Jurnal Pendidikan Vokasi
Vol. 9, No 3, November 2019

9 772476 940005

9 772088 286003

JURNAL PENDIDIKAN VOKASI

Volume 9, No 3, November 2019

Volume 9, No 3, November 2019

ISSN 2088-2866 (print)
ISSN 2476-9401 (online)

JURNAL PENDIDIKAN VOKASI

Accredited by Ministry of Research, Technology, and Higher Education Republic of Indonesia
No: 36a/E/KPT/2016, on 23 May 2016

ADGVI
ASOSIASI DOSEN & GURU VOKASI INDONESIA
IN COOPERATION WITH
GRADUATE SCHOOL OF
UNIVERSITAS NEGERI YOGYAKARTA

Volume 9, No 3, November 2019

ISSN 2088-2866 (print)
ISSN 2476-9401 (online)

JURNAL PENDIDIKAN VOKASI

Publisher:
Asosiasi Dosen dan Guru Vokasi Indonesia (ADGVI)
in Coopertaion with
Graduate School of Universitas Negeri Yogyakarta

Correspondence: Graduate School of Universitas Negeri Yogyakarta
Kampus Karangmalang, Yogyakarta, 55281,
Telp. (0274) 550835, Fax. (0274) 520326
Homepage: **http://journal.uny.ac.id/index.php/jpv** e-mail: **jpvokasi@uny.ac.id**

Jurnal Pendidikan Vokasi publishes three issues a year
in February, June and November
disseminating the result of scientific studies and research

Accredited by Ministry of Research, Technology, and Higher Education Republic of Indonesia No: 36a/E/KPT/2016, on 23 May 2016

ADGVI
ASOSIASI DOSEN & GURU VOKASI INDONESIA
IN COOPERATION WITH
GRADUATE SCHOOL OF
UNIVERSITAS NEGERI YOGYAKARTA

Jurnal Pendidikan Vokasi
Vol. 9, No. 3, November 2019

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (217-228)
Online: http://journal.uny.ac.id/index.php/jpv

SOFT SKILLS PROFILE OF VOCATIONAL SCHOOL STUDENTS IN YOGYAKARTA CITY FOR ENTERING THE INDUSTRIAL WORLD

Tri Wulaningrum
Universitas Negeri Yogyakarta

Samsul Hadi
Universitas Negeri Yogyakarta

Abstract

This study aims to determine the profile and how much the level of soft skills of Vocational High School students in Yogyakarta City. This study is survey research. The population of this study was all students grade XI of State Vocational Schools in Yogyakarta City. The sample of this study was 990 students. The data were collected using a questionnaire. The data were then analyzed and presented in a percentage form. The results of the study present that the percentage gain shows the soft skill profile of Vocational High School students in Yogyakarta City in each aspect, namely communication/persuasion skills of 75.19%; performance management skills of 77.22%; self management skills of 70.27%; interpersonal skills of 78.68%; leadership/organizational skills of 77.85%; and cultural skills of 75.60%. Then, the level of soft skills ability of Vocational High School students in Yogyakarta City is generally categorized in medium, which is in the profile range between M-0.5SD and M + 0.5SD ($M - 0.5SD < x \leq M + 0.5SD$).

Keywords: *vocational school students, industrial world, soft skills profile*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.24944*

Contact Tri Wulaningrum triwulaningrum.2017@student.uny.ac.id
Department of Educational Research and Evaluation, Graduate School of Universitas Negeri Yogyakarta
Jl. Colombo No. 1, Karangmalang, Depok, Sleman, Yogyakarta 55281, Indonesia

INTRODUCTION

Community needs always change. One of the dynamic community needs is employment needs, which are related to the availability of jobs and the needs of the workforce. The actual condition shows a disharmony relationship between employment and the needs of labor in Indonesia. Data from the Indonesian Central Bureau of Statistics (2017) state that "…in the past year, unemployment increased by 10.000 people, while the Open Unemployment Rate (*Tingkat Pengangguran Terbuka* or TPT) fell by 0.11 points".

Those data are a problem for Indonesia. It shows that the implementation of employment policies in Indonesia has not been optimal. Therefore, we need a planned and systematic problem-solving. One of the strategies for solving labor problems is through education.

Educational institutions are institutions that aim to produce quality human resources and superior competency. Thus, the function of educational institutions is to keep the improvement process running well and produce graduates who meet the needs of the community. Educational institutions consist of formal educational institutions, non-formal educational institutions, and informal education institutions. One of the formal education institutions that specifically aims to produce a professional workforce in Indonesia is a vocational education institution held at the secondary education level, namely Vocational High School (*Sekolah Menengah Kejuruan* or SMK).

