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Analysis of the relevance between Vocational High School competencies and the needs of the industrial sector on Computer and Network Engineering Competencies

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Abstract. The curriculum applied in vocational schools aims to synchronize graduate competencies with the demands of the industrial sector on workforce competencies. This study aims to analyze the relevance of the 2013 Vocational High School curriculum on Computer and Network Engineering Competencies and the needs of the workforce in the Telecommunications Industry Sector. This research was conducted using quantitative descriptive methods. The study population was the Vocational High School and the Telecommunications Industry in West Java Province and DKI Jakarta. The sample is determined by purposive sampling technique for the Telecommunications Industry and saturated sampling for Vocational High Schools. Participants in this study were 6 respondents from the Vocational High School and 21 respondents from the Telecommunications Industry. The research instrument used was a questionnaire. The analysis technique used is recall and precision. The results showed a high relevance between Basic Competence in the field of computer and network engineering and the need for workforce in the telecommunications industry sector by 83.84%.

1. Introduction

Vocational schools in implementing their education programs have a curriculum. The curriculum, in this case, is a set of plans and arrangements regarding the purpose, content, and material of the lesson as well as the methods used as guidelines for the implementation of learning activities to achieve certain educational goals. In the field of education, the curriculum is an important element in any form and model of education. Without a curriculum, it is difficult for educational planners to achieve their educational goals. The relevance of vocational schools to the workplace causes the curriculum implemented in schools to meet the minimum criteria demanded by the workplace. As in the Regulation of the Director-General of Primary and Secondary Education of the Ministry of Education and Culture number: 06 / D.D5 / KK / 2018 deciding on the third point that in each skill competency opened, vocational high school can specialize certain competencies (concentration of expertise) according to the demands the needs of the workforce are related to not ignoring the basic abilities of these skills [1]. Based on these regulations students are required to be able to master certain competencies according to the needs of the workforce.

Current labor issues state that the industry is still low in absorbing vocational graduates, one of which is due to minimal skills or expertise. To improve vocational graduates, the Head of Sub Directorate of the Directorate of Vocational Alignment and Industrial Cooperation of the Ministry of Education and

Culture pushed for the school level to synchronize the curriculum where content must always be updated. Because the demands of the workplace are always changing [2].

The gap that occurs between Vocational Schools and Industry, especially in the Nasional Vocational High School 4 Bandung, according to its graduates, is due to not yet being taught some of the basic competencies needed by industry. Not all basic competencies were taught due to practicum tools were not yet available and the teacher could not predict the technology needed by the industry that would develop in the future. Conformity between basic competencies in schools and what is needed by the industry will facilitate synergy between Vocational Schools and the needs of the industrial world. According to the minister of education and culture of the Republic of Indonesia Regulation Number 24 of 2016, the basic competencies in the 2013 curriculum must contain the ability and learning material for a subject in each education unit.

Based on the background, it is very necessary to review the relevance of vocational competencies with the competencies needed by the workplace. In this study, we focus on Computer and Network Engineering competencies skill.

2. Vocational education and curriculum

Vocational education is an effort to provide a stimulus in the form of learning experiences and interactions with the world outside of the students to help them develop themselves and their potential [3]. Curriculum is an important part of vocational education. The curriculum is a series of activities carried out by students in the school environment and under the responsibility of the school, in this case, is the vocational curriculum. As one expert explained, according to Saylor J. Gallen and William N. Alexander in his book "Curriculum Planning" states the curriculum is "The entire school effort to influence learning both take place in class, on the page or outside the school" [4]. The relevance of vocational schools to the workplace causes the curriculum implemented in schools to meet the criteria set by the workforce. To achieve industrial needs, revitalizing VHS is needed to encourage industries and Vocational Schools to carry out education by the needs of two parties namely school and industry [5].

The development of the curriculum in Indonesia that the curriculum has been replaced 11 times from the beginning of independence, this can be seen in figure 1.

Figure 1. The development of the curriculum in Indonesia.

Based on figure 1, it can be seen from the development of curriculum usage since 1947 called the Lesson Plan to the revised 2013 curriculum. Since 2013 all schools including Vocational Schools are required to use the revised 2013 curriculum that is applied nationally.

