Curriculum analysis design and creative product craft expertise program in the developing the mathematics learning devices based on realistic mathematics education approach

I Putri1, A Armiati1*, D Permana1, and Y Yerizon1

1Mathematics Department, Universitas Negeri Padang, Padang, Indonesia

*corresponding author: armiati_math_unp@yahoo.co.id

Abstract. This research is development research using Plomp development model. This research aimed to analyze the curriculum between mathematics and productive subjects of design and creative product craft expertise program. Analysis curriculum aims to obtain information in developing the mathematics learning devices in the form of Learning Plans and Student Worksheet based on Realistic Mathematics Education (RME) approach

1. Introduction
Vocational High School or in Indonesian abbreviated as SMK is one level of education where the students are prepared to work and have expertise in according to the chosen expertise program. In accordance with Permendikbud No. 60 of 2014 on Curriculum 2013, SMK / MAK that vocational curriculum is divided into three subjects among others charge groups A, B, and C[1]. Payload subjects groups A and B is a group of general subjects, while subjects in group C contains about vocational specialization subjects.

Based on the attachment decision of the Director-General of Primary and Secondary Education No. 4678 / D / KEP / MK / 2016 on Spectrum's expertise program of SMK, there are nine areas of expertise that each area of expertise is divided into several program expertise, among others: (1) technology and Engineering with 13 expertise programs, (2) Energy and Mining with 3 expertise programs, (3) Information and Communication Technology with 2 expertise programs, (4) Health and Social Worker with 5 expertise programs, (5) Agribusiness and Agro technology with 6 expertise programs, (6) maritime with 4 expertise programs, (7) Business and Management with 3 expertise programs, (8) Tourism with 4 expertise programs, and (9) Arts and Creative Industries with 8 expertise programs[2].

In order for the purpose of learning in vocational reached then the efforts that teachers can do is to develop the potential of vocational learners in accordance with expertise programs. Based on the decision of the Director-General of Primary and Secondary Education No. 30 of 2017 concerning CC (Core Competencies) and BC (Basic Competence) Subject Payload National, that CC and BC in vocational divided into 3 parts: C1 (Basic Expertise), C2 (basic Skills Program), and C3 (basic Skills Competency) [3]. Thus, it can be concluded that C1, C2, and C3 is a mandatory competency in vocational students learn productively with expertise programs.

From some of these expertise programs, researchers choose Design and Creative Product Craft expertise program because this expertise program includes a focus on national development [4]. There are few job opportunities for Design and Creative Product Craft expertise program, such as performers
(products/works), art critic, artist, entrepreneur, fashion designer, or the advertising industry. Those job opportunities require communication skills. These communication skills can be trained and developed through the study of mathematics, due to communication skills included in mathematics in vocational learning objectives in accordance with Permendikbud No. 59 of 2014 regarding curriculum SMA / MA / SMK / MAK [5].

However, in reality, the process of learning mathematics in vocational still not in line with expectations. Based on observations in class X SMKN 8 Padang on 6th – 7th September 2018 and SMKN 4 Pekanbaru on 19th and 26th September 2018 showed that the learning process is still dominated by the teacher as for the education of students tend to accept the concept or formula of teachers without getting involved in finding it. This is according to research conducted Firdawati and Wahyu, the result that there is a relationship between students’ learning activeness on mathematical communication skills. In other words, if the activity of learning students classified as either the mathematical communication skills are also good and vice versa [6]. Then, the results Rahmayanti and Sumartini also stating that the communication skills of vocational students are still low [7], [8].

Armiati and Hestu research results and states that the cause of mathematics courses at the vocational less desirable learning devices and teaching materials used by teachers either general or the same as learning devices and teaching materials used in high school [9,10]. This causes less interested learners to follow learning of mathematics.

Based on the above problems, needs a revision of the learning device used. Learning device materials used should relate math competency skills program for the learning process more interesting and meaningful so as to improve the communication of mathematical learners. So, we need an approach that connects the material math competency skills program, which can attract the interest and attention of learners in the learning process.

To be a learning tool developed is related to the subjects of productive learners should certainly do the analysis of the curriculum. This curriculum analysis performed on the mathematics and subjects of productive learners membership of design and creative product craft expertise program. The purpose of this curriculum analysis is to determine the productive subjects anywhere that context can be used and adapted to the indicators and material mathematics. Thus, before being developed and used in the learning process necessary for an analysis of the curriculum first so the resulting device can improve the communication skills of students mathematical design and creative product craft expertise program.

2. Materials and Methods

This research is developmental research by using Plomp development model. Plomp development model chosen because it has several advantages including in terms of practicality, where practicality assessed through three stages, namely the one-to-one evaluation, small group, and field evaluation test [14]. Analysis curriculum is part of a development model [15]. Due to this research study on curriculum analysis, this research includes descriptive qualitative research. Data collection techniques by triangulation (combined), data analysis is inductive/qualitative and qualitative research results further emphasize the significance of the generalization. Descriptive aims to describe the systematic and accurate facts and characteristics of issues gained in the field.