The organization of Vocational High School is regulated in the Law of Republic of Indonesia No. 20 of 2003 on National Education System. The legal regulation asserts that "...the construction of Vocational High School in all regions of Indonesia is intended to prepare graduates for being ready to work independently or work in certain industries or agencies that need middle-level labor". Furthermore, the sustainability of vocational schools in Indonesia is also regulated in a national education standard listed in the Regulation of the Minister of Education and Culture No. 34 of 2018 on the national standard of education in Vocational High School. This regulation states that there are minimal criteria regarding the education system at the Vocational High School level in order to achieve the competence of graduates according to the needs of graduate users. Those regulations become not only a legal regulation that must be respected but also the mandate of the state that needs to be guarded and taken care of as well as possible for the welfare of the people in Indonesia.

Vocational High School is one of the alternative government policies in overcoming the problems of labor needs. Therefore, the existence of Vocational High School cannot be deprived of the development of workforce policies. It is in line with the idea of Pardjono, Sugiyono, and Budiyono (2015), which highlights that vocational education cannot be eliminated from the development of the workforce. Although the existence of SMK does not necessarily solve existing problems, through the skills taught to students in SMK, indirectly, it will increase their productivity. It will make vocational graduates have the skills and abilities to create their own jobs. This expectation is in line with the idea of Thompson (1973) stating that vocational education enhances students' skills, which will ultimately increase their productivity.

The existence of Vocational High School and the needs of the workforce are very relevant. The law has ruled Vocational High School as one of the educational institutions responsible for producing mature students who are ready to enter the workforce. In this way, the nation's development efforts will move faster. It is in accordance with Komariah (2010) that Vocational High School is an educational institution that is responsible for preparing students to enter the labor market, which is one of the nation's development efforts.

In fact, graduates of Vocational High School have yet to be able to answer the problems of labor in Indonesia. Supriyadi (2002) reveals that until now, there are still many job market offers that have not been filled. This condition is supported by data published by the Indonesian Central Bureau of Statistics (2017), "...seen from the level of education, TPT for Vocational High School is the highest among other education levels, which is 11.41 percent".

The empirical observation of the Department of National Education (2004), as quoted by Mariah and Sugandi (2010), states that most graduates of Vocational High School (SMK) in Indonesia are less able to adjust to the development of science and technology. Further, graduates of SMK in Indonesia are also less able to develop themselves and careers in the

places where they work. It shows that graduates of SMK in Indonesia do not yet have mature work-readiness so that their existence has not been able to answer the problems of labor in the country.

Work readiness of someone entering the workforce shows a pattern. The pattern is composed of several factors that are interconnected and influence. Mariah and Sugandi (2010) state that in general, a person's work readiness is composed of three factors. First, physiological factors which involve several aspects, namely age maturity, physical condition, and body organs. Second, the experience factor that contains a learning experience or work that must be owned by a prospective worker. In this work experience factor, a prospective worker is said to have work readiness if he has the ability, knowledge, and skills, or hard skills. Third, psychological factors involving mental, emotional, and social conditions. In this psychological factor contained the ability of soft skills that must be possessed by a prospective worker who has work readiness.

Those three factors show that there is a pattern of relationships between hard skills and soft skills in a person who has work readiness. The relationship between hard skills, soft skills, the world of work, and education can be identified through the ratio of the needs of soft skills and hard skills to the world of work and education.

Soft skills in humans include personal and interpersonal behaviors that develop and maximize human performance, including: "leadership, team building, decision making, initiative, so it does not include technical skills such as financial, computer or assembly skills" (Bernthal, Weaver, & Wellins, 2002). Kaipa, Milus, Chowdary, and Jagadeesh (2005) mention that soft skills become essential competencies and are the key to success for a workforce in the place where he works and also to develop himself. It certainly strengthens the importance of soft skills for someone in the workforce. By having soft skills attributes that are in harmony with the needs of the world of work, of course, a workforce will be able to survive and develop themselves.

In certain fields of education, such as Vocational High School, soft skills cannot be revoked from the system of education. Vocational High School, as an education system oriented to produce graduates who are ready to work and competitive, always directs graduates to be ready-to-work, smart, have competitive and comparative advantages and have strong character as professional workers.

In fact, a study conducted by Ghufron et al. (2017) found a discrepancy between Vocational High School and the industrial world in terms of understanding soft skills needs. It does not just happen but has a cause. Some other studies, if analyzed, will provide answers to the causes of these inconsistencies. One of them is the study of Neff and Citrin (1999) in Mariah and Sugandi (2010), which reveals the imbalance in the ratio between the needs of soft skills in the world of work and the soft skills taught at school. Neff and Citrin (1999) in Mariah and Sugandi (2010) state that the ratio of the needs of soft skills and hard skills in the workplace/ business that is able to retain someone at work is 80% determined by the mindset (soft skills) and 20% determined by technical skills (hard skills). However, the education system runs the opposite, where the ratio of soft skills is only given an average of 10% in the curriculum. The contradictory comparison between the needs of soft skills and hard skills in the world of work and educational institutions is shown in Figure 1 and Figure 2.

