Effectiveness in mathematics learning with the problem solving approach in vocational high school

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Abstract. Creative teachers are the key to the success of vocational learning in the XXI century. One of the learning models applied to vocational learning is a problem solving or problem solving learning model. The purpose of this study is to describe the effectiveness of vocational mathematics teachers in the learning process with problem solving models in terms of their application, as well as an overview of problem solving skills of vocational high school students. The main instrument of this study was the research themselves assisted with problem solving questions, questionnaires and observation sheets. The results showed that the aspects of learning planning preparation had shown to be effective, but there were still less effective indicator, namely the preparation of worksheet and the use of teaching aids. The category of problem solving abilities of vocational high school students in understanding the problem on average is quite good. But the indicator verifies the results of the answers including the less category.

1. Introduction

Learning needs of students in the XXI century change very significantly. Changes in student learning should be followed by the style and pattern of new vocational teaching that is increasingly suited of student the needs. Vocational learning models that apply XXI century skills need to be developed and tested for their effectiveness. One of the learning models applied to vocational learning is a problem solving. According to [8] problem solving learning model is the most effective learning model applied in vocational learning. In his book Learning to Solve Problem an Instructional Design Guide states “learning in the everyday world, where people live and work, is omnipresent essential to survival, let alone progress. In home business, organizations, and societies in every culture, learning is driven by problems that need solving. This statement means that problems are part of life.”

Wherever we live and move, we are always faced with problems that need solutions. The problem solving lies in the heart of mathematics education, the description emphasizes the importance of obtaining student troubleshooting skills. He concept of problem solving has been defined as “a process where student incorporate elements of knowledge, rules, techniques, skill learned beforehand and concepts to provide solution to new situations” [1]. Kosheim, [3] starting by completing the problem solving, students can feel the beauty of using mathematics and overcoming daily challenges, and applying problem solving questions in class showing students how the mathematics is connected to everyday life, which increases their level, motivating and empowering math role. In vocational learning, including one of them is mathematics learning in vocational high schools, it should provide learning contributions that prepare graduate to carry out the tasks of learning students, look for experiences on how to solve Problems are always present everywhere on all sides of work after they graduate. For example in learning mathematics how students apply approximations measurement on the competency of motorcycle engineering expertise.
Life work modern is always flooded with problems and work challenges that require solutions [8]. Learning to solve problems requires a process and practice on how to learn to solve problems. Problem Base Learning or PBL is packaged learning where problems are used as the basis of a learning process. Problems that form the basis of a learning process can be in the form of authentic problems or simulative problems. Problems can be prepared by the teaching teacher, can also be sought by students and then made an agreement to be the basis of learning. In the learning process of problem solving students are expected to apply various skills, knowledge, work procedures or ways of thinking algorithms in solving problems. The teacher facilitates students by giving basic concepts of problem solving, instructions on how to solve problems, and sources that can be used as references for problem solving [5]. expressed many high school students with specific learning difficulties (SLD) struggling with problem solving mathematics.

When students with SLD are taught to use an effective problem solving strategy, their ability to solve mathematical problems increases. To realize the problem solving skills, problem solving learning models become important to be applied in learning at vocational high school, so learning how to solve important problems to be trained. Perception of mathematical benefits [9], increases awareness about the importance of mathematics [4], self confidence and perceptions about mathematics and learning [10]. Successful beliefs in mathematics are fostered by effort, efforts to understand something, and collaboration with peers [6] in [2]. Polya [7] suggests four steps to solving problems, namely understanding problems, planning solutions, implementing plans and looking back. The research objectives to be achieved are: (1) describing the effectiveness of vocational mathematics teachers in the learning process with a problem solving approach in terms of their application (2) describing the description of the problem solving ability categories of vocational high school.

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| Table 1. Indicators and guidelines for assessing the ability to understand problem. |
|---------------------------------|---------------------------------|
| Category | Description |
| Well | Understand the problem correct. Able to reveal know information and question asked from problem given. |
| Enough | Incorrect interpretation of some problem. |
| Less | Do not understand the problem as whole. |

| Table 2. Indicators choose a strategy plan problem solving the right |
|---------------------------------|---------------------------------|
| Category | Description |
| Well | Make plan the right and lead to the right solution. |
| Enough | Make a plan problem solving that can be applied but allows not to get results accordingly or get results the wrong. |
| Less | Don't have a plan that is relevant to the problem |

| Table 3. Indicators to Solve Problems |
|---------------------------------|---------------------------------|
| Category | Description |
| Well | Complete all problems and get the right answer |
| Enough | Resolve some problems and get the right answers |
| Less | Do not solve problems or resolve some or all of the problems but get the wrong results. |

| Table 4. Indicator of verification and interpretation of results |
|---------------------------------|---------------------------------|
| Category | Description |
| Well | The process of identification and all of the results problems solving. |
| Enough | Verify and resolve problems. |
| Less | Does not verify the process and the results of problem solving. |
Table 5. Category Ability Problem

| Category | Description                      |
|----------|----------------------------------|
| Well     | At least three good categories on each indicator. |
| Enough   | At least three categories are sufficient for each indicator. |
| Less     | At least three categories are lacking. |

2. Method
The research method used is descriptive research, which is intended to explore and clarify a phenomenon or social reality, by describing the variables relating to the problem and the unit under study. The purpose of the descriptive research published in this study was to produce accurate results about the effectiveness of the mathematics learning process with the problem solving model in vocational high school and an overview of the categories of student problem solving abilities. The population in this study was a vocational high school mathematics teacher in Bojonegoro district, while the sample was a mathematics teacher at one of the peripheral vocational high school. The purpose of the descriptive research planned in this study is to produce an overview of the effectiveness of teachers in the learning process of mathematics with problem solving models and students' problem solving abilities. This research quantitative descriptive used questionnaires and observation sheets.

