

PAPER • OPEN ACCESS

An analysis of the relevancy between mathematics and productive subject in computer and network engineering program at vocational high school

To cite this article: Wahyuni Silvia and Armiati 2019 *J. Phys.: Conf. Ser.* **1317** 012016

View the [article online](#) for updates and enhancements.

You may also like

- [Risk of diseases of the circulatory system after low-level radiation exposure—an assessment of evidence from occupational exposures](#)
Richard Wakeford
- [A review of radiation doses and associated parameters in Western Australian mining operations that process ores containing naturally occurring radionuclides for 2018–19](#)
Martin I Ralph, Andrew Chaplyn and Marcus Cattani
- [Development of Vocational High School based on regional potential](#)
YY Cahyaningrum and Dr. Wagiran



ECS
The
Electrochemical
Society
Advancing solid state &
electrochemical science & technology

DISCOVER
how sustainability
intersects with
electrochemistry & solid
state science research

An analysis of the relevancy between mathematics and productive subject in computer and network engineering program at vocational high school

Wahyuni Silvia* and Armiati

Mathematics Departement FMIPA Universitas Negeri Padang West Sumatera,
Indonesia

*unaymath93@gmail.com

Abstract. The fast development of science and technology and the workforce competition in this globalization era, require education academy to produce a competent and good quality of human resources in their field. Vocational high school is an education academy that is expected to create professional and productive human resources to fulfil every skill pursuit that is needed in the workforce. Computer and network engineering program and mathematics have a role in science and technology development and in the workforce competition. Productive subject in computer and network engineering will produce productive and professional graduates that can compete in the workforce. Since the activity that include mathematics could develop logical reasoning, logical thinking, systematic, critical, neat and objective, mathematics could help computer and network engineering graduates in solving the problem in the workforce. This paper will deliver the relevancy between mathematics and productive subject in computer and network engineering program at vocational high school.

1. Introduction

Vocational high Schools as formal education institutions have an important role to produce a good quality and competent human resources in their fields and are coming the workforce professionally and productive. the Vocational high schools graduates are more prepared to work than continue their study in a higher education. to achieve this goal, vocational schools adhere to the principles of education and efforts to produce more productive graduates. Through vocational high school education, students are given a variety of skills in accordance with their fields and are prepared to enter the workforce. According to Jatmoko [1] Vocational High Schools become educational institutions that produce good quality of human resources and competent that are the needed in the workforce.

Permendikbud Number 70 Year 2013 concerning the basic framework and curriculum structure of Vocational High School / Vocational Madrasah Aliyah , Vocational Schools are divided into several areas of expertise namely: (1) Technology and Engineering, (2) Information and Communication Technology, (3) Health, (4) Agribusiness and Agrotechnology, (5) Fisheries and Maritime Affairs, (6) Business and Management, (7) Tourism, (8) Fine Arts and Crafts, (9) Performing Arts. In the field of information and communication technology expertise has many expertise programs, one of which is a computer and network engineering expertise program.

The development of information and communication technology will never stop. The use of technology that is increasingly prevalent in Indonesian society and even the world such as computers,



Content from this work may be used under the terms of the [Creative Commons Attribution 3.0 licence](https://creativecommons.org/licenses/by/3.0/). Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

cellphones, internet, telephone and television business makes entrepreneurs in the field of technology and information much need competent, productive and professional human resources. In addition, from time to time human needs for computer networks continue to increase. Everyone demands to be able to connect with others and everyone demands to be able to obtain information quickly and accurately. With all the demands about these networks and computers, computer and network engineering graduates have the skills to meet all the demands of computer networks

The rapid development of science and technology and the competition in the workforce in this globalization era, requires educational institutions to produce qualified and competent human resources in their fields. In this case mathematics is one of the sciences that has a large role in dealing with the development of science and technology. This is in line with the opinion of Sumarmo (2006: 1) which states that mathematics education is an active, dynamic and generative process, with mathematical activities students can develop reasoning, logical thinking, systematic, critical and careful and be objective and open in facing various problems. Therefore, it is not surprising that mathematics is a subject learned at various levels of education with the aim of improving the quality of human resources.