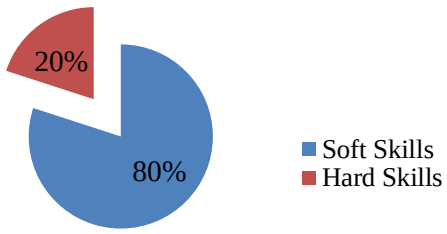


Figure 1. Percentage of Soft Skills as a Component of Success in the World of Work

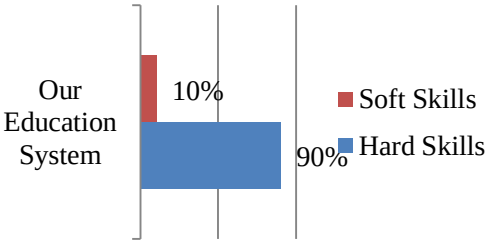


Figure 2. Portions of Soft Skills Given in Education

Problems do not only stop at the imbalance of the ratio of hard skills-soft skills between the industrial world and the world of education. Another problem is the lack of relevance of understanding between the world of industry and the world of education about the soft skills needed by the world of work. The actual condition shows the gap between the soft skills needed by the business/industry (*Dunia Usaha/Dunia Industri* or DU/DI) and those taught at school. Suryanto, Kamdi, and Sutrisno (2013) state that there was a mismatch between soft skills needed by the industrial world and those taught at Vocational High School, that (1) the soft skills mostly needed by the industrial world are communication skills; while (2) the most important soft skills to be taught at Vocational High School, according to the teacher, are honesty and good attitude and according to students is time discipline.

Figure 1 and Figure 2, coupled with the analysis of the results of the study related to the lack of relevance of hard skills-soft skills between the world of work and the world of education, illustrate the existence of conditions that should not occur. The world of work and educational institutions should develop with a balanced ratio. The imbalance of the ratio of hard skills and soft skills to educational institutions and the world of work shows a problem that must be solved. In other words, the pattern of imbalances in the ratio of hard skills and soft skills and the incompatibility of understanding of the soft skills needed by the world of work with those given by the education system show that education in Indonesia has not fully been able to improve national development.

The disharmony of hard skills and soft skills ratios, as well as the incompatibility of the understanding of prospective workers' soft skills from vocational education with industrial needs, demands an immediate solution. These problems can be solved if both of them have the required soft skill standards or indicators as well as the soft skill profiles that are currently owned by Vocational High School students. The soft skill profile of Vocational High School students is useful to provide an overview of the readiness Vocational High School students to enter the industrial world, so judgment and recommendations can be made. In fact, there is no official standard released by the government through the Indonesian National Qualifications Framework (*Kerangka Kualifikasi Nasional* Indonesia or KKNI) related to the need for industrial workforce soft skills along with the soft skill profile of current Vocational High School students.

The absence of national standards governing the soft skills needed by the industrial world and the lack of studies on soft skills profiles of current vocational students is undoubtedly a challenge for vocational education institutions. Vocational education is required to actively keep abreast of the development of the needs of soft skills in the industrial world and to measure the achievements of their students' soft skills towards existing standards. The soft skill profile of Vocational High School (SMK) students is essential to see. It relates to the relevance of the prospective soft skills of workers with industrial needs. Therefore, today, a study is needed to look at the profiles and achievements of the soft skills of Vocational High School students based on the needs of the industrial world. This study indeed must be preceded by a study of the basic standards of soft skill needs in the industrial world.

Regarding the standard urgency of the needs of soft skills in the industrial world, a soft skills measurement instrument needed by the world of work has been developed, namely Kantrowitz's Soft Skills Performance Measurement (SSPM). Kantrowitz (2005) mentions that there are seven soft skills components that must be possessed by a workforce in order to be able to survive in the workforce, namely (1) communication/persuasion skills, (2) performance management skills, (3) self-management skills, (4) interpersonal skills, (5) leadership/organization skills, (6) political/ cultural skills, and (7) counterproductive skills.

SSPM is a soft skills measurement instrument used in general, not for particular fields of expertise or specific levels of education (Kantrowitz, 2005). It is motivated by the opinion of Boyatzis (1982) in Kantrowitz (2005), who stated that soft skills broadly apply to various jobs. Thus, all fields of work need a tendency for soft skills that can be generalized.