3. Result And Discussion
Presentation of research results can be divided into two groups that reveal about: a). The effectiveness of teachers in mathematics learning with a problem solving model is reviewed from (1) aspects plan of learning (2) aspects of implementation learning. b). Category of problem solving ability of student vocational high school.

3.1. The Effectiveness of Teachers in the Mathematics Learning Process in Vocational High School.

3.1.1. Aspects of Plan Learning
The results of recapitulation of data from four mathematics teacher respondents were described in table 6- table 10.

Table 6. Achievement of Learning Objectives.

Table 6 shows: the four respondents answered strongly agree with the number of 2 people (50%) and agreed with the number of 1 people (25%) who had decided to use the model with the number of 1 people (25%). this means the learning objectives include categori effective.
Table 7. Shows: the four respondent answered strongly agree with of 2 people (50%) and agree with the number of 1 people (25%) had not decided to use the model use with the number of 1 people (25%). This means learning objectives include category effective.

Table 8. Compilation Worksheet.

Table 8. shows that of the four respondents answered agree with the number of 2 people (50%) and disagree with the number of 2 people (50%). This means the preparation of worksheets is in the less category effective.

Table 9. Use of Teaching Aids or Teaching Aids

Table 9. Shows that of the four respondents answered strongly agree with the number of 1 person (25%) have not decided to set the model used with the number of 2 people (50%) and do not agree with 1 person (25%). this means that the use of teaching aids or teaching aids belongs to the less category effective.

Table 10. Assessment of Outcome Learning

Table 10. Shows four respondents answered strongly agree 2 people (50%) and agreed to number 2 people (50%). Learn more, learning outcomes include category effective.

3.1.2. Aspects of Implementation Learning,
The results of general data recapitulation of 20 students with five ability category are described in table 11 - table 14.
Table 11. Indicators of Learning Activities to Understand Problem

Table 11. Shows that: of the 20 respondents in understanding the problem with the criteria of good 3 students (15%), enough 12 students (60%) and less than 5 students (25%). Indicators to understand the problem are included in enough categories.

Table 12. Indicator activity of learning choose strategy plan problem solving the right.

Table 12. shows that: of the 20 respondents in choosing the right problem-solving strategy plan with the criteria of good 6 students (30%), enough 7 students (35%) and less well 4 students (20%) and not very good 3 students (15%). The indicator for choosing the right problem-solving strategy plan is sufficient.

Table 13. Indicators Problem Solving

Table 13. Shows that: of the 20 respondents in solving the problem with the criteria of good 5 students (25%), enough 8 students (40%) and not good 7 students (35%). Indicators to understand the problem are included in enough categories.

Table 14. Verification of Results and Interpretation of Result.
Table 14. Shows that: of the 20 respondents in verifying the results and interpretation of the results with the criteria of good 3 students (15%), enough 8 students (40%) and not good 9 students (45%). Indicators verifying results are in the less category.

4. Discussion
Based on the results of research for teacher effectiveness aspects in the process of learning mathematics with problem solving models.

4.1. Aspects of Learning Preparation
From the interpretation of the results of the study show that the mathematics teacher in vocational high school in the aspect of learning planning preparation has shown to be effective, but there are still less effective indicators, namely the preparation of worksheets and the use of teaching aids, on the results of this small-scale study. vocational middle schools in the suburbs are still not good at making worksheets and use of teaching aids.

4.2. Aspects of Implementation Learning.
The interpretation of the results of the study shows that in general the problem solving ability categories of vocational high school students in understanding problems are on average quite good. The right problem solving strategy plan is in sufficient category. Understanding the problem of belongs to enough categories. Verifying the results of the answers is in category less. The author has an opinion on the results of research on this small scope of teachers 'ability to manage learning will affect the improvement of students' problem solving abilities.

5. Conclusion
From the discussion of the results of the study, learning mathematics with problem solving approach in vocational high school can be concluded as follows. Teachers vocational high school teachers in on the edge schools are mainly at Sumberrejo Bojonegoro State Vocational High School, their effectiveness in learning mathematics with problem solving models in terms of effective learning planning categories, but in the preparation of worksheets and the use of teaching aids are still less effective. The problem solving ability of students with indicators of understanding the criteria is enough at 60%, the indicator of choosing a problem solving strategy plan is enough criteria of 35%, in solving problems with sufficient criteria of 40%. Indicators verify results and interpretation of the highest results criteria is not good 45%.

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