Design of Mathematics Learning Devices Based On Professional Competency On Video Audio Engineering Expert Programs

D Kurniawan¹, A Armiati¹, A Fauzan¹, and Y Yerizon¹

¹Mathematics Department, Universitas Negeri Padang, Padang, Indonesia

*corresponding author: doni.kurniawan.ismail@gmail.com

Abstract. Vocational students are prepared to work and have expertise in the vocational field, therefore learning in vocational schools should pay attention to the professional competencies of the students themselves. Learning mathematics in vocational schools in learning mathematics does not relate the relationship of mathematics to the subject matter so that made students bored in learning mathematics and think mathematics is a difficult, unattractive and less useful lesson. Learners prefer productive subjects according to their professional competence. This will affect the purpose of learning mathematics in Vocational Schools in improving students' mathematical problem solving skills. The development of professional competency-based learning tools is expected to overcome the problem of increasing problem-solving skills of vocational students in the audio video engineering program. This study aims to develop learning tools in the form of Learning Implementation Plans (RPP) and Student Worksheets (LKPD) using the Plomp model which consists of three stages: preliminary research, stage prototype, and assessment phase. This article is a preliminary research phase, which is needs analysis, curriculum analysis, and concept analysis, analysis of students and teachers of vocational mathematics. Audio video techniques. The results in the Preliminary Research stage become a reference in designing products in the form of mathematics-based professional learning devices in the audio video engineering expertise program.

1. Introduction

Vocational high school (SMK), which is one of the continuations of basic education, is prepared students to work and have expertise in their vocational fields. The objectives of mathematics learning at SMK are contained in the [1] concerning the objectives of high school / vocational / MA mathematics learning include as follows:

- Understanding mathematical concepts, it is a competence in explaining the correlation between concepts and applying concepts or algorithms, in a flexible, accurate, efficient, and precise manner, in solving problems
- Using patterns as guesses in solving problems, and being able to make generalizations based on phenomena or existing data
- Using reasoning in nature, doing mathematical manipulation both in simplification, and analyze existing components in problem solving in mathematical contexts and outside mathematics
- Communicating ideas, reasoning, and being able to compile mathematical evidence using complete sentences, symbols, tables, diagrams or other media to clarify the situation or problem;
• Having an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as being tenacious and confident in problem solving;
• Having attitudes and behaviors that appropriate with the values in mathematics and learning, such as obedience, consistency, upholding agreement, tolerance, respecting other people's opinions, being polite, democratic, resilient, creative, respecting equality (context, environment), cooperation, fair, honest, thorough, careful, flexible and open, have the willingness to share with others
• Perform motor activities that use mathematical knowledge;
• Using simple teaching aids and technology to carry out mathematical activities. These skills or abilities are closely interrelated, one strengthens and requires the other.

From the goals of mathematics learning above, the ability to solve problems is an important part. This is in accordance "problem solving has an important function in mathematics teaching and learning activities". Thus it can foster responsibility, cooperation, fair competition and learning involvement [2]. In addition, in solving problems, vocational students can apply concepts and use skills in dealing with various problems encountered when entering the workforce.

The competency of audio video engineering is one of the competencies of expertise in the electronics study program at the technology and engineering vocational group. The aim of this study program is to equip students with knowledge and skills in the field of audio video electronics and a high work ethic. Competencies that must be mastered in audio video engineering competency are maintenance, planning, and repairing of electronic equipment and aircraft [3].

But in reality the state of mathematics learning that occurs in Vocational High Schools is not in appropriate with the expected goals. Moreover, the learning process of mathematics is still weak, the strategies and learning tools used by mathematics teachers are not in line with mathematics learning activities. Mathematics learning in Vocational School is still the same as other majors and tends to be the same as mathematics learning in high school, so students especially in Vocational Schools assume that mathematics is a difficult lesson, uninteresting and less useful. Students who participate in mathematics learning are less sincere because their interest and motivation towards students' mathematics learning is low, which in turn will affect the achievement of the goals of mathematics learning.

Vocational mathematics learning requires the involvement of the teacher as a facilitator in teaching mathematics learning to achieve competent mathematics learning objectives in vocational schools. This is in line with Sudjana's opinion [4] which states that: "Mathematics learning is a process or work of subject teachers in teaching mathematics to students, in which the efforts of teachers to create a climate and service to abilities are contained, potential, interests, talents, and needs about mathematics ".

The researcher choose an audio video engineering expertise program that would be developed for learning devices, namely learning tools based on professional competence. The reason the researchers chose the field of audio video engineering is because the field of expertise in Technology and engineering is a field of expertise that is much in demand by students and the unavailability of mathematics competency-based learning tools in Vocational Schools 2 Solok City.

To achieve the learning objectives and realize a good and directed learning atmosphere as required by the 2013 Curriculum, the tools that must be possessed by teachers before teaching are Learning Implementation Plans (RPP) and Student Worksheets (LKPD).

RPP is an important component in the curriculum that is carried out professionally. The implementation plan of learning is a guide to the steps that will be carried out by the teacher in the learning activities arranged in the activity scenario [5]. With the existence of RPP, teachers have guidelines in conducting the teaching and learning process. In addition, the lesson plan is prepared with the aim that learning can be carried out in a systematic, effective, and enjoyable and achievement of the expected learning objectives. The RPP used as a guideline for implementing learning by the teacher
should be prepared by the teacher in question and truly made a guideline in the implementation of learning.

Whereas LKPD According to the Ministry of Education [6] "Student Worksheets (sheets) are sheets containing tasks that must be done by students. In the process of learning mathematics, it is expected that teachers can design LKPDs in Vocational Schools in accordance with professional competencies and students' expertise programs. LKPD that is in accordance with the students' expertise program gives a good influence in the learning process of students. LKPD that is made can help students to understand the material and guide students in solving problems in a structured and systematic manner so that they can improve students' mathematical problem solving abilities.