Sources of data obtained from observations, interviews, and documents. Methods of data collection in the form of a combination of observation, interviews, and documents. This interview was conducted with the subjects of mathematics teachers who teach in class X of Design and Creative Craft Products skills program. Analysis of the data in this study using an interactive model that consists of data collection, data reduction, data presentation, and conclusion data. Some stages are carried out for the curriculum analysis to view and analyze the mathematics curriculum subjects and prolific with BC and indicators see each curriculum. After that, an analysis of the BC on mathematics and subjects the material productive by adapting productive subjects anywhere that context can be used for mathematical material.
3. Results and Discussions
Before analyzing the curriculum, the first researcher doing interviews with the subjects of a mathematics teacher at SMKN 8 Padang on 7th September 2018 and SMKN 4 Pekanbaru on 26th September 2018. From the interviews, we obtained information that learners do not like to study mathematics because the material is hard to understanding and does not have a relation with the membership program. In addition, the learning resources that are used only printed books. Then from the results was observed that during the learning process the teacher no matter relate math skills program learners. This causes the students to think math is only compulsory subjects only and has nothing to do with their skills program so that students actively participate less in learning mathematics.

Efforts that teachers can do that is by linking the material math and programming skills of learners. The process of linking the mathematical material with learners' skills program called curriculum analysis. At this stage of the curriculum analysis, an analysis of the content of the mathematics curriculum in 2013 at SMK. This analysis aims to look at Core Competence (KI), Competency, Competency Achievement Indicators and learning of mathematics in vocational goal. Learning mathematics in vocational referring to the decision of the Director-General of Primary and Secondary Education No.330 / D.D5 / KEP / KR / 2017 on vocational education curriculum structure in which there are some basic competencies that are taught to the students of SMK.

However, due to limited conditions and time, the curriculum analysis in this study is limited to the class X of the first semester. The Basic Competency on the first semester of class X was reformed by VHS hereinafter MGMPs serve as guidelines for the curriculum analysis in this study.

| Materials                          | Basic Competencies (BC) on Mathematics                                                                 |
|-----------------------------------|-------------------------------------------------------------------------------------------------------|
|                                   | Knowledge                                                                                             |
| Exponents and Logarithms          | 3.1 Selecting and applying the rules of exponents and logarithms according to the characteristics of the problems to be solved and verify the steps. |
|                                   | 4.1 Presents a real problem using algebraic operations in the form of exponents and logarithms and solve them using the properties and rules that have been proven true. |
| Absolute Value Equations and Inequalities | 3.2 Describes and analyzes the concept of the absolute value equations and inequalities and apply them in solving real problems. |
|                                   | 4.2 Apply concept in the absolute value equations and linear inequalities in solving real problems. |
|                                   | 4.3 Make the mathematical model in the form of linear equations and inequalities involving two variables that the absolute value of the real situation and mathematics, as well as determine responsibility and analyze the model as well as the answer. |
| Systems of Linear Equations Two and Three Variables | 3.3 Describing the concept of systems of linear equations in two and three variables and able to apply effective strategies in determining the set of settlement |
|                                   | 4.4 Creating a mathematical model in the form of SPLDV and SPLTV daari real situation and to determine the answer. |
| Relationships and Function        | 3.4 Describes the area of origin, comrade, and the range of a relation between two sets yang presented in various forms (charts, the set of ordered pairs, or a symbolic expression). |
|                                   | 4.5 Applying the area of origin, and the range of functions in solving the problem. |
Sequence and series 3.6 Predict patterns of sequence and series of arithmetic and geometry or row, more through observation and give the reason.

4.6 Presenting the results, find the pattern of sequence and series and its application in solving simple problems

Source: MGMPs SMKN 4 Pekanbaru

From table 1 above, BC on this mathematical material will then be associated with BC productive subjects on Design and Creative Craft Products skills program. Researchers conducted the study on subjects BC productive and Design and Creative Product Craft expertise program by looking at indicators and context are taught. So we get to the math BC between mathematics and productive subjects.

Based on the analysis of the BC of mathematics subjects and the productive subject of mathematics, not all mathematics BC can be linked with the subject of productive, e.g., exponents and logarithms. Material exponents and logarithms generally discuss the concept of exponents, equations and inequalities exponent, the concept of logarithms and logarithmic equations and inequalities have nothing to do with the subject of productive learners’ membership of Design and Creative Product Craft expertise program focusing learners to create a product and sell it. Thus, some of the material in class X first-semester mathematics there are 4 items that have relevance to the subject matter productive learners, including absolute value equations and inequalities.