2.1. Competence and basic competence

According to Government Regulation No. 32 of 2013 concerning national education standards, states "Competence is a set of attitudes, knowledge, and skills that must be owned, internalized, and mastered by students after learning a learning content, completing a program, or completing a particular education unit" [6]. The core competency in the 2013 curriculum is the level of ability to achieve graduate competence standards that must be possessed by students at each grade level. Basic competence in the 2013 curriculum contains the ability and learning material for a subject in each education unit that refers to core competencies [7].

2.2. Theory of suitability

The suitability is the appropriate subject matter; harmony (about opinions, understandings, tones, color combinations and so on; compatibility). Thus, what is meant by conformity in this study is the alignment or compatibility of the basic competencies of the revised 2013 curriculum with the needs of the working sector of the industrial sector. The suitability of basic competencies will facilitate the synergy between vocational high schools and the needs of the industrial world. This is in line with one of the objectives of vocational education, namely to prepare graduates to work directly in the industry [8].

2.3. Workplace and industry

According to law Number 3 of 2014 concerning Industry states "Industry is all forms of economic activities that process raw materials or utilize industrial resources to produce goods that have higher added value or benefits, including industrial services" [9]. The industry is an effort to process raw materials or semi-finished goods into finished goods that have added value to obtain profits [10]. The workplace is a complex environmental condition that has various interrelated aspects. Aspects of the workplace include aspects of the work environment and individual aspects. The workplace and the industrial world is a complex environment that has an important role in improving the economy.

2.4. KKNI

The Indonesian National Qualifications Framework (KKNI) is a competency qualification framework that can juxtapose, equalize and integrate between the field of education and the field of job training and work experience to provide recognition of work competencies by the work structure in various sectors [11]. Vocational graduates have the second level qualification in the KKNI as an operator. The basic competencies possessed by vocational high school graduates are adjusted to their respective competency skills. Figure 2 is the level of KKNI.
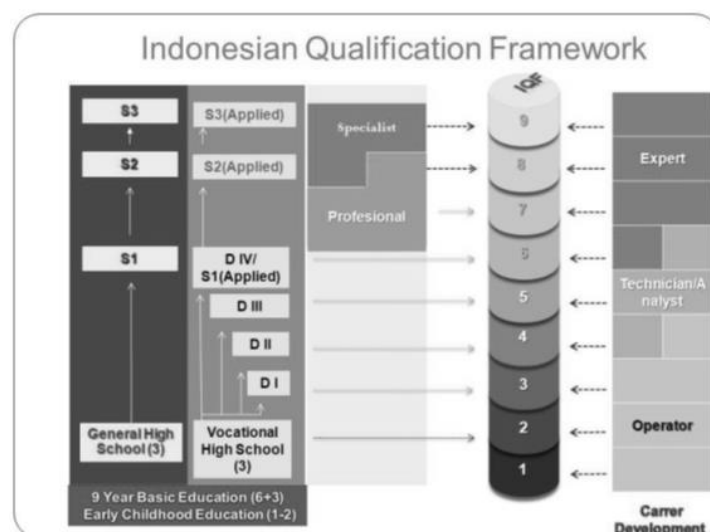

Figure 2. Level of KKNI.

2.5. SKKNI

The preparation of these competencies is based on the Indonesian National Work Competency Standards (SKKNI) which are adjusted to the industrial world or the business world for each skill competency. Based on the Minister of Manpower Regulation of the Republic of Indonesia Number 3 of 2016 concerning Indonesian National Work Competency Standards states that "Indonesian National Work Competency Standard is a formulation of work capabilities that includes aspects of knowledge, skills and/or expertise and work attitudes relevant to the implementation of tasks and Job requirements set in accordance with statutory provisions" [12].

3. Research methodology

In the study of analysis of relevancy between VHS competencies with industrial sector needs, especially in computer and network engineering competencies skill in 2013 curriculum, using descriptive research with a quantitative approach. Descriptive research is a method in examining the status of a group of humans, an object, a condition, a system of thought and the purpose of descriptive research helps provide an overview or description of a phenomenon under investigation [13]. Quantitative research is a study that requires the use of numbers in each stage of its research, starting from data collection, estimation of data and results of data [14].

