stated by Gulcin and Melek (2014) that in order to improve mathematical literacy, students are given a problem related to real life and open issues. Thus is formed a confident attitude of students, and students are more motivated in solving mathematical problems.

SSCS learning this refers to the four-step problem-solving sequence starts at investigating the problem (search), planned solving (solve), constructing the problem-solving (create), and the latter is to communicate the settlement obtained (share) (Chin, 1997).

According to reports Laboratory Network Program (1994), NCTM standards that can be achieved by SSCS learning model are as follows: 1) submit (pose) matter / mathematical problems, 2) builds on the experience and knowledge of students, 3) develop thinking skills mathematics reassuring about the validity of a certain representation, making allegations, solving a problem or make a response to the problems, 4) involving intellectual students shaped submission of questions and tasks that engage students and challenge each student, 5) develop students' mathematical knowledge and skills, 6) stimulate students to make connections and develop a coherent framework for mathematical ideas, 7) useful for the formulation of the problem, problem solving and mathematical reasoning, and 8) to promote the development of all students' ability to perform mathematical work (Irwan, 2011). Based on the eighth of the above, it can be concluded that the model SSCS can be used in mathematics, particularly in problem solving, reasoning and mathematical literacy.

Contextual approach is the concept of learning that help teachers connect between what is taught with real-world situations students and encourage students to make connections between knowledge possessed by its application in everyday life (Aqib, 2013). According Nurhadi in Husnawati (2006) states that contextual learning (Contextual Theaching And Learning) is a concept of learning that help teachers connect between what is taught with real-world situations students and encourage students to make connections between the knowledge possessed by the application in their lives as

family members and society. With this concept, the learning outcomes expected to be more meaningful for students. The learning process takes place naturally in the form of student activities work and experience, not a transfer of knowledge from teacher to student, learning strategies more important than the result. Contextual approach can associate learning materials (instructional content) with the context and needs of students will increase learning motivation and will make the learning process more efficient and effective (Husnawati, 2006).

Draft assessment framework PISA (OECD 2013) defines literacy mathematics as a person's ability to formulate, implement and interpret mathematics in various contexts, including the ability to perform reasoning mathematically and using the concepts, procedures, and facts to describe, explain or predict phenomena or events. Three major components identified in the PISA study (OECD, 2013), namely: content component, process component, and component context.

Component content in PISA interpreted as content or materials or subjects studied in school mathematics. The material studied in component content based on the Draft Framework Mathematics PISA (OECD, 2013) include: (1) changes and linkages (change and relationship), Space and shape (space and shape), Numbers, and (4) Uncertainty and data (uncertainty and data). Component process in the PISA study interpreted as things or steps a person to solve a problem in a particular situation or context by using mathematics as a tool so that the problem can be resolved. Process capability is defined as a person's ability to formulate,employing, andinterpreting (interpret) mathem atics to solve problems (OECD, 2013).The component context in the PISA study is defined as a situation which is reflected in the problem. There are four contexts into focus, namely: personal context (personal), the context attached directly related to students' personal activities of daily; the context of the work (occupational); social context (social); and the context of science (scientific) (OECD, 2013).

Formally, the definition of mathematical literacy in mathematics PISA 2012 framework submitted by the OECD as follows: mathematical literacy is an individual's ability to formulate, employ and interpret mathematics in a variety of contexts. Including the use of mathematical reasoning and mathematical concepts, procedures, facts and tools to describe, explain and predict phenomena. It can help people to recognize the role played by mathematics in the world and to make informed decisions and the decisions it takes are constructive, engaged and reflective.

Self-efficacy refers to the perception of the individual's ability to organize and implement actions to display certain skills (Bandura, 2006: 307). Self-efficacy of mathematics refer to a person's belief in the ability to solve math problems and tasks with success (Zimmermann et al., 2010: 3). Self-efficacy is the belief that students need to have in order to succeed in the learning process of mathematics. Dimensions that can be used to measure self-efficacy by Bandura (1977: 194-195), among others: (1) the magnitude, (2) strength, (3) generality.

Based on background above problems, formulation of the problem in this study are as follows. How is the initial condition of mathematical literacy and self-efficacy of students in preparation of learning materials geometry? How is the quality of learningSSCS with contextual approach? How mathematical literacy skills of students learningSSCS with contextual approach? How self-efficacySSCS of student mathematics learning with contextual approach?

Based on the formulation of the problems mentioned above, the purpose of this study is: Describe the condition early mathematical literacy and self-efficacy of students in preparation for teaching geometry, describing the quality of learning SSCS with contextual approach, describe the application of learning models SSCS with a contextual approach to the literacy skills of mathematics, and describe implementation of SSCS model learning with contextual approach to the self-efficacy of students.