SSPM is used to see the soft skills profile of Vocational High School students. This profile can be used as a reference for detecting soft skills in students. The results of this study can be used as further study material (for example, improving aspects of students' soft skills that are still low). The problem is that SSPM cannot be used directly. Detecting students'

soft skills will be better if it is adapted to the needs of soft skills in the business world and industry. Ghufron et al. (2017) explain that:

> *"work culture is soft skills possessed by a group of prospective workers (who are in SMK) in order to be able to optimize their hard skills. The profile of vocational school graduates who have a work culture in harmony with the demands of the industry and or the business world will definitely increase absorption".*

The results of a survey conducted by Widarto (2011) show that the current profile of labor needed by the industrial world is a workforce that has strong, soft skills aspects. Widarto (2011) states that there are 13 work cultures (soft skills) needed by the business world and the industrial world, namely: (1) discipline; (2) honesty; (3) commitment: (4) responsibility; (5) confidence; (6) ethics; (7) manners; (8) cooperation; (9) creativity; (10) communication; (11) leadership; (12) entrepreneurship; and (13) organizing.

Based on some of the reviews previously presented, this research was conducted to look at the profile and measure the level of Vocational High School students' soft skills based on industry needs. The instruments developed in this study used SSPM to be adapted to the work culture in Indonesia as a reference in looking at the needs of soft skills in the business world and industry. Soft skills instruments are reduced to six aspects tailored to the work culture in Indonesia. These six aspects are (1) communication/persuasion skills; (2) performance management skills, (3) self-management skills, (4) interpersonal skills; (5) leadership/organization skills, and (6) cultural skills. The selection of Vocational High School students as research respondents was motivated by the main objective of Vocational High School as an educational institution that standardized to produce graduates who were ready to work. The soft skills that must be possessed by a vocational graduate in entering the industrial world are one indicator of work readiness. Data acquisition related to the suitability of Vocational High School graduates' soft skills with the needs of soft industrial sketches, of course, can be used as material for scientific studies in the improvement and development of vocational education systems in Indonesia.

RESEARCH METHOD

This study is survey research employing a quantitive approach. The research only profiled and examined the level of soft skills Vocational High School students (how high level of soft skills by presenting it in the form of diagrams and numbers with a description in sentence form). The population in this study is all of the students of State Vocational Schools (grade XI) in Yogyakarta City. The sample of this study was 990 students. The sample size is determined based on Roscoe's theory (1975), which is taken 30 students in each department in eight schools. Then, the next step is determining the sample in each department in each school by using simple random sampling. The data collection technique used is questionnaire.

The study used one variable described into several aspects originating from SSPM and reduced to only six indicators: communication/persuasion skills, performance management skills, self-management skills, interpersonal skills, leadership/organization skills, and cultural skills. The data were analyzed descriptively. Analysis was used to calculate the mean, median, mode, standard deviation, data distribution table, profile percentage, and chart categories that show the level of student's soft skills. Profile percentage of soft skills was analyzed using the following formula:

$$\text{Profile Percentage} = \frac{n}{N} x100\%$$

n = empiric score
N = Ideal Score

Table 1. Calculation Formulas for Soft Skills Level Categories

Category Level	Calculation Formula
Very Low	$x \leq M - 1{,}5SD$
Low	$M - 1.5SD < x \leq M - 0.5SD$
Medium	$M - 0.5SD < x \leq M + 0.5SD$
High	$M + 0.5SD < x \leq M + 1.5SD$
Very High	$M + 1.5SD < x$

M = Average of Ideal Score = $\frac{1}{2}(ideal\ maximum\ score + ideal\ minimum\ score)$
SD = Ideal Standard Deviation = $\frac{1}{6}(ideal\ maximum\ score - ideal\ minimum\ score)$

The level category of soft skills, according to Azwar (2012), is divided into five: very low, low, medium, high, and very high. These five categories are obtained through the calculations presented in Table 1.

RESULTS AND DISCUSSION

The results of the study are presented in the form of the results of calculations of central tendencies (mean, median, mode) and data distribution. The presentation of data distribution includes variants and standard deviations. Next is the presentation of the size of the frequency distribution and interpretation of the research data, where interpretation refers to five-level categories, namely, very low, low, medium, high, and very high. The description of the variable data on soft skills of students of State Vocational Students in Yogyakarta City consists of six aspects: (1) communication/persuasion skills, (2) performance management skills, (3) self management skills, (4) interpersonal skills, (5) leadership/organization skills, and (6) cultural skills.

Before the presentation of the profile and level of soft skills in each aspect, it will first be presented the profile of Vocational High School students' soft skills in Yogyakarta City in general. In general, the profile of Vocational High School student soft skills is shown by the percentage gain in each aspect, namely communication/persuasion skills of 75.19%; performance management skills of 77.22%; self management skills of 70.27%; interpersonal skills of 78.68%; leadership/organization skills of 77.85%; and cultural skills of 75.60%. This percentage number does not indicate the number of students, but rather the score of achievement of soft skills in each aspect. The general profile of Vocational High School students' soft skills is presented in Figure 3.

