

Research Article

Needs Assessment for the Development of Learning Models Based on Mathematical Problem Posing to Improve Critical Thinking Skills

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Abstract.

Needs assessment is used as a base or a foundation in designing learning models based on mathematical problem posing. This research aims to identify mathematics learning that occurs and should occur. Needs assessment is carried out by literature study and field study. The participants in this study were junior high school mathematics teachers in Palu City. Of the 25 mathematics teachers who sent the mathematics learning questionnaire results, it was found that 65% of the teachers rarely applied the problem-posing task, and 35% never gave the assignment of proposing mathematics problems. The information obtained from the interviews with 4 mathematics teachers regarding problem posing was that the students understanding about the concept. The teacher argues that if students are given the task of problem posing, they would only copy in the book. They construct problems from the textbook and replace the numbers. The task of posing a problem is given when the math teacher is unable to attend. The task of constructing problem was a punishment for students for not working on the questions. The conclusion from this study results is that the teacher rarely gives the task of problem posing. There are misconceptions about the task of mathematical problem posing.

Keywords: critical thinking skills, learning models, mathematical problem posing, needs assessment.

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1. INTRODUCTION

Critical thinking appears to be directed by a motivational component in problem solving and is a high order type of reasoning employing cognitive skills [1]. Critical thinking is a capability essential to contemporary life [2]. Contemporary evidence of the importance of critical thinking skills for employment has been provided from the National Association of Colleges and Employers [NACE] (2016) which indicated that critical thinking skills were

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ranked most important by the 144 surveyed employers [3]. Thus, critical thinking skills must be possessed by students for their future.

Critical thinking is not an auto-generated skill. Critical thinking is a learned skill that should be taught. This requires a training and stimulus to develop the skill in students [4]. Critical thinking is a learned skill that takes instruction and practice [5]. Developing critical thinking abilities is something which is very important in the world of education [6–8]

Several factors that can improve one's thinking ability: a thoughtful learning environment [9]. There are several ways of organizing for instruction in critical thinking. Giving writing assignments to students is the best way to teach critical thinking. Learning that strongly supports critical thinking uses questioning techniques that require students to synthesize, analyze, and find information to solve problems and make decisions (think) not to repeat information [5].

Problem posing can be used to teach critical thinking. Problem-posing has an indirect positive effect on mathematics achievement and attitude towards mathematics by improving students' creativity, critical thinking, mathematical reasoning and problem-solving skills [10, 11]. Formulate mathematical problems can contribute to making such good decisions [12]. When individuals have to pose a problem, they must think, analyze the formulation critically, examine the data of the formulation and overcome the possible solution strategies to get a solution to the problem [13]. To assist teachers in managing learning that involves a problem posing process, it is necessary to develop a problem posing based learning model.

Needs assessment is an important stage of learning model development. Several researchers have intended to explain need assessment. To define learning requirements begins with a preliminary study conducted with a need assessment [14]. Needs assessment can be used as a basis or foundation in designing a learning model. Needs assessment is the first step in instructional design [15]. Needs can simply be as a measurement of needs in what is usually done at an early stage in defining the subject's assessment. This needs assessment process will also be a kind of "bridge" to address the gaps existing in the language training syllabus with the learners' needs [16]. A needs assessment is carried out in order to identify between the actual product or situation and the optimal solution that can be accepted [17].

In this study can be said that needs assessment is used as a basis or foundation in designing learning models based on mathematical problem posing. This research aims to identify mathematics learning that occurs and should occur and determine the need for learning mathematical necessary critical thinking skills. This paper will present the

results of a case study on the importance of needs assessment in designing learning models based on mathematical problem posing that can improve critical thinking skills.

2. RESEARCH METHOD

This research is the initial stage from development research. This stage is the stage of needs assessment by applying the principle of front-end analysis. Needs assessment is carried out by literature study and field study. The literature study examines the theory of learning models, problem posing, and critical mathematical thinking. The field study identified the learning management of students' mathematical critical thinking skills. The analysis was carried out by distributing instruments in the form of questionnaires and interviews to mathematic teachers about student character and an overview of the management of learning in the classroom related to the development of students' mathematic critical thinking skill. The subjects of this study were junior high school mathematics teachers in Palu City.

3. RESULT AND DISCUSSION

3.1. Results of Field Studies

The results of the interview with the mathematics teacher at SMPN 1 Palu obtained information that learning at SMPN 1 Palu implemented the 2013 curriculum, including mathematics learning. The teacher at SMPN 1 Palu sometimes gave HOTS questions. However, mathematics teachers never give assignments for students to problem posing. The teacher argues that problem posing requires understanding the material.

The results of interviews with mathematics teachers at SMPN Madani Palu obtained information that teachers' perceptions of HOTS questions were not uniform. There are those who think that if students cannot work on the questions, it means that the questions are HOTS questions. The teacher stated that an indicator of questions including HOTS questions was needed. The teacher never gives a problem posing assignment. The teacher thinks that if students are given the task of problem posing, students only look in the textbook. Students find it hard to ask questions. Only students with high abilities dared to ask questions.

The results of interviews with mathematics teachers at SMPN 15 Palu obtained information that learning mathematics has never assigned students to make their own questions. The teacher once gave HOTS questions in books. The teacher selects or

chooses which questions the students will understand about the questions. HOTS problem as a matter of strengthening.

The results of the interview with the mathematics teacher at Karuna Dipa Middle School showed that he had given the task of problem posing. Students construct problem from textbooks and just replace the numbers. The task of problem posing was given when the math teacher in charge was unable to attend. The task of problem posing is a punishment for not doing the questions.