Based on the above, the hypothesis in this research is, learning SSCS with contextual approach to be effective against the literacy skills of mathematics and self efficacy of students, which is indicated by the following, namely: the literacy skills of mathematics students achieve mastery classical study, the proportion of students in the classroom who obtained SSCS learning with contextual approach that reaches completeness individual reaches 75%, the literacy skills of mathematics students obtain SSCS learning with contextual approach is better than the literacy skills of students with expository mathematics.

METHODS

This research using mixed methods research design with embedded concurrent research. Embedded concurrent design a research method that combines qualitative and quantitative research methods by mixing

these two methods are not balanced (Sugiyono, 2015: 537). Data analysis was performed based on data obtained in the second stage both quantitatively and qualitatively. Quantitative analysis was conducted to see the effectiveness of SSCS model learning with contextual approach to the material geometry class X. qualitative analysis was conducted to identify the mathematical literacy skills and self-efficacy in the initial conditions and to 6 students choices, the quality of teaching, the response of teachers and student responses on SSCS mathematics learning model with a contextual approach to the material geometry class X.

The study was conducted in SMA N 1 Kendal. The population in this study were students of class X SMA N 1 Kendal Mathematics which consists of seven classes. In quantitative research, the sample used is two classes, class X MIPA 2 as an experimental class and class X MIPA 7 as the control class is selected using simple random sampling technique. While the qualitative research, the sampling technique used was purposive sampling sampling technique based on certain considerations (Sugiyono, 2010: 68). The sample used as the data source is 6 class X MIPA 2 that each of the two groups of students in upper, middle, and bottom based on test results preliminary. Students are selected based on the consideration of ease to be able to provide information. In this research, mathematical literacy skills and self-efficacy of students as independent variables, and mathematical literacy skills of students as the dependent variable.

Qualitative data analysis done by Miles and Huberman model analysis. Miles and Huberman in Sugiyono (2009) describes the technique of data analysis includes three concurrent activities, namely: (1) data reduction; (2) presentation; and (3) conclusion (verification).Quantitative data analysis consists of the analysis of the validity of the study, the analysis of mathematical literacy items, analyzing the response of teachers to learning, student response analysis, and analysis of the effectiveness of learning which includes the test of completeness in the classical and comparative tests. Mastery test can be seen if the literacy skills of mathematics students who complete or achieve a score of 70 to 75%. Whereas comparative tests used to determine if the experimental class is better than the control class.

RESULT AND DISCUSSION

The study begins with the initial observation followed by making of research instruments to be used.The research instrument is then validated by a team of experts before being used in research.Scores for the validation of the instrument was 3.99 with a good classification.So it can said that the research instrument is valid.Furthermore, analysis of instrument tests conducted on the validity test, reliability test, level of difficulty, and distinguishing features.Based on the results of the analysis indicate where the instruments are valid and reliable, and has a medium level of difficulty and distinguishing good.So that the test instrument can be used on an experimental class and control class.

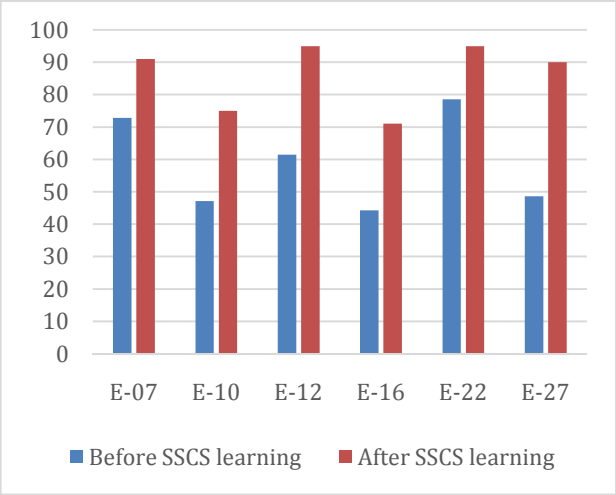

Figure 1. The results of tests of mathematical literacy skills

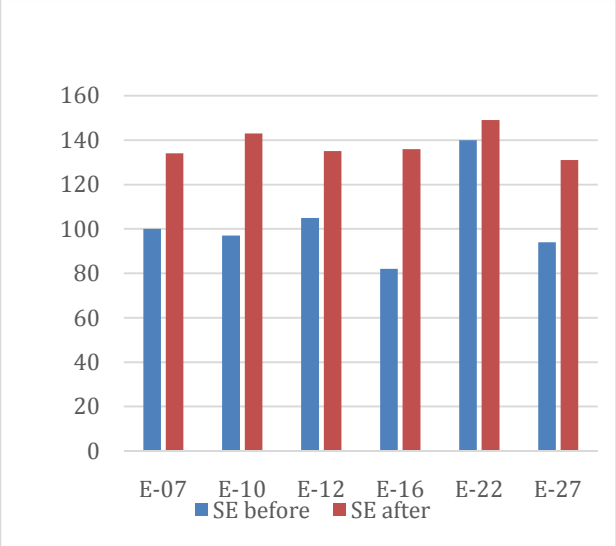

Figure 2. Self-Efficacy Students

Preliminary tests conducted to determine the condition of mathematical literacy and self-efficacy of students before being given the SSCS learning with contextual approach.Results of preliminary tests that provide an overview of mathematical literacy skills and self-efficacy of students are still lacking.From the results of preliminary tests showed that only 9 students scoring

