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DEVELOPING LEARNING MATERIALS WITH SEARCH-SOLVE-CREATE-SHARE STRATEGY TO ENCHANCE PRE-SERVICE TEACHERS' BASIC SKILLS OF TEACHING MATHEMATICS

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Abstract. One of skills which must be achieved by mathematics pre-service teachers is the basic skills of teaching mathematics. By having these skills, the pre-service teachers are expected to be able to become qualified teachers of the field they are going to have. However, there are still many mathematics pre-service teachers and mathematics teachers who haven't achieved good basic skills of teaching mathematics. This was one of many factors that cause students' low achievement in math. This study aims at solving the problem by developing learning materials with Search-Solve-Create-Share strategy to enhance the pre-service teachers' basic skills of teaching mathematics. The research method used in this study is modified research and development method. In a nutshell, this study provides a significant contribution towards research in the mathematics education field particularly in producing suitable learning materials to enhance the pre-service teachers' basic skills of teaching mathematics.

Keywords: *Basic Skills of Teaching Mathematics, Learning Material, Search-Solve-Create-Share*

Legislation, Number 12 Year 2012 concerning College explicitly states that learning in college is expected to provide opportunities for students to optimally develop their cognitive, affective, and psychomotor aspects. In order to support that, the government has issued Presidential Regulation Number 8 Year 2012 concerning *Kerangka Kualifikasi Nasional Indonesia (KKNI),* which becomes the reference in preparing nationally the learning outcomes of graduates from every level of education nationally. Learning outcomes of bachelor's degree graduates is contained in the level of 6 (*KKNI DIKTI, 2013).*

In relation to the matter, The Indonesian Mathematical Society (IndoMS) has formulated learning outcomes of bachelor's degree of mathematics education program based on several parameters, by which one of them is the parameter of field work capability. Learning outcomes based on the mentioned parameter are as follows: 1) To be able to plan, implement, and evaluate mathematics learning innovatively by applying didactic pedagogical concepts of mathematics and mathematical science as well as to make use of the various learning resources, science and technology which orientates in life skills; 2) To be able to study and apply various available mathematics learning methods innovatively and tested; 3) To

be able to assist students in mathematics learning; 4) To be able to plan and conduct research in order to obtain ways of solving problem in mathematics fields as well as to publish the findings (Team of KKNI IndoMS, 2013).

Based on qualifications of learning outcomes in KKNI and the formulation by IndoMS, bachelor's degree students majoring in mathematics education program should have good teaching skills as the foundation in teaching mathematics. Teaching skills are defined as measurable and coherent activity that teachers use in order to make students learn (Kyriacou, 2007). Therefore, teaching skills are related to several fundamental skills or abilities and must be mastered by teachers in doing their job.

The importance of teaching skills are in accordance with Legislation Number 14 Year 2005 concerning the teachers and the lecturers, one of which is pertained to pedagogical competence and professional competence. Sanjaya (2009) states that teaching skills are required by teachers in order to be able to perform their role in managing the learning process, so that the learning can run effectively and efficiently. Ruseffendi (1991:18) states that one of the skills that mathematics teachers in high school need is the skill of being able to demonstrate various methods and techniques in teaching the subject taught.

In reality, it is demonstrated that teaching skills of most teacher-to-be students are still low, which is evidenced in several previous studies (Fitriana 2014; Mulyatun 2014; Rahayu 2014). It is caused by the lack of opportunities to probe and integrate various things in relation with mathematics learning.

This problem should be soon addressed through the use of specific strategy in designing learning activities in class, so that learning process can be beneficial for the students. One of the learning strategies that is believed can improve teaching skills on teacher-to-be students is learning with Search-Solve-Create-Share (SSCS) strategy. Learning stages of SSCS strategy consist of four phases, they are *search, solve, create,* and *share* phase. In order that each phase in SSCS learning runs well, there needs to be supporting learning materials. Unfortunately, learning materials for SSCS learning are still limited; therefore, the researcher is interested in developing learning materials.

The question that arises to the researcher is, "what kind of learning materials can be used in learning with SSCS strategy which can provide solutions to the lack of teaching skills of pre-service teacher?" This is what interests the researcher to conduct a study on development of learning materials in learning using SSCS strategy in order to improve teaching skills of mathematics pre-service teacher. Hence, the researcher proposed a study entitled "Developing Learning Materials with *Search-Solve-Create-Share* Strategy to Enhance Pre-Service Teacher' Basic Skills of Teaching Mathematics."

