Profile of mathematical knowledge for teaching of prospective mathematics teachers in develop the lesson plan

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Abstract. The purpose of this case study is to get description of mathematical knowledge for teaching (MKT) of prospective mathematics teacher in development the lesson plan. Subjects in this research are prospective mathematics teacher of Mathematics Education Study Program Universitas Kuningan Semester V academic year 2017/2018. Data analysis used in this research is qualitative data analysis technique that include data reduction, data display, as well as drawing conclusion and verification of prospective mathematics teacher work sheet, observation and interview. MKT is contributing the prospective mathematics ability teacher in developing set of lesson design of mathematics learning. Based on the case study, it can have concluded that: MKT of prospective mathematics teacher specifically in aspect 1) curricular knowledge, 2) planning for teaching and learning are still lacking. It can have caused by that prospective teachers who lack in curriculum knowledge, pedagogical knowledge and content knowledge. The result of this study can used as basis for development of learning trajectory that is able to train and give MKT of prospective mathematics teachers in develop of lesson plan.

1. Introduction

Prospective mathematics teachers essential to have suitable knowledge for teaching mathematics, to development of professional skills and competences in mathematics lessons. Prospective mathematics teachers’ knowledge for teaching mathematics as including two components, specifically mathematics content knowledge (MCK) and mathematics pedagogical content knowledge (MPCK) [1]. MCK and MPCK are combined into mathematical knowledge for teaching (MKT) [2]. The MCK structure, consists of four knowledge areas (number and operations, algebra and functions, geometry and measurement, and data and chance) and three cognitive areas (knowing, applying and reasoning). The MPCK structure, consists of three areas, specifically curricular knowledge, planning for teaching and learning, and enacting teaching and learning [2].

Developmental of professional skills and competencies: knowledge about subjects, pedagogy, assessment and learning [3]. To improve teaching capabilities that include content knowledge and pedagogical content knowledge can be done not only in teacher professional development programs but also in teacher education program [4]. Prospective mathematics teachers should study both aspects of mathematics content knowledge and pedagogical content knowledge in university [4,5]. The MCK and MPCK of prospective mathematics teachers are important aspect for researched, because the knowledge

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that prospective teachers have developed by the end of their last year of study may be a key indicator of
the success of their teacher education program [1]. Teachers’ knowledge impacts the mathematics
achievement of their students [6].

The research to explore MKT practice of prospective mathematics teachers. Obtaining description
profile of prospective primary teachers on MKT in traditional learning and problem-based learning [7].
Investigate the level of teaching knowledge attained by Malaysian prospective primary dan secondary
teachers [2]. The results of analysis show that Malaysian pre-service teachers at the primary and
secondary performed below the international average for MKT [2]. Investigate association between
Chinese elementary teaching MKT and their experiences in mathematics courses, mathematics methods
course and students teaching [8].

This study to explore the profile of mathematical knowledge for teaching (MKT) of prospective
mathematics teachers in development set of equipment mathematics learning in the form of lesson plan
and lesson material the two-variable linear equation system. One of the subjects in the study program
of mathematics education in Kuningan University which aims to prepare prospective teachers as a
professional teacher is "Lesson Design". This course is designed so that prospective teachers can pour
mathematics content knowledge and pedagogical content knowledge in the develop of lesson plan.
Lesson plan is a valuable professional activity for teachers, not only in acquiring teachers' understanding
of the textbook content but also in the thinking and skills of better learning methods [9]. Pedagogical
decisions, such as designing and planning activities, partly on content knowledge based [10]. General
pedagogy skill used in planning and structuring a mathematics lesson include managing the classroom,
organizing activities, lesson planning, motivating students and assessing mathematics content [11]. The
result obtained can be used as reference in developing learning trajectory that can improve MKT
prospective mathematics teachers in develop of lesson plan.