The importance of learning mathematics requires teachers to create learning conditions that can attract students' interest in learning mathematics and more easily understand the material delivered by the teacher. The success of learning is largely determined by the design of learning tools that the teacher will use in the learning process. Learning devices function as a means of guiding the course of the learning process. The learning tools consist of Learning Implementation Plans and Student Worksheets.

From the data of observations and interviews at Vocational High School 6 Padang, learning mathematics has used the 2013 curriculum, but the learning process has not been fully in accordance with the devices made. Classroom learning process is still dominated by teachers and students appear to be less active in the learning process. The interest of students towards mathematics is still not visible. The cause of the lack of interest of students towards mathematics in the learning process is that the tools used by teachers are still general in nature, namely the learning tools used are the same as the RPP used in high school. In addition students think that mathematics is a difficult lesson. Some students said that they chose a Vocational High School in addition to gaining expertise in computer and network engineering skills programs but also because they avoided math.

Availability of adequate learning tools, will help teachers in carrying out the learning process so that the learning goals and objectives can be achieved. In addition to achieving the goals and objectives of learning in vocational schools, the tools that teachers use must be based on professional competencies and expertise programs that are of interest to students who can improve student achievement and learning outcomes. Professional competency-based learning devices in question are devices that pay attention to work in accordance with the program of expertise taken by students.

Of the above problems, it is necessary to develop learning tools namely RPP and LKPD based on professional competencies in computer and network engineering expertise programs. Based on some descriptions above this research will discuss curriculum analysis on the development of professional competency-based learning tools in computer and network engineering expertise programs

2. Research Methods

This research is the initial stage in conducting development research with a development model adapted from the Plomp model. This model was developed by Tjeerd Plomp which consists of three stages, namely the initial investigation stage (preliminary research), the development or prototype development phase (development or prototyping phase), and the assessment stage [2]. The initial investigation phase is aimed at determining the basic problems needed for the development of professional competency-based mathematics learning tools in computer and network engineering expertise programs. At this stage needs analysis, curriculum analysis, concept analysis and analysis of students and teachers. In this paper a curriculum analysis will be explained which will show the relationship between mathematics subject matter and productive subject matter in computer and network engineering expertise programs.

3. Results And Discussion

At the stage of curriculum analysis, a review of the structure of vocational curriculum, curriculum structure of computer and network engineering expertise programs, mathematics subjects in vocational schools, as well as links between mathematics subjects and productive subjects in computer and network engineering expertise programs. In the Republic of Indonesia Education and Culture Regulation Number 70 of 2013 concerning the Basic Framework and Curriculum Structure of Vocational High Schools, it is explained that the curriculum of Vocational High Schools is designed with the view that Senior High School and Vocational High School are basically secondary education, the difference is only in accommodating students' interests when entering secondary education. Therefore, the general structure of Vocational High School is the same as the general structure of Senior High School, namely there are three groups of subjects which can be seen in the following table.

Table 1. General Subjects of Vocational Schools

General Vocational School		
Group A (Required)	Group B (Required)	Group C (Productive)
1. Religious Education and Characteristics	1. Cultural Art	Academic Productive and Vocational Subjects
2. Pancasila and Citizenship Education	2. Physical Education, Sports and Health	
3. Indonesian	3. Workshops and Entrepreneurship	
4. Mathematics		
5. Indonesian history		
6. English		

In Vocational Schools, productive group subjects (C) consist of: groups of basic subject areas of expertise (C1), groups of basic subjects of expertise programs (C2) and groups of subject matter packages (C3)

Vocational Secondary Schools are divided into several fields of expertise namely Technology and Engineering, Information and Communication Technology, Health, Agribusiness and Agrotechnology, Fisheries and Maritime Affairs, Business and Management, Tourism, Fine Arts and Craft and Performing Arts. Of the nine areas of expertise that exist in Vocational High School, they are further divided into several skill programs.