Here is an example of the use of context on subjects productive in matter of mathematics:

Figure 1. An example of the use of context in the material productive subjects Systems of Linear Equations Two Variables

Both the image above is an example of a mathematical relationship with BC productive subjects in materials Systems of Linear Equations Two Variables. It is seen that the issues presented on making doormats of patchwork in two forms: round and rectangular as well as issues concerning the purchase of equipment such as canting batik and night. The context of the problems of patchwork mat included in BC subjects of sewing and batik tool context issues are included in BC subjects’ batik. Here's an example of the use of other contexts:
Figure 2. An example of the use of context in the material productive subjects

Systems of Linear Equations Two Variables

Figure 2 is an example of the problems in the context of SPLDV material. The figures show that the context of the problem that is used in the manufacture of accessories and sweets and wall decorations with Arabic calligraphy shaped wall and cobwebs. Both this context included in the program of productive subjects BC of Program Design Expertise and Creative Product Craft. Making the candy holder and accessories is on subjects BC working techniques bench while the manufacture of wall decoration is one of the BC on the subjects of productive work carving techniques.

By doing the math curriculum analysis of the BC and BC subjects presented productive course can vary according to the subject BC productive learners. In addition, the learning process begins from close thing for students in this program expertise will certainly attract the interest and attention of learners. Then, with the presentation of the problems associated with the expertise program can motivate learners so that the activity during the study will be created for the learning process more meaningful.

4. Conclusion

RME-based math learning devices developed in this study is limited to the analysis stage of the curriculum. Analysis curriculum aims to connect mathematics subject with productive subject of Design and Creative Product Craft expertise program. This is done to find out which contexts in the expertise program can be used in learning mathematics. Thus, the process of learning mathematics begins with something that is close to learners, namely their expertise program.

According to analysis carried out showed that not all of the BC on math materials can be linked with BC in the productive subject. Thus, from 5 math material presented in the first semester of only four materials that can be attributed to the program expertise of learners, including absolute value equations and inequalities, systems of equations in two and three variables, relations and functions, as well as the sequence and series.

References

[1] Permendikbud 2014 Kerangka Dasar dan Struktur Kurikulum Sekolah Menengah Kejuruan/Madrasah Aliyah Kejuruan (Jakarta: Depdiknas)
[2] Direktur Jenderal Pendidikan Dasar dan Menengah 2016 Spektrum Pendidikan Menengah Kejuruan (Jakarta: Dirjen Pendidikan Dasar dan Menengah)
[3] Direktur Jenderal Pendidikan Dasar dan Menengah 2017 Kompetensi Inti dan Kompetensi Dasar Mata Pelajaran Muatan Nasional (Jakarta: Dirjen Pendidikan Dasar dan Menengah)
[4] Kominfo.go.id 2017 Revitalisasi SMK Untuk Produktivitas dan Daya Saing Bangsa

[5] Permendikbud 2014 Kerjanya Dasar dan Struktur Kurikulum Sekolah Menengah Kejuruan/Madrasah Aliyah Kejuruan (Jakarta: Depdiknas)

[6] Intan F and Hidayat W 2018 Hubungan antara keaktifan belajar siswa terhadap kemampuan komunikasi matematis siswa SMK Jurnal Visipena 9

[7] Rahmayanti, Rizki K, Hasanuddin, Zulkifli N 2018 Pengaruh penerapan metode pembelajaran aktif modelling the way terhadap kemampuan komunikasi matematis ditinjau dari kemampuan awal siswa smk taruna pekanbaru” Juring (Journal for Research in Mathematics Learning) 1 65-70

[8] Sumartini TS 2017 Meningkatan Kemampuan Komunikasi Matematis Siswa Melalui Model Pembelajaran Predict Observe Explanation JES-MAT

[9] Armiati 2008 Pengembangan Modul Matematika Berbasis Kompetensi Profesi Pada Sekolah Menengah Kejuruan Teknologi Dirjen PT Depdiknas. Penelitian Hibah Bersaing: FMIPA-UNP

[10] Armiati, La’ia HT 2018 The developed mathematics learning devices which based on professional competency in the phase of one to one evaluation for trigonometry topic in the major of information and communication engineering of SMK 2nd International Conference on Mathematics and Mathematics Education 2018 (ICM2E 2018) advances in Social Science, Education and Humanities Research (ASSEHR) 285

[11] Fauzan A 2002 Applying realistic mathematics education (RME) in teaching geometry in indonesian primary schools (Den Haag: Univeristy of Twente)

[12] Parida I 2018 Improving the ability of mathematic communication through the realistic mathematic education approach (RME) at the student class IV New SDN Karang 04 Cikarang Utara-Bekasi American Journal of Educational Research 6

[13] Zulyadaini 2017 Development of student worksheets based realistic mathematics education (RME) IJERD 13 1-14

[14] Plomp T and Nievenn M 201 Educational Design Research-Part A : An Introduction Enschede Netherland Institute for Curriculum Development (SLO) PQ4R Strategy Accompanied by Refutation Text Reading

[15] Arnawa IM, Yerizon, Nita S and Putra RT 2019 Int J. Sci Tech Res. 8 287-92