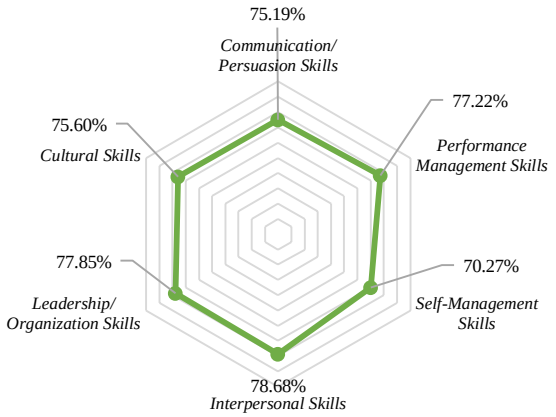


Figure 3. Profile of Soft Skills of Vocational High School (SMK) Students in Yogyakarta City

Figure 3 shows that *interpersonal skills* are aspects of soft skills that have the highest percentage achievement, while the lowest percentage achievement is in aspects of *self-management skills*. In other words, in Yogyakarta City, the most prominent soft skills of Vocational High School students are on the aspects of interpersonal skills. Based on the achievements of the highest to lowest percentage, the soft skills aspect in the profile of Vocational High School soft skills in Yogyakarta is written as follows: (1) *interpersonal skills;* (2) *leadership/organization skills*; (3) *performance management skills*; (4) *cultural skills*; (5) *communication/persuasion skills*; (6) *self-management skills.*

Table 2. Comparison of the Aspect Levels of Soft Skills of Students of State Vocational School in Yogyakarta City

Aspects of Soft Skills	Average Values	Rank
Interpersonal Skills	3.15	1
Leadership/organization Skills	3.11	2
Performance management skills	3.09	3
Cultural skills	3.02	4
Communication/persuasion skills	3.01	5
Self management skills	2.81	6

The same sequence of the highest and lowest soft skills aspects was also obtained through the comparison of each aspect's average value. Table 2 shows the order of soft skills aspects of students of Vocational High School in Yogyakarta City viewed from the average value. Furthermore, the levels of Vocational High School students' soft skills in Yogyakarta are presented in more detail in each aspect.

Interpersonal Skills

Interpersonal skills measurement of students of Vocational High School in Yogyakarta City used 20 questionnaire items. The ideal maximum score on this aspect is 80, and the ideal minimum score is 20. The average score of students in this aspect is 62.94, with a maximum score of 80 and a minimum of 23. The standard deviation in this aspect is 7.85. Based on the calculation results using SPSS software, the percentage of score tendency in the interpersonal skills aspects of the students of Vocational High School in Yogyakarta City can be seen in Figure 4.

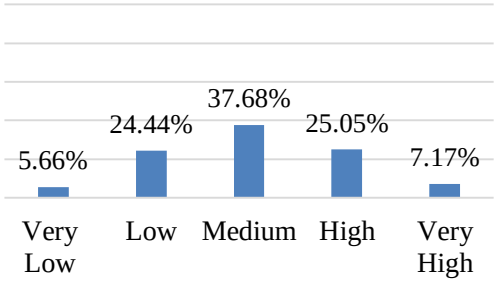


Figure 4. Interpersonal Skills Graph

Figure 4 shows that in the interpersonal skills aspect, as many as 5.66% of Vocational High School students in Yogyakarta have very low levels; 24.44% at the low category level; 37.68% is in the medium category level; 25.05% at the high category level; and 7.17% at the very high category level. These results indicate that the level of achievement of Vocational High School students' soft skills in Yogyakarta city is generally at the level of achievement of the medium.

Leadership/Organization Skills

Leadership/organization skills measurement of students of Vocational High School in Yogyakarta City used questionnaires as many as 17 items. The ideal maximum score on this aspect is 68, and the ideal minimum score is 17. The average score of students in this aspect is 52.94, with a maximum score of 68 and a minimum of 17. The standard deviation in this aspect is 7.33. Based on the calculation results using SPSS software, the percentage of score tendency in the leadership/organization skills aspects of the students of Vocational High School in Yogyakarta City can be seen in Figure 5.

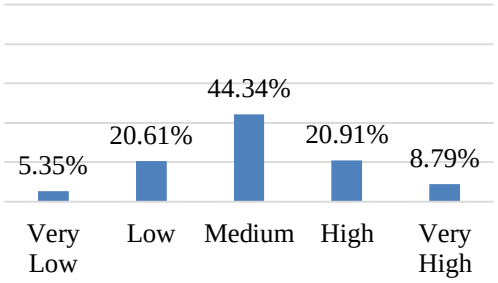


Figure 5. Leadership/Organization Skills Graph

Figure 5 shows that in the aspect of the leadership/organization skills, 5.35% of Vocational High School students in Yogyakarta have very low levels of achievement; 20.61% at the low category level; 44.34% is in the medium category level; 20.91% at the high category level; and 8.79% at the very high category level. These results indicate that the level of achievement of Vocational High School students' soft skills in Yogyakarta on aspects of leadership/organization skills, in general, is at the level of achievement of the medium.