Computer and network engineering is one of the expertise programs in the fields of Information and Communication Technology expertise. Based on Permendikbud Number 70 of 2013 [3] productive subjects in computer and network engineering expertise programs can be seen from the following table.

Table 2. Productive Subjects Of Computer and Network Engineering Expertise Programs

Productive Subjects of Expertise Programs Computer and Network Engineering		
Basic Areas of Expertise (C1)	Basic Expertise Program (C2)	Expertise Package (C3)
1. Physics	1. Computer Systems	1. Broad-Based Network Technology
2. Basic Programming	2. Basic Computers and Networks	2. Network Infrastructure Administration
3. Computer System	3. Basic Programming	3. Network System Administration
	4. Basic Graphic Design	4. Network Service Technology
		5. Creative Products and Entrepreneurship

Based on Kepmendikbud Number: 130 / D / KEP / KR / 2017 [4] concerning the structure of the curriculum of vocational secondary education presents Core Competencion (CC) and Basic Competencion (BC) of mathematics in Vocational Schools. CC, a mathematics BC in Vocational School is divided into two parts, namely CC, BC technology mathematics and CC, BC non-technology

mathematics. Computer and network engineering expertise programs, CC and mathematics BC are used are CC and BC technology mathematics in computer and network engineering expertise programs in class X Semester 1. Given the developed learning tools are professional competency-based mathematics learning tools in computer engineering expertise programs and a network that includes mathematical problems associated with computer and network engineering expertise programs. Therefore, mathematics BC can be associated with BC in productive subjects in computer and network engineering expertise programs which can be seen in the following table.

Table 3. BC Mathematics Subjects and Vocational Productive Subjects in Computer and Network Engineering Expertise Program

Mathematics		Productive	
Knowledge	Skills	Knowledge	Skills
3.1 Applying the concept of numbers, root forms and logarithms in solving problems	4.1 Presents the resolution of problem of number, root shape and logarithm	3.1 Understanding number systems: Decimal, Binary, Hexadecimal (Computer Systems) 3.9 Analyze memory based on memory system characteristics: location, capacity, speed, way of access, physical type (Computer System) 3.5 Applying arithmetic and logic operations (Basic Programming)	4.1 Convert number systems: Decimal, Binary, Hexadecimal (Computer Systems) 4.9 Make an alternative need to modify some memory in a computer system (Computer System) 4.5 Creating program code with arithmetic and logic operations
3.2 Apply the equation and the absolute inequality of the linear form of a variable	4.2 Resolve the problems associated with the absolute value equation and inequality of the linear variable one	3.1 Analyzed broad-based networks (WAN technology) 3.7 Evaluating fiber optic connection (WAN technology)	4.1 Making broad-based network design (WAN Technology) 4.7 Conducting a fiber optic connection (WAN technology)
3.3 Determine the value of a variable in a system of linear equations of two variables in contextual problems	4.3 Presenting the solution to the problem of a two-variable linear equation system	3.10 Analyzing CPU Structure and CPU functions (Computer Systems) 3.1 Implementing a network operating system (Network System Administration)	4.10 Presenting internal CPU (Computer System) circuit 4.1 Installing a network operating system (Network System Administration)
3.4 Determine the maximum and minimum values of contextual	4.4 Presents contextual problem solving related to the	3.2 Applying computer assembly (Computers and Basic Networks) 3.8 Evaluating external devices / peripherals (Computer Systems)	4.2 Assembling computers (computers and basic networks) 4.8 Assembling external devices with consule units 4.2 Repairing the VLAN (Network Infrastructure