3.1. Population and samples

The population in this study was Vocational High School and Telecommunication Industry. The sample is part of the number and characteristics of the population. To determine the sample to be used in the study, there are various sampling techniques used. This study uses purposive sampling and a saturated sampling technique. Purposive sampling is a sampling technique that sources data based on certain considerations [15]. Purposive sampling techniques are used to determine samples or participants in the Telecommunications Industry. Saturated sampling is a technique of determining the sample in which all members in the population are used as samples [15]. The technique used to determine the sample or participants at VHS 4 Bandung. Participants in this study were 6 respondents from Vocational High School and 21 respondents from PT. INTI, PT. LEN, PT. Dirgantara Indonesia (DI), PT. Telkom, PT. Aplikanusa Lintasarta, PT. Ghuma, PT. Gojek, PT. Nexwave, PT. Infomedia and PT. Indosat.

3.2. Research instruments

In this study, a closed and open questionnaire as instruments are used to collect data. The questionnaire uses a Guttman scale with yes or no answers. Industrial questionnaires are used to obtain data on the basic competencies needed by the industrial sector. The school questionnaire is used to obtain data on basic competencies in VHS 4 Bandung along with the basic competencies taught and not taught. The validity test of the instrument is using the reproducibility coefficient formula (kr) and the scalability coefficient (ks) [16]. The calculated result of kr value is 0.948 and ks value obtained after testing is 0.896, which shows that the instrument is suitable for use [16]. Test reliability using Kuder-Richardson 20 (KR 20) gives a result of 0.961 (the best result was> 0.8), that means the questionnaire used in the research was reliable [17].

3.3. Research procedure

This research was conducted through steps as follows:

3.3.1. Planning stage. At the planning stage, the researcher takes preparatory steps such as literature studies, determines the problems to be studied, develops problem formulation, chooses research methods, then determines the population and sample be studied, composes research instruments, performs validation and data collection techniques and analysis techniques data to be used.

3.3.2. Implementation phase. In the implementation phase, the researcher carried out implementation steps such as distributing questionnaires to the respondent then analyzing and processing the data with the chosen method.

3.3.3. Reporting stage. At the reporting stage, researchers compile a report by describing the findings that have been obtained according to the data found in the field and the results of data analysis that has been done, then provide suggestions for further research.

3.4. Data analysis
Data analysis is done by summing all the "Yes" answers by giving a value of 1 for each answer given by the respondent, adding up the percentage of basic competencies of each subject needed by the industry, and calculating the average value of basic competencies percentage for each subject needed by the industry using equation (1):

$$X = \frac{\sum X}{N} \qquad (1)$$

Note:
X   = The average value of the basic competencies of each subject needed by the industry
$\sum X$ = Amount of percentage of each basic competency needed by industry
N   = Number of basic competency subjects in the Computer and Network Engineering competence skills (TKJ).

To find out the percentage value of the basic competencies needed in each productive study field is categorized in the following values [18]:
- Excellent (very relevant / appropriate) 76% -100%
- Good (relevant / appropriate) 56% - 75%
- Fair (less relevant / appropriate) 40% - 55%
- Poor (irrelevant / appropriate) <40%

Furthermore, looking for the value of suitability/relevance of the basic competencies in the expertise of Computer and Network Engineering expertise needed by the industrial world using equations (2) and (3) [19].

$$\text{Recall} = \frac{a}{a+c} \text{x } 100 \text{ \%} \qquad (2)$$

$$\text{Precision} = \frac{a}{a+b} \text{x } 100 \text{ \%} \qquad (3)$$

Note:
a (hits) = relevant / appropriate document
b (noise) = irrelevant / appropriate document
c (misses) = relevant / appropriate documents not found
d (reject) = irrelevant / appropriate document not found

4. Research results and discussion
The research result is shown in table 1.

Table 1. Number of basic competencies.

No.	Item	Basic competencies number
1.	Basic competencies TKJ program competency 2013 Curriculum Revision	135
2.	Basic competencies are taught at Vocational High School 4 Bandung	119
3.	Basic competencies are not taught at Vocational High School 4 Bandung	16
4.	Basic competencies are relevant and needed by the telecommunications industry	125
5.	Basic competencies are less relevant and less needed by the telecommunications industry	10
6.	Basic competencies needed by the telecommunications industry but not listed in the curriculum 2013 (R)	26

After knowing the basic competencies needed as shown in table 1, the calculation of suitability or relevance is as follows.