Teaching skills are defined as a measurable and coherent activity that teachers use in order to make students learn (Kyriacou, 2007). Wragg (in Kyriacou, 2007) sees teaching skills as "strategies that teachers use which facilitate pupils' learning and which are acknowledged by those competent to judge as being skills."

Teaching skills are related to several skills or abilities which are fundamental and inherent, and must be owned and actualized by every teacher, lecturer, or instructor in doing their job. In relation with teachers' duty, Regulation of Ministry of Empowerment of State Apparatus and Bureaucracy Reform Number 16 Year 2009 states that teachers should be able to plan and carry out excellent learning, assess, evaluate learning outcomes, and carry out learning/enrichment and remedial. Besides, teachers are also authorized to select and decide the materials, strategies, methods, learning media, and assessment/evaluation tools in teaching. This aims at achieving educational outcomes of quality according to teachers' code of ethics.

Based on that matter, every teacher should have good teaching skills. These skills involve skills in questioning, affirming, making variations, giving explanations, beginning and ending class sessions, guiding small group discussions, managing class, and individual teaching (Usman, 2002).

Teaching skills in teaching mathematics are related to several special abilities which are according to characteristics of mathematics, and it should be actualized by every teacher (Nasution, 2014; Frasetyana et al., 2015; Mauigoa and Tekene, 2006; Ball, 2003; Shellard and Moyer, 2002; Anthony and Walshaw, 2009).

Based on definitions, notions, and results of the aforementioned studies, the researcher believes that in teaching mathematics, there needs to be teaching skills which can accommodate the characteristics of mathematics itself. This is in order for the teachers to be able to put together learning process in a good and interesting way, so that the students are eager to learn. These skills are called basic skills of teaching mathematics, they are:

(1) The ability to master mathematics content,
(2) The ability to explain mathematics concepts, definitions, formulas, and symbols,
(3) The ability to question in order to probe mathematical ideas and respond to curiosity as well as to questions that students have,
(4) The ability to use various mathematics learning approaches or strategies effectively according to the situations and conditions that one faces,
(5) The ability to provide affirmation through mathematical connections,
(6) The ability to manage the class including facilitating group and individual discussion,
(7) The ability to begin and end mathematics learning/class,
(8) The ability to do authentic assessment.

Furthermore, those skills will be the indicators of mathematics teaching skills in this present research.

According to Pizzini et al. (1988), *Search-Solve-Create-Share* (SSCS) is a learning model that teaches a process of problem solving and develops problems solving skills. There are 4 stages or phases in this learning model, they are *search, solve, create*, and *share* phase.

Search phase concerns other ideas that simplify, identify, and develop researchable questions. This phase helps students connect concepts in a problem to relevant science concepts.

Solve phase focuses on specific problems/issues which are specified in search phase. It requires students to create and implement their plans in order to get an answer. During solve phase, students reorganize concepts from search phase to higher-order concepts, in which these higher-order concepts identify ways to solve the problems and get the answers.

Create phase requires students to create a product-related issues, compare data with the issues, make generalizations, and if needed, modify. The results of creating phase is the development of an innovative product that communicates results from search phase to solve phase to other students (Pizzini, 1996).

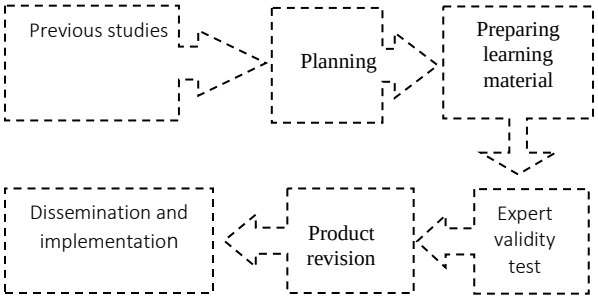
Share phase has a basic principle of involving students to communicate answers of the issues or answers of the questions. The created product becomes the focus of share phase. Share phase is not limited only to communicating to other students. Students express their ideas through communication and interaction, receive and process feedbacks, which are reflected in the solutions of the problems and answers of the questions. Students also recreate researchable questions in other activities (Pizzini: 1996).

METHOD

Research method employed in this research is research and development method. Research and development method is defined as a research method employed to create certain products and to test the effectiveness of the products (Sugiyono, 2011). Research and

development method that is employed aims at creating products which are mathematics learning materials with SSCS strategy in anthology of selected topics *(Kapita Selekta)* of mathematics for senior high school course.

The design of research and development of learning materials that is used refers to design of research and development modified from design of development by Borg & Gall (1989). It consists of (1) conducting the research and obtaining data from previous studies, (2) planning, (3) preparing learning materials, (4) expert validity test, (5) product revision, and (6) dissemination and implementation. Steps of research and development are shown in chart 1 as follows.