Performance Management Skills

The masurement of performance management skills of students of Vocational High School in Yogyakarta City used questionnaires as many as 21 items. The ideal maximum score in this aspect is 84, and the ideal minimum score is 21. The average score of students in this aspect is 64.86, with a maximum score of 84 and a minimum of 21. The standard deviation in this aspect is 7.88. Based on the calculation results using SPSS software, the percentage of score tendency in the performance management skills aspects of the students of Vocational High School (SMK) in Yogyakarta City can be seen in Figure 6.

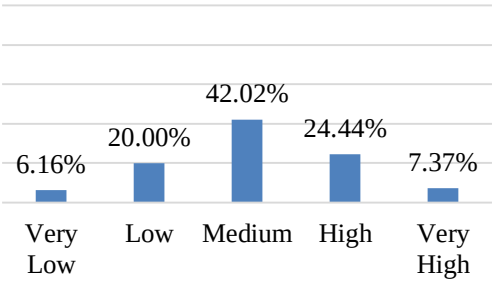


Figure 6. Performance Management Skills Graph

Figure 6 shows that in the aspect of performance management skills, 6.16% of Vocational High School students in Yogyakarta have very low levels of achievement; 20% are in the low category level; 42.02% is in the level of the medium category; 24.44% at the high category level; and 7.37% at the very high category level. These results indicate that the achievements of Vocational High School students' soft skills in aspects of management skills performance, in general, are at the level of medium achievement.

Cultural Skills

Cultural skills measurement of students of Vocational High School in Yogyakarta City used 13 questionnaire items. The ideal maximum score in this aspect is 52, and the ideal minimum score is 13. The average score of students in this aspect is 39.31, with a maximum score of 52 and a minimum of 16. The standard deviation in this aspect is 5.03. Based on the calculation results using SPSS software, the percentage of score tendency in the cultural skils aspects of the students of Vocational High School (SMK) in Yogyakarta City can be seen in Figure 7.

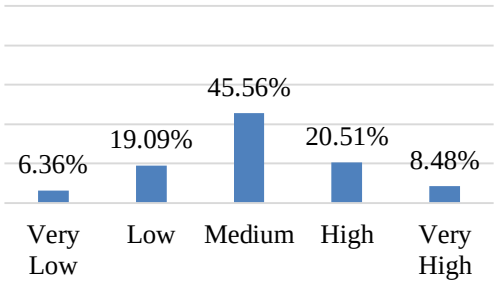


Figure 7. Cultural Skills Graph

Figure 7 shows that in the cultural skills aspect, as much as 6.36% of Vocational High School students in Yogyakarta have very low levels of achievement; 19.09% is in the low category level; 45.56% are in the medium category level; 20.51% at the high category level; and 8.48% at the very high category level. These results indicate that the achievements of Vocational High School students' soft skills in the city of Yogyakarta are generally at the medium level.

Communication/Persuasion Skills

Communication/persuasion skills measurement of students of Vocational High School in Yogyakarta City used 12 questionnaire items. The ideal maximum score on this aspect is 48, and the ideal minimum score is 12. The average score of students in this aspect is 36.09, with a maximum score of 48 and a minimum score of 15. The standard deviation in this aspect is 4.73. Based on the calculation results using SPSS software, the percentage of score tendency in the communication/persuasion skills aspects of the students of Vocational High School in Yogyakarta City can be seen in Figure 8.

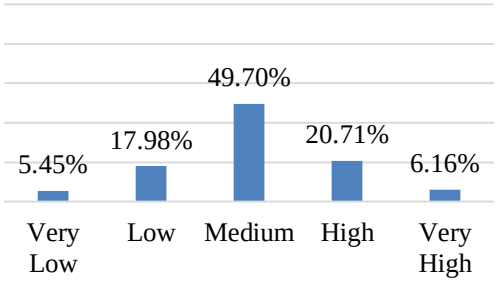


Figure 8. Communication/Persuasion Skills Graph

Figure 8 shows that in the aspect of communication/persuasion skills, 5.45% of Vocational High School students in Yogyakarta have a very low level of soft skills achievement; 17.98% at the low category level; 49.70% at the medium category level; 20.71% is in the high category level; and 6.16% at the very high category level. These results indicate that the achievements of the vocational students' soft skills in the aspects of communication/persuasion skills are generally at the medium level.