- Recall $= \frac{a}{a+c} x 100\%$

$$= \frac{125}{125+26} x 100\% = 77.64\ \%$$

- Precision $= \frac{a}{a+b} x\ 100\ \%$

$$= \frac{125}{125+11} x\ 100\% = 92.60\ \%$$

Based on the calculations above, it can be seen that the percentage of competency suitability of TKJ expertise with the needs of the workforce in the telecommunications industry sector has a recall value of 77.64% and a precision of 92.60%. To find out how much suitability or relevance, that the ideal condition of the effectiveness of an information retrieval system is when the recall ratio and precision are equal (1: 1) [20]. Therefore, the ratio of recall and precision will be calculated and multiplied by 100% to find out the percentage.

- Ratio $= \frac{Recall}{Precsion} = \frac{77.64}{92.60} = 0.8384$
- Relevance $= 0.8384\ x\ 100\% = 83.84\%$

Based on the calculation of the ratio, the value of suitability or relevance is 83.84% and it is said that basic competencies are very suitable with the needs of the workforce in the telecommunications industry sector.

- Basic competencies taught at TKJ program of Vocational High School 4 Bandung. There are 135 basic competencies in TKJ expertise competencies at VHS 4 Bandung, with details of 119 basic competencies which are taught basic competencies and 16 basic competencies are basic competencies which are not taught by teachers at VHS 4 Bandung. Competencies that are not taught include competence Testing computer performance, Managing repairs to application software installations, Installing various use resources on computer networks, Installing internet connections on workstations, Designing local networks (LANs), Installing local networks (LANs), Maintenance of local networks (LAN), Managing repair of local networks (LAN), Installing software programming languages, Creating interfaces (User Interfaces) on applications, Creating program codes for various control structures in application interfaces (User Interface), Formulating a simple package installer application, Using a fiber optic work tool, making a fiber optic connection, configuring a passive fiber optic network device, repairing a fiber optic network. Basic competencies that are not taught are due to several things including

inadequate practice tools, besides that basic competencies are more emphasized for RPL expertise competencies rather than TKJ and insufficient time for the implementation of learning. basic competencies that is not taught is the basic competencies required by the Telecommunications Industry.

- Competencies needed by the Telecommunications Industry World on TKJ program. As technology develops, the needs of the industrial world, especially the telecommunications sector develop as well. Based on the research that has been carried out, the basic competencies required by the telecommunications industry is 151 basic competencies, of which 125 basic competencies are the basic competencies listed in the revised 2013 curriculum and 26 basic competencies are basic competencies added by the telecommunications industry. The most additional competency is in computer and network subjects where basic competencies related to fiber optic networks are needed. This is due to the high need for fiber optics for the modernization of telecommunications operator networks that previously used copper cables [21]. This further supports that VHS graduates are expected to be proficient in fiber optic related competencies.

The competencies needed by the industry as the era grows continues to increase following the development of science and technology (science and technology), local, national and global needs [22]. This shows the competencies needed must be relevant to current needs where the implication is that technical education providers must consider their existing curriculum, which must be embedded with the competencies needed [23]. This makes the need for creativity and innovation from the teacher to develop learning. The important thing about the implementation of the revised 2013 curriculum is the change in the mindset of teachers in carrying out their duties related to teaching. This curriculum is also expected to be able to overcome the problem of the gap between education and the workplace, then the long-term hope is to be able to form quality human resources [22]. Figure 3 is a circular diagram that maps the basic competencies needed by the telecommunications industry sector.
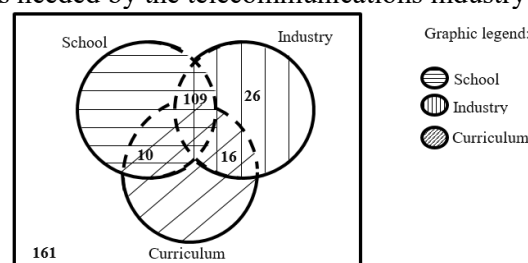

Figure 3. Circular diagram that maps the basic competencies needed by the telecommunications industry sector.

Note:
- The curriculum, with a value of 10 is the basic competencies taught but not needed by the workplace in the telecommunications industry sector.
- The curriculum, with a value of 16 is the basic competencies not taught and needed by the workplace in the telecommunications industry sector.
- The curriculum, with a value of 109 is the basic competencies taught and needed by the workplace in the telecommunications industry sector.
- Industry, with a value of 26 is the additional basic competencies from industry and needed by the workplace in the telecommunications industry sector.

5. Conclusion
Based on the results of the research, the relevance of basic competencies in the competence of computer and network engineering program and the needs of the telecommunications industry sector is 83.84% and suitable with industrial needs.

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