

## PRESENTER'S PAPER

### Developing the Task to Solve Students' Trigonometry Problem in Mechanical Vocational Senior High Schools Based on the Differences in Mathematics Competence and Their Cognitive Style

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#### *Abstract*

*Vocational senior high schools will have been cooperating by the year of 2020. They must adjust to the competencies of each region to achieve 60% of vocational high school and 40% of senior high school ratio. However, the fact shows that they have not met the required competencies since only 49% of vocational and 51% of senior high school ratio have been earned. The number of senior high schools will be minimized but vocational high school will be increased due to the consideration of the internal challenges in the year of 2020, in which the Indonesian population will overflow so that it needs efforts to use human resources especially those of productive age to be useful nor being burden for the national development. Thus, the way to achieve this aim is to transform human resources who have the competence and skills through education (rule of government, number 70 in 2013). The design of this research is developmental research, which develop task to solve trigonometry problem. The model of teaching and learning sets developed in this research relates to modified 4-D models, consisting of ; to define, design, and develop.*

**Keywords:** *students' tasks on Trigonometry problems, development, Mathematical competence, cognitive style*

#### **1. INTRODUCTION**

Establishing Vocational senior high school will continue until the year of 2020 which is adjusted to the competency of each region to achieve 60% of vocational high school and 40% of senior high school ratio. However, the fact shows that 49% of vocational and 51% of senior high school, meaning that it doesn't meet the ratio. The number of Senior high schools will be minimized but vocational high school will be increased due to the consideration of the internal challenges in the year of 2020, in which the Indonesian population will overflow so that it needs efforts to use human resources especially in productive age to be useful nor being burden for development. Thus, The way to achieve this aim is to transform human resources who have the competence and skills through education (rule of government, number 70 in 2013).

Through development of vocational senior high school, it is recommended that its curriculum, which has been set in the regulation of government No. 70, in the year of 2013, in 2013 curriculum in 2013, where mathematics is one of the compulsory subjects taught from tenth to twelfth class in all skill fields, such as; (1) technology and engineering, (2) information and communication technology, (3) health, (4) agribusiness and agro technology, (5) fishery and marine, (6) business and management, (7) tourism, (8) visual art and craft, (9) the performing arts.

One of the purposes of teaching mathematics written in the curriculum is as a means of structuring students' reasoning ability. By studying mathematics, students are expected to give reason and think logically, analytically, critically, creatively, and can work together.

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Additionally, the attachment of minister's national education regulation No.22,2006 in the standards of the contents on 23 May 2006 (*Depdiknas*, 2006:346) states that the purpose of learning mathematics in vocational senior high school is that vocational students can: (1) understand the concept of mathematics, (2) use their reasoning ability, (3) solve the problem, (4) communicate ideas, and (5) have an attitude to appreciate the usefulness of mathematics in life.

Furthermore, by learning mathematics, students are expected to solve all problems or issues facing both problems associated with mathematics itself and any other subjects or use mathematical concepts relating to everyday life in the work field which is suitable with their talents and interests.

Based on interviews with several teachers and students in mechanical vocational senior high school, the information obtained was that students were not concerned with mathematics subjects compared with other subjects in their department. Besides that, the students consider that mathematics is less relevant to their practical field. This is due to a lack of understanding mathematics fully and deeply, when applying mathematical concepts to solve mathematical problems that match their interests and skills contained in each vocational fields, those made the students get trouble. In addition, mathematics books and worksheets, provided by either government or market for mechanical vocational senior high school students still uses general mathematical problems, but not the mathematical problems associated with expertise and interest in mechanical vocational high school.

Based on those problems, it is important for the students of mechanical vocational senior high school both with field dependent or field independent cognitive style to understand the mathematics fully and deeply in order to solve mathematical problems both in the field of mathematics itself and its application in the subjects of their specialization in accordance with their expertise using a problem-solving task that raised the issue of mathematical problems relating to daily life or their expertise with their talents and interests.

From the preliminary study conducted by researchers in SMK Krian 1 Sidoarjo at Mechanical department obtained the information that was only about 30% of students were able to complete the task well or could understand mathematical concepts fully and deeply in applying these concepts to solve the mechanical tasks using the concept of trigonometry, while the remaining 70% were still not able to complete the task well or had difficulty in understanding and applying mathematical concepts in particular the subject of trigonometry. The information obtained from the students about their difficulty to understand the concepts of trigonometry is due to their teachers who assign tasks is general and does not deal directly with the mechanical problem. Teachers should assign the task of solving trigonometry problems associated with machining so that there is an apparent relationship between trigonometry and machining.

Based on the phenomenon, the purpose of this research is to develop the task to solve students' trigonometry problem in mechanical vocational senior high school based on the differences in mathematics competence and their cognitive style.

## 2. RESEARCH METHODOLOGY

The design of this research is developmental research, which develop task to solve trigonometry problem for mechanical vocational high school based on their mathematical skill and cognitive style.

The model of teaching and learning sets developed in this research relates to modified 4-D models, consisting of ; to define, design, and develop.

## 3. FINDINGS AND DISCUSSION

Results from this study shows that the problem solving of trigonometry in mechanical vocational high school based on their differences in mathematical skill and cognitive style, in which the developmental process is started from defining five steps that include front-end analysis, students analysis, task analysis, and determine the objectives. Stage two is the design phase starting from selecting media that is adapted to characteristics of trigonometry materials and vocational senior high school students, while the next step is selecting format to structure

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the task of solving problems related to vocational students. The final activities in this stage is designing the task of solving trigonometry based their differences in skill and cognitive style.

The last stage in this research is a developmental stage, which aims to generate tasks to solve trigonometry problem based differences in skill and cognitive style. Activities in this stage are expert validation, simulation and test of legibility, and field testing. After the drafting process was validated by 4 validators, 2 lecturers of dissertation advisor, 1 (one) mathematics teacher of Mechanical department in SMK Krian 1, 1 peer of writer who is expert in the field of trigonometry. The problem-task assessment was conducted by using *check mark* in the appropriate fields with assessment scores on the attachment. Based on the results of the assessment of validator, it can be concluded that the problem solving of trigonometry developed are good and can be used with minimal revision. The next step is to revise the results of the validation of the validator, followed by simulation and legibility test in class X-1 TPM 5 SMK Krian Sidoarjo. Based on the observations, there are many things in simulation activities that need to be corrected relating to the writing of sentence, and the explanation of sentence meaning in the problem solving of trigonometry.

The task of problem-solving (draft 1) was validated by expert and revised, and will produce task of problem-solving (draft II). After that, draft II which is based on result of simulation and legibility test (draft III) tested in the class of X-TPM 5 SMK Krian 1 Sidoarjo. The result makes the researcher see the students' profile and meta-cognitive in solving trigonometry problem respectively.

#### 4. CONCLUSIONS AND SUGGESTIONS

From the described objectives and results, it can be concluded that the development of problem-solving task of trigonometry based the differences in skill and cognitive style using modified four-D models, including: the stage of defining (define), design (design), and development (develop) and without deployment phase (disseminate). After conducting the expert validation, simulation and legibility test, field test, then analyzed. It indicates the necessary to do a few revisions. The revised task of solving trigonometry problems can be seen in Appendix

To improve students' understanding to solve task of trigonometry in mathematics due to the lack of mathematics books, especially for mechanical vocational senior high school either provided by government or market, it is needed to develop problem-solving task of trigonometry in topics or other materials than trigonometry materials.

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