2. Method
The research is a case study. this research examines MKT of prospective mathematics teacher in the
course of Lesson Design. Subjects in this study were 32 prospective mathematics teacher (male 11 and
female 21) in the program of mathematics education of Universitas Kuningan semester V of academic
year 2017/2018. MKT of prospective mathematics teachers by work sheet find, observation and
interview about development set of equipment mathematics learning, in the form of lesson plan and
lesson material the two-variable linear equation system. MKT Prospective teacher’s skill in development
set of equipment mathematics learning are analyzed using aspect in specifically curricular knowledge,
planning for teaching and learning [12].

3. Results and discussion

3.1. Results description
Prospective teacher’s skill in development set of equipment mathematics learning by qualitative explore.
They are making the lesson plan according to the curriculum 2013 format, with reference to the syllabus
already available. According the work sheet of lesson plan, the concern is that the students have not
been well. Some part of the lesson plan developed by prospective mathematics teachers of material the
two-variable linear equation system.
Figure 1. Indicators of achievement of competencies formulated by prospective teacher.

Figure 1 shows that the basic competencies are Solve the two-variable linear equation system and its interpretation. The formulate learning goals are 1) Understand the system of linear equations, 2) Make a mathematical model of everyday problems related to the two-variable linear equation system, 3) solve everyday problems associated with the two-variable linear equation system. The formulated learning objectives have not been adapted to the problems that we will propose in the learning process. It shows that prospective teacher has not been able to decide learning objectives appropriately. Other than that, prospective teacher has not been able to find key ideas in the learning program.

Figure 2. Part of core learning activities in lesson plan developed by prospective teachers.

Figure 2 shows that in the lesson plan developed by prospective mathematics teachers using problem based learning model. But in the part of core learning activities, there is an activity to deliver the material and give an idea of material the two-variable linear equation system. The student’s activity is actively record material submitted and asked. It shows that prospective teacher has not been able to plan and choose the right activity. Other than that, prospective teacher has not been able to associate methods.

Figure 3. Use of learning media “Neon Linier”.

Figure 3 shows that in the lesson plan developed by prospective mathematics teachers using learning media, namely “Neon Linier”. In the part of core learning activities, there is nothing used Neon Linier. It shows that, prospective teacher has not been able to plan proper methods for representing mathematical ideas.
MODELING THE PROBLEM IN THE EQUATION OF LINE TWO VARIABLES

In an area of electrical networks die, up to several days due to natural disasters. So that for lighting the residents most use candles. Suppose there are two types of candles, first the candle with a height of 25 cm melts on average as high as 1.5 cm per hour and the second candle is 30 cm high melting on average as high as 2 cm per hour. When turned on together, when are the two candles the same height? How tall is it? Make a two-variable linear equation to state this problem using the steps provided.

Step 1: read and understand the problem well / find two quantities that are unknown and must be seek

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............... ..........................................................

Step 2: state these two quantities with variables x and y (may also use letters other than x and y)

Example:

x: ..........................................................
y: ..........................................................

Figure 4. Examples of problems on lesson design.

Figure 4. shows one of contextual problems associated with the two-variable linear equation system in lessen material. The prospective mathematics teacher not used the Neon Linier as learning medium that mentioned in the lesson plan, to solve the problem presented in the lesson material. It shows that prospective teacher has not been able to plan proper methods for representing mathematical ideas. Other than that, prospective teacher has not been able to link different approaches to problem solving.

Here are the results of interviews with one of the prospective teacher related to the work sheet of Lesson Plan that she has made:

Researcher : “Is this teh Lesson Plan you developed for material the two-variable linear equation system.”
Prospective Teacher : “Yes, ma’am”
Researcher : “The Learning model used, here written is problem solving”
Prospective Teacher : “Yes, ma’am”
Researcher : “In this lesson plan, there is mentioned the use of the two-variable linear equation system learning media that is Neon Linear”
Prospective Teacher : “Yeah, that's the learning media that I am with my group in the learning media course”
Researcher : “Good, you use the media in learning. You have also explained how to use the media in the developed lesson plan”
Prospective Teacher : “Yes ma'am”
Researcher : “But why on lesson design there is no activity to construct using Neon Linier media? Can you demonstrate the use of linear fluorescent media to solve the first problem in the lesson design”
Prospective Teacher : “Understand problems, plan solutions, implement plan solutions, and re-examine procedures and settlement steps”
Researcher : “Is it true that the step of the problem-solving learning model?”
Prospective Teacher : “Yeh, that's the steps of the problem-solving learning model.”
Researcher : “In this lesson plan, there is mentioned the use of the two-variable linear equation system learning media that is Neon Linear”
Prospective Teacher : “Hehe, yes ma'am. Not yet media usage in the lesson design. Eum, if to solve the first problem using Neon Linier rather hard ma'am”
Researcher : “Oh, its means Neon Linear media is hard to use in solving the first problem”
Prospective Teacher : “Yes ma'am”
Researcher : “It is good if making learning planning using media, media should be used in student activity in solving the problem in lesson design”
Prospective Teacher : “Oh, yes ma'am”
Researcher : “OK. Thank You”

3.2. Discussion

Based on the analysis of the work sheet in the form of lesson plan, interviews and observation activities of prospective mathematics teachers in the development set of equipment mathematics learning, has not shown the expected results. MKT of prospective mathematics teachers in the development set of equipment mathematics learning included in the low category in formulating learning indicator and learning goals, knowledge of planning for mathematics teaching and learning, enacting mathematics for teaching and learning. The prospective mathematics teachers generally formulate goals without adjustment to learning activities to make basic competence. For example, based on Lesson plan using Linear Neon media, learning objectives are student can 1) Understand the two-variable linear equation system using Neon Linier, 2) Make a mathematical model of everyday problems related to the two-variable linear equation system using Neon Linier, 3) solve everyday problems associated with the two-variable linear equation system using Neon Linier.

Indicators of learning are behaviors that used to show the basic attainment that becomes the subject of Lesson [13]. The formulate of learning indicators has a very important role in the develop of set of equipment learning. The learning indicators has function as guidelines in the develop of teaching materials, development learning activities, design and implementation the check of learning [14].

In developing teaching materials, prospective mathematics teachers do not adapt to the developed of lesson plan. For example, in the lesson plan written that learning using Neon Linear media, but in developing teaching material (lesson design) there is no use of media. It shows that students do not understand that the development set of equipment mathematics learning into an inter-related between lesson plan and teaching material (lesson design). The activities of designing learning activities and developing learning materials or teaching materials base on the formulate learning indicators [15].

Prospective mathematics teachers are also not good in determining contextual problems in teaching materials, which is by the characteristics of media that figure in the lesson plan. Prospective mathematics teachers also, have difficulty in formulating command sentences that ease students construct knowledge in developed teaching materials. Such as designing and planning activities, partly on content knowledge base [10]. This weakness can have addressed through personalization as an independent task [15].

Generally, the difficulties experienced by prospective mathematics teachers in development set of equipment mathematics learning are still the results as follows 1) have not been able to formulate the learning objectives of the existing basic competencies; 2) difficulties in representing the syntax of learning models in lesson plan in the form of teacher and student activities; 3) knowledge of the learning models is lacking, thus having difficulty in determining the learning model used to teach certain material; 4) students have difficulties in making contextual problems which become the basis for constructing the concept; 5) difficulties in formulating sentences in teaching materials intended for students to build their own knowledge; 6) students have difficulties in making teaching materials by selected learning model; 7) lack of understanding of the mathematical material that make of the teaching materials.

4. Conclusion

Based on the case study, It can be concluded that: MKT of prospective mathematics teacher specifically in aspect 1) curricular knowledge, 2) planning for teaching and learning are still lacking. In addition to development set of equipment mathematics learning, there is both MCK and MPCK include, such as planning lessons and activities that meet the needs of varied learners and understanding subject mater concept. Such as designing and planning activities, partly on content knowledge base. The result of this
study can be used as basis for development of learning trajectory that is able to train and give MKT of prospective mathematics teachers in the development set of equipment mathematics learning.

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