above the mastery is 70 and the other 22 students who get score below 70. The results of the students' work on the mathematical literacy problems illustrate that each student is lacking in mathematical literacy process, at the stage formulate, employing and interpreting.Students tend to not write out the process well, did not describe the problem in mathematical modeling.Results of preliminary self-efficacy questionnaire indicate that as many as 18 students were in the bottom group and 13 children are in the top group for self-efficacy.This illustrates that at the beginning condition mathematical literacy skills and self-efficacy of students is still low.

Valid instruments further used in the experimental class, learning quality observations showed a score of 83.7%, which means the quality of learning is said to be good.The results of the teacher's response to the learning device showed a score of 4.1 in both categories.Furthermore, the student questionnaire responses showed at the high category with 74.5% said that students responded positively to learning.

The effectiveness of learning mathematics through contextual approach SSCS to show that: (1) The ability of the mathematical literacy of students achieve mastery of classical learning, the proportion of students in classes that derive SSCS learning with contextual approach that reaches completeness individual reaches 75%.Test of proportion with the significant level of 5% shows that $z = 2{,}02 > z_{0{,}5-\alpha} = 1{,}65$.It shows that the proportion of students who achieve a complete individual more than 75%.(2) The ability of the mathematical literacy of students who received SSCS learning with contextual approach is better than the literacy skills of students with expository mathematics.The results of the comparative tests states that valuet_{c} $= 2{,}103 \geq t_{t;}$ $= 2{,}002$, in order to obtain that the average literacy skills math test experimental class is better than the control class.

Based on preliminary tests showed that the literacy skills of mathematics SMA N 1 Kendal is still low, especially in the literacy process capability, namely employing and interpreting.After using SSCS learning with contextual approach, mathematical literacy skills of students has increased mainly on the process of employing and interpreting.For the process of formulating the students of students has increased, but not very significant, because the preliminary tests students already have a good score in the process of formulating.According to the students they are not used to write the settlement plan, but directly on workmanship matter of course.Students SE-22 stated that by writing the gradual settlement will assist the process of thinking.Writing about the completion of the information and planning will make the process of thinking becomes more focused.The test results of mathematical literacy skills before and after SSCS learning with contextual approach can be seen in the following diagram.

After learning SSCS with contextual approach, many student groups on the level of self-efficacy increased.Self-efficacy scores of students before and after SSCS learning with contextual approach can be seen in the following diagram.

From the graph shows that students have increased self-efficacy after a given learning with contextual approach SSCS.Students with code E-16 looks to increase self-efficacy is high.According to the results of student interviews E-16 states that the SSCS learning with contextual approach him feel more confident both in group discussions, as well as work on the problems.While the E-22 students increased but not significantly.Based on preliminary test results of students E-22 already have high self-efficacy.

Increasing students' mathematical literacy skills may occur because SSCS learning with contextual approach encourages students to construct their own knowledge, and to encourage students to work together.Given contextual problem that makes learning more meaningful and makes the process of student thinking is more developed.SSCS learning with contextual approach to the material geometry is designed to improve the mathematical literacy skills and self-efficacay students to develop students' skills and work together in groups.

CONCLUSION

Based on the results, it can be conclude as follows.Early literacy and math ability of self-efficacy of students is still low.The research instrument used is declared valid after validation by experts.The response of teachers to the learning device SSCS with contextual approach considered good, and the students gave positive responses to learning.According to the observation of the quality of teaching, learning have good quality.The results of the analysis of effectiveness of study stated that: matheatical literacy of students achieve mastery

classical study, the proportion of students in classes that derive learning SSCS with contextual approach that reaches completeness individual reaches 75% and the literacy skills of mathematics students who obtain teaching SSCS with contextual approach better of the literacy skills of students with expository mathematics.After the implementation of SSCS learning with contextual approach the experimental class, the result that mathematical literacy skills and self-efficacy of students increased.SSCS learning with contextual approach, can develop the mathematical literacy mainly on process employing and interpreting.

Based on the conclusion, there are some advice: SSCS learning with contextual approach can be used as an alternative to learning geometry, need the necessary research for development on the other level or different material.

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