Self Managements Skills

Self-management skills measurement of students of Vocational High School (SMK) in Yogyakarta City used ten questionnaire items. The ideal maximum score on this aspect is 40, and the ideal minimum score is 10. The average score of students in this aspect is 28.11, with a maximum score of 40 and a minimum of 14. The standard deviation in this aspect is 3.86. Based on the calculation results using SPSS software, the percentage of score tendency in the self-management skills aspects of the students of Vocational High School in Yogyakarta City can be seen in Figure 9.

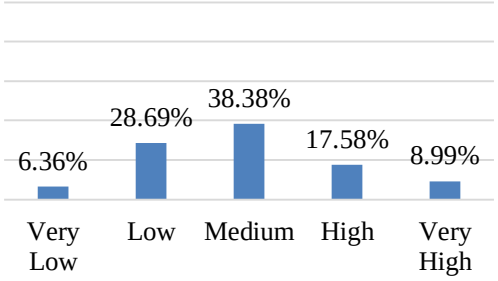


Figure 9. Self-Management Skills Graph

Figure 9 shows that in the aspect of self-management skills, 6.36% of SMK students in Yogyakarta have very low levels of achievement; 28.69% is at the low category level; 38.38% is in the medium category level; 17.58% at the high category level; and 8.99% is in the very high category level. These results indicate that the achievements of Vocational High School students' soft skills in Yogyakarta on the aspects of self-management skills, in general, are at the medium level.

The existence of soft skills in Vocational High School (SMK) students to enter the industrial world is very important. It is in line with Evenson (1999) that soft skills have been around for a long time in the business and education environment, in company meetings, and curriculum development.

The soft skills of Vocational High School (SMK) students in Yogyakarta in this study were measured based on six aspects, namely, communication/persuasion skills, performance management skills, self-management skills, interpersonal skills, leadership/ organization skills, dan cultural skills. These aspects are aspects obtained through the theory of Kantrowitz (2005).

Furthermore, six major aspects of soft skills in this study have a framework in general. Aspect 1 is labeled as Communication/ Persuasion Skills. It includes behaviors generally aimed at communicating with others, in terms of asking questions, delivering presentations, influencing others, negotiating, persuading, and seeking information. Aspect 2 is labeled as Performance Management Skills. This cluster encompasses behaviors involved in managing the work of others and managing projects. It includes activities such as analyzing needs, articulating expectations, coaching/ training, developing others, and evaluating performance. Aspect 3 is labeled Self-Management Skills, which are aimed at managing, controlling, and regulating one's own behaviors. This aspect includes acting calm during a crisis, controlling emotions, and tolerating stress. Aspect 4 is labeled Interpersonal Skills, which describe work behaviors that involve interacting with others in work situations. It includes acting courteous and respectful, building a network, complimenting others on valid points, compromising, developing rapport, and reconciling opinions. Aspect 5 is called Leadership/Organization Skills, which involve envisioning and implementing plans and strategies. This aspect includes developing strategies/plans, showing a vision, providing solutions, and setting goals. Aspect 6 is termed Political/Cultural Skills and involves demonstrating competence with respect to functioning in the culture and climate of an organization. This aspect includes behaviors such as adapting to environments and people, adjusting a message to an audience, learning unwritten rules, and modifying reactions to fit the culture.

The six aspects of soft skills, according to Kantrowitz (2005), have related to other theoretical soft skills aspects, one of which is Robles (2012). In more detail, Robles (2012) states that there are ten aspects of soft skills needed to enter the workforce, namely: (1) communication, (2) courtesy; (3) flexibility; (4) integrity; (5) interpersonal skills; (6) positive attitude; (7) professionalism; (8) responsibility; (9) teamwork; and (10) work ethic. If analyzed, between Kantrowitz (2005) and Robles (2012), there are two similar aspects related to the needs of the workforce's soft skills, namely *communication skills* and *interpersonal skills* aspects.

The results of the study indicate that the level of soft skills of Vocational High School (SMK) students in Yogyakarta City is generally categorized as *medium.* If viewed from the level of student's soft skills in each aspect, the highest soft skills of the vocational student in Yogyakarta City is interpersonal skills with the percentage of the profile of 78.68%; and the lowest aspect of the student's soft skills in Yogyakarta City is self-management skills with the percentage of the profile of 70.27%. If sorted from aspects that have the best profile (high percentage), the profile of vocational students' soft skills in Yogyakarta is (1) interpersonal skills; (2) leadership/organization skills; (3) performance management skills; (4) cultural skills; (5) communication/persuasion skills; and (6) self management skills.

Based on the above sequence, it is known that the best soft skills in vocational students in Yogyakarta City are about abilities in work behaviors that involve interacting with others in work situations. It includes acting courteous and respectful, building a network, complimenting others on valid points, compromising, developing rapport, and reconciling opinions. Meanwhile, the soft skills with the lowest achievements include the ability in

managing, controlling, and regulating one's own behaviors, acting calm during a crisis, controlling emotions, and tolerating stress.