	problems related to linear programs of two variables	linear two variable program	3.2 VLAN (Network Infrastructure Administration) Problems 3.3 Applying computer assembly tests (Computers and Basic Networks) 3.5 Applying image / illustration / text scanning procedures in design (Basic Graphic Design) 3.16 Evaluating network security systems (Network System Administration) 3.12 Applying IP addressing on computer networks (Computers and Basic Networks) 3.11. evaluate the manufacture of bitmap image-based designs (Basic Graphic Design) 3.9 Analyze memory based on memory system characteristics: location, capacity, speed, way of access, physical type (Computer System) 3.13 Applying sharing resources on computer networks (Computers and Basic Networks)	Administration) configuration 4.3 Testing computer performance (Computers and Basic Networks) 4.5 Perform the process of scanning text images / illustrations with a scanner in design (Basic Graphic Design) 4. 16 Configure the network security system (Network System Administration)\ 4.12 Configure IP addressing on computer networks 4.11 makes a bitmap image-based design (Basic Graphic Design) 4.9 Make an alternative need to modify some memory in a computer system (Computer System) 4.13 Installing shared resources on computer networks (Computers and Basic Networks)
3.5	Analyzing arithmetic sequences and series	4.5 Resolving contextual problems related to arithmetic sequences and series		
3.6	Analyze geometric ranks and series	4.6 Resolve contextual problems related to geometric ranks and series		
3.7	Analyzing growth, decay, interest and annuities	4.7 Resolve contextual problems related to growth, decay, interest and annuities	3.7 Analyze the production costs of prototypes of goods / services (Creative Products and Entrepreneurship)	4.7 Calculating the cost of producing prototype goods / services products (Creative Products and Entrepreneurship)

Mathematical materials taught in class X of Vocational High School Semester 1 are (1) Rank Numbers, Root Forms and Logarithms, (2) Equations and Inequalities of Absolute Values of Linear One Variable Forms, (3) Two Variable Linear Equation Systems, (4) Linear Programs, (5) Arithmetic ranks and series, (6) Geometry ranks and series and (7) growth, interest and annuity decay. However, based on the results of the MGMP in Mathematical Vocational High School, not all of the mathematics material is taught in class X of Semester 1 Vocational Schools because some are taught in class XII

The following explains examples of the relationship between mathematics learning material in BC 3.1 Applying the concept of number, root shape and logarithm in solving problems with productive material in BC 3.9 Analyzing memory based on memory system characteristics: location, capacity, speed, way of access, physical type (Computer System) BC 3.1 in mathematics studies discusses the number, root shape, equation in the form of rank and logarithm. BC 3.9 in Computer Systems subjects

discusses the characteristics of the system memory, location of memory, memory capacity, speed, way of access, physical type and maintenance. An example of the problem that is made in the following is the relationship between the material of the numbered equation and the memory treatment.

Problem Identification:

Pita Pertiwi is a student of vocational school majoring computer and network engineering. Her teacher gave her a task to clean up the virus in Seagate Hardisk on a PC by using Bitdevender antivirus. Bitdevender antivirus makes bad virus population decrease $T = 37^{5-x}$, where x is the time used (in minute). How long does it need to make the virus 1 left?

Solution:

In order to make left 1 virus, so function $T = 1$. X score can be counted as follows:

$$37^{5-x} = 1$$

$$37^{5-x} = 37^0$$

$$5 - x = 0$$

$$x = 5$$

Thus, bad virus population will only 1 left after 5 minutes.

4. Conclusion

Based on the discussion are obtained general subject category for vocational high school consist of A category (required) that include math subject, category B (required) dan C (productive) consist of basic skill subject category (C1), basic skill program subject (C2), and skill package subject category (C3). There is connection between basic competition of math subject and basic competition in computer and network engineering skill program

References

- [1] Jatmoko, Dwi. (2013). Relevansi Kurikulum SMK Kompetensi Keahlian Teknik Kendaraan Ringan Terhadap Kebutuhan Dunia Industri di Kabupaten Sleman. Jurnal Pendidikan Vokasi 3(1):1-13
- [2] Plomp, T dan N. Nieveen. (2013). Educational Design Research. Enshede: Netherlands Institute for Curriculum Development (SLO).
- [3] Kementrian Pendidikan dan Kebudayaan Keputusan Direktur Jenderal Pendidikan Dasar dan Menengah Nomor: 130/D/KEP/KR/2017 tentang Struktur Kurikulum Pendidikan Menengah Kejuruan
- [4] Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 70 Tahun 2013 tentang Kerangka Dasar dan Struktur Kurikulum SMK/MAK.