RESULTS AND DISCUSSIONS

Products created in this present research are learning materials with SSCS strategy. Loveridge (in Muslich, 2010:56) states that if the situation of a teacher is not properly qualified, then textbooks/learning materials become the guide and support in teaching. Learning materials developed is mathematics learning module in learning with SSCS strategy. It consists of four phases with the purpose of improving pre-service teacher' basic skills of teaching mathematics. These phases in SSCS learning becomes the base of learning materials development by the researcher.

Basic competences developed by the researcher in this learning material refer to eight basic skills of teaching mathematics indicators which have been described previously. The eight competences are developed integrally in seven chapters. Furthermore, chapters in this learning material are called "*Kegiatan Belajar (Kabel).*" Every "*Kabel*" has "objectives", "indicators of competence achievement", "description of the materials", "learning activities", "exercise questions", "summary", "feedback and follow-up."

"Objectives" are a part which conveys information about the aims of learning related to materials in general. "Indicators of competence achievement" are sentences containing information about specific competences that will be achieved from learning activities. "Description of materials" is subject matter and important matters which students need to comprehend. "Learning activities" consist of questions or structured commands that students need to be involved in during the learning activities. "Exercise questions" consists of questions that students need to do. "Summary" consists of brief description of materials. "Feedback and follow-up" are evaluation tools and reflection of the success of learning activities.

Learning materials with SSCS strategy are examined based on the presentation of learning materials and the effectiveness of learning materials. This representation of learning materials is in the form of a module that students use in learning, which is designed to be used in a group. This is also based on one of the phases in SSCS learning, that is, share phase.

Presentation and data analysis in this research are divided into two aspects, which are (1) presentation and data analysis of product improvement, (2) presentation and data analysis of product effectiveness. The data presentation of product improvement is classified in terms of aspect of face validity and aspect of content validity. Meanwhile, presentation and data analysis of product effectiveness are examined through the aspect of improvement in achievement of competence indicators, that is, basic skills of teaching mathematics.

According to the results of product trials, the mean score obtained is 4.68 of 5 (on a scale of 5). This indicates that the learning material is highly valid. Average score is obtained from assessment of face validity aspect and content validity aspect. From face validity aspect of learning material, the mean score is 4.52, indicating that the learning material is valid. Based on the results of qualitative and quantitative data of face validity validation aspect of learning materials, revision is done by (1) putting header and footer and giving the right theme according to the learning materials in order to mark the materials that is being learned, (2) adding empty spaces between exercise questions so that the students have spaces to write their answers. From content validity aspect of learning materials, the mean score is 4.84, which shows that the learning material is highly valid. Based on the results of qualitative and quantitative data of content validity validation aspect of learning materials, revision is done by (1) writing the indicators of competence achievement more specifically and in more detail, and (2) changing the term "the ... meeting" into "learning activity" to name the chapters of learning materials.

Aspect of effectiveness is analyzed by calculating score difference between score of basic skills of teaching mathematics after being treated and the score before being treated. Subsequently, the scores are compared with ideal total score subtracted from the score from before being treated. Aspects assessed include eight indicators of basic skills of teaching mathematics which have been mentioned previously. According to the result of the calculation, it can be concluded that this learning material can effectively improve mathematics teaching skills of teacher-to-be students. These results are obtained from calculation of improvement by using N-gain which indicates that there is an increase of 0.37 with medium category.

CONCLUSIONS

Suggestions of the use, dissemination, and development are directed at the use of products in learning, dissemination activities, and further product developments. Based on the results of the trials, it is discovered that this learning material is valid and can be used effectively in learning. However, there are several weaknesses. The weaknesses result in suggestions for further use of products. Dissemination is an activity of disseminating products or works which have been developed, so that they can be widely known by the community and be used as its functions. The products of development can be disseminated through science publication, some of which are through journals and research seminars.

Based on the results of product trials, the next product developers are expected to consider the right time in conducting the trials. Products must be presented in alignment with several basic competences so that it can be beneficial and efficient in terms of time. It is also suggested that the developers have links in conducting the research; meaning that the researchers should have links which can help them bridge the research and the school. Not every campus has adequate microteaching laboratories to conduct laboratory test. Thus, it is possible that the developers must conduct laboratory test in schools. It is also suggested that the developers choose the schools that support the research; meaning that not every school is concerned with this activity. Thus, it should be ensured that the selected schools where the trial is carried out are the schools that support the research activities.

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