Based on the description above, improvements to the learning device are needed in the form of RPP and LKPD. Learning tools that will be used to overcome the problems above are RPP and LKPD that are based on professional competence.

Learning tools are a guide for teachers in carrying out classroom learning. Concerning Basic and Secondary Education Process Standards stated that the compilation of mathematical learning tools is part of learning plan that can improve the ability of learners in learning and as a support for the achievement of mathematics learning goals [7].

Professional competency-based learning tools are learning devices designed by teachers specifically for vocational students, where vocational schools consist of several fields of expertise and majors. So that the learning device created must be in accordance with the needs of his field of expertise. Making this professional competency-based learning device (RPP and LKPD) is able to improve mathematical problem-solving skills in each field of expertise of vocational students.

Based on the descriptions above, the research was carried out with the title Development of Mathematics Learning Tools Based on Professional Competence in Vocational Audio Video Engineering Expertise Program.

2. Method
The research conducted in this study is developmental research. State that development research is a research method used to develop or validate products used in education and learning [8]. The research model used in this study is the development model of Plomp. Plomp provides a development model consists of three phases, namely the initial investigation phase (preliminary research), the development phase or prototype creation (development or prototyping phase), and the assessment phase [9].

In the initial investigation phase (preliminary research) there are several activities carried out, namely collecting data, analyzing and identifying problems that occur in learning as a basis for determining alternative solutions and product specifications needed, studying the scope of material needed to achieve competency achievement indicators. Analysis of this phase consists of needs analysis, curriculum analysis, concept analysis, student analysis.

3. Result and Discussion
At the Preliminary stage, it is needed to get information about the problems found in the Vocational School. At the preliminary stage this is done with several activities in it, namely as follows:

3.1. Needs Analysis
In needs analysis, the activities carried out is collecting information in the form of problems that exist in the process of mathematics learning. This activity was carried out by conducting observations and interviews with several teachers who teach in Vocational Schools as well as requesting data in the form of learning devices used so far. The observation activities were carried out to several mathematics teachers at Solok City Vocational High School 2 in May 2018.

From the observations and interviews that have been carried out there is an illustration that the learning devices used by teachers who in the implementation of mathematics learning tend to be the
same as learning mathematics in high school. The lesson plan does not describe how the relationship between mathematics and its expertise subjects so that saturated students in learning mathematics and think mathematics is a difficult, uninteresting and less useful lesson, which in turn affects the goals of mathematics learning at Vocational School in improving mathematical problem solving skills of the students. LKPD as a mathematical learning device and as a medium in learning mathematics. The teacher uses learning resources in the form of mathematical books that contain mathematical material in general such as high school lessons. Examples of existing questions are still direct, general and formal, less oriented to students' mathematical problem solving. Material that is not related to the professional competencies of each student this results in students not being accustomed to solving problem solving questions that are in accordance with one of the learning objectives.

3.2. Curriculum Analysis
The activity carried out in the analysis of this curriculum was to review the 2013 curriculum for mathematics subjects at Vocational High School in audio video engineering programs. The activity is to conduct a review of the analysis of content standards and basic competencies in mathematics subjects contained in the 2013 curriculum in Vocational Schools in audio video engineering expertise programs. Furthermore, it describes basic competencies into indicators of achievement of competencies and learning objectives.

3.3. Concept analysis
At this stage, the activities were carried out identifying concepts, detailing, and systematically arranging the materials to be studied by students. Concept analysis aims to determine the content and material of mathematics lessons needed in learning devices. In addition, in this concept analysis, looking for a relationship between productive material in the vocational study program, audio video engineering expertise and mathematics is the content of the learning tools that will be developed.

3.4. Analysis of students and teachers
In this analysis, a review of the characteristics of students was carried out, the ability of students in learning mathematics and the professional competence of students. The main characteristics of vocational school students are more like theory than practice and they don't like mathematics and low motivation to learn mathematics. The problem solving ability of students in Vocational School is still low because students are not yet accustomed to mathematical problem solving questions.

In addition, an analysis of the teacher was also conducted, namely the procedure for teachers to design mathematics learning tools for vocational students, learning models and learning strategies used by teachers and LKP used by the teachers themselves.

References
[1] Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 59 Tahun 2014 tentang tujuan pembelajaran matematika SMA/SMK/MA
[2] Hudojo H 2005 Pengembangan Kurikulum dan Pembelajaran Matematika (Malang: UM Press)
[3] Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 70 Tahun 2013 tentang kerangka dasar dan struktur kurikulum Sekolah Menengah Kejuruan
[4] Aini K Penerapan pendidikan matematika realistik (PMR) dalam meningkatkan kemampuan pemecahan masalah matematika peserta didik sekolah dasar Jurnal Autentik 1
[5] Trianto 2009 Mendesain Model Pembelajaran Inovatif-Progresif (Jakarta: Kencana Prenada Media Kelompok)
[6] Depdiknas 2008 Pengembangan Rencana Pelaksanaan Pembelajaran (Jakarta: Direktorat Jendral Manajemen Pendidikan Dasar dan Menengah)
[7] Peraturan Menteri Pendidikan dan kebudayaan Nomor 22 Tahun 2016 tentang Standar proses Pendidikan dasar dan Menengah
[8] Sugiyono 2006 Metode Penelitian Kuantitatif, Kualitatif dan R &D (Bandung: Alfabeta)
[9] Plomp T and N Nieveen 2013 *Educational Design Research* (Enschede: Netherland Institute for Curriculum Development (SLO))