The results of a questionnaire conducted by 25 SMP mathematics teachers in Palu City can be seen in the following table 1.

TABLE 1: Results the implementation of mathematics learning by junior high school.

| Statement | The indicators of critical thinking | Never (%) | Rarely (%) | Often (%) |
|-----------|---|-----------|------------|-----------|
| 1 | I provide a summary/ conclusion of the material when I close the lesson | | 15.4 | 84.6 |
| 2 | I teach material begins by asking students to observe facts / objects | | 76.9 | 13.1 |
| 3 | I ask students to discuss the assignments that given with other friends | | 85 | 15 |
| 4 | I ask students to problem posing | 35 | 65 | |
| 5 | I explain the formula in the book | | 20 | 80 |
| 6 | I teach step by step how to solve the problem in detail | | 7.7 | 92.3 |

3.2. Development of Literature Studies

The results of the literature analysis about the learning model show that in order to develop a theoretical foundation, implementation instructions and design of the elements of a learning model. There are five important components in a learning model. Syntax, the social system, principle of reaction, support system, and instructional impact and accompaniment impact. The syntax which is usually called the phase is the stages of learning activities. The social system is the learning situation or atmosphere and the norms that apply in the model. The principle of reaction is a pattern of activities that describes how the teacher sees and treats students, how the learner should respond, how the teacher uses the game that applies to each model. The support system is all the facilities, tools and materials needed to implement the model, such as classroom settings, instructional systems, learning tools, learning materials, and learning media. Instructional impacts are learning outcomes that are achieved directly by directing the expected competencies and accompaniment impacts are other learning outcomes

produced by the learning process as a result of creating a learning atmosphere that is experienced directly by students without direct direction from the teacher [18].

The results of the literature analysis about the problem posing, problem posing means reformulating a given problem or proposing a new problem situation in terms of the given conditions [19]. There are two ways to express problem posing namely a) Problem posing to find situations or experiences. At this point, one important contribution of problem posing is the provision of sub-problems to overcome the difficulties encountered during problem solving. b) Problem posing based on the solution of the problem. At this perspective, problem solving can be considered as a transitional phase for problem posing [20]. Problem posing activities starting from the problem posing stage of the problem-solving process [21]. Problem posing can be done before, during, and after solving problems. The aim of problem posing before solving problem is not solving the problem, but the generating of a problem from a given condition. During solving problem, the problem statement addressed can be designed by reconsidering the problem statement. Problem posing sometimes occurs after solving a certain problem. By changing the conditions of the problem, alternatives to the given problem can be proposed. Problem posing after solving a problem is related with the "Looking back" phase from problem solving. Process of problem posing can be realized in three different categories (a) free problem posing situation, (b) semi-structured problem posing situations, and (c) structured situations [22]. Problem posing activity is useful in learning. Teachers can use problem posing activities as an alternative evaluation method. The inability to construct student problems helps lecturers to easily diagnose any of the following complications [23]. To explore the potential for problem posing as an assessment technique. Task of problem posing engaged students to generating questions is a tool to assess students' understanding and the results of the assessment are used by the teacher to make further instructions [13].

The results of the teacher interview related to problem posing show that the teacher's perspective on problems posing is still wrong. There are misconceptions about the task of mathematical problem posing. Indecision in posing problems that are appropriate to the student's level, difficulty in remembering the subject clearly and not having sufficient information about the problem posing is the challenging side of problem posing [19]. The teacher does not consider posing a problem important, and considers the task of asking questions to be an activity that is not important in learning critical thinking skills. Teachers react negatively or reject the problem posing approach. This is contrary to the opinion that problem posing is an important aspect of pure and applied mathematics [24]. Problem posing and problem solving are important mathematical process skills that

students are expected to acquire in a classroom environment [25]. Based on the results of the questionnaire in Table, it can be found that 84,6 % the teacher often provides a summary. This means that the teacher has not trained students to make conclusions. Skills to formulate conclusions are one of the indicators of critical thinking.

The results of the questionnaire were 76.9% of teachers rarely started learning by asking students to observe objects. Even though teaching material begins by asking students to observe facts/objects is the teacher's way of stimulating students to think. The results of questionnaire statements 5 and 6 show that mathematics learning is teacher-centered and dominated by lectures. If the teacher teaches the material by lecturing students are not stimulated to critical thinking. Learning with lectures makes students think passively while critical thinking is an active process. To improve critical thinking skills, teachers are encouraged to provide students with experiences to explore mathematical concepts and techniques [26]. With students discussing, training students to communicate, giving opinions through thinking, assessing the opinions of others and believing that the opinions expressed are true. The results of the questionnaire showed that 85% of teachers rarely facilitate students to discuss. The discussion learning method facilitates students to express ideas, respond to other people's ideas and compare them with their own ideas. Thus, the discussion learning method encourages students to think critically. Assign the task to problem posing encourage students to read, analysis, identify and evaluate information or statements about the situation. Based on the results of analysis, identification, and evaluation and connecting concepts related to the information in the situation or question statements, the students then make the decision to pose/formulate a problem. Knowledge that has been learned contributes and is useful in problem posing [20]. The results of the questionnaire showed that 35% of teachers never and 65% of teachers rarely gave assignments to pose problems. This means that teachers rarely condition students to carry out critical thinking activities.

4. CONCLUSION

Based on the finding obtained from this research, the teacher rarely gives the task of problem posing. The teacher has rejected or reacted negatively to instructional approach of problem posing. There are misconceptions about the task of mathematical problem posing. The teacher teaches the material by lecturing students are not stimulated to critical thinking.

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