The results show that, in general, vocational students in Yogyakarta City were at the level of achievement of the medium in all aspects. Referring to the results of the study, it can be said that in the soft skills variable, SMK students in Yogyakarta City are considered to have the readiness to enter the industrial world. The level of vocational soft skills of students in the medium category can be used as a supporting factor in entering the workforce. This is in accordance with Pusriawan and Soenarto (2019) that it is not only hard skills that students must have, but also soft skills. One form of soft skills is employability skills (Pusriawan & Soenarto, 2019). Employability skills of the students of State Vocational Schools should be a supporting factor for students to get decent work and in accordance with their competency skills so that stakeholders can really use it well (Pusriawan & Soenarto, 2019).

Pusriawan and Soenarto (2019) state that employability skills are non-technical skills needed by each individual, both job seekers and workers themselves, that can be transferred and learned through both habituation and training. There are nine aspects of employability skills according to Pusriawan and Soenarto (2019), namely: (1) communication skills; (2) collaboration skills with TIM; (3) problem-solving skills; (4) skills in taking initiatives and trying; (5) skills in planning and organizing activities; (6) self management skills; (7) skills in learning; (8) skills in using technology; and (9) occupational health and safety skills.

The results of the study show that in vocational students in Yogyakarta City, the interpersonal skills aspects became the most prominent aspect. The existence of interpersonal skills aspects as the aspect with the highest achievement projects that vocational students in Yogyakarta City have representation with the needs of today's industry. It is in line with Sheikh (2009) that interpersonal skills are the most critical skills at all levels. In addition, Klaus (2010) states that companies assess employee interpersonal skills as more important than their analytical abilities. Bernthal et al. (2002) state that soft skills include personal and interpersonal behaviors that develop and maximize human performance, which include: "leadership, team building, decision making, initiative, so it does not include technical skills such as financial, computer or assembly skills".

Nowadays, it is increasingly realized that soft skills in vocational students are so important in preparing graduates who are in accordance with the vision and mission of the Vocational School. It is evidenced by several studies related to the development of soft skills learning models conducted at Vocational High School. Amin, Zamroni, and Sofyan (2017) developed a soft skills learning model integrated with the learning program. Furthermore, Hamidah (2013) also developed a soft skills learning model that is integrated into vocational students in culinary study programs, which is a hypothesis learning model. This learning model allows the mastery of soft skills in students to be consistent. The integration process can start from student learning design, ongoing implementation, and evaluation based solely on continuous improvement or performance management. Related to the importance of soft skills to prepare students to enter the workforce, Abdullah-Al-Mamun (2012) states that education institutions should present a well-formed learning experience with enhancing graduate employability as a core constituent where soft skills are embedded in the curriculum process.

CONCLUSION

The level of soft skills of Vocational High School students in Yogyakarta is generally categorized at a medium level. If viewed from the level in each aspect, there are communication/persuasion skills of 75.19%; performance management skills of 77.22%; self-management skills of 70.27%; interpersonal skills of 78.68%; leadership/ organizational skills of 77.85%; and cultural skills of 75.60%.

The highest soft skills of vocational students in Yogyakarta are in aspects of interpersonal skills with a percentage of 78.68% with an average value of 3.15, and the lowest aspect of soft skills of vocational students in Yogyakarta is on the aspect of self-management skills with a percentage of 70.27% with an average value of 2.81. The existence of the level of soft skills of students in the medium in vocational students of Yogyakarta City should be a supporting factor for students to get decent work and in accordance with their competency skills so that stakeholders really use it well.

ACKNOWLEDGMENTS

The researchers thank the mentors and academic members of the Educational Research and Evaluation Study Program (Graduate School of Universitas Negeri Yogyakarta) for the provided input so that this research could be completed.

REFERENCES

Abdullah-Al-Mamun, M. (2012). The soft skills education for the vocational graduate: Value as work readiness skills. *British Journal of Education, Society & Behavioural Science*, *2*(4), 326–338. https://doi.org/10.9734/BJESBS/2012/1858

Amin, M., Zamroni, Z., & Sofyan, H. (2017). A model of soft skill instruction based on the local culture for vocational teacher candidates in North Sumatra. *Jurnal Pendidikan Vokasi*, *7*(2), 127–138. https://doi.org/10.21831/jpv.v7i2.14902

Azwar, S. (2012). *Penyusunan skala psikologi* (2nd ed.). Yogyakarta: Pustaka Pelajar.

Bernthal, P., Weaver, P., & Wellins, R. (2002). *The state of e-learning: Developing soft skills*. Bridgeville, PA: HR Benchmark Group.

Central Bureau of Statistics. (2017). Agustus 2017: Tingkat pengangguran terbuka (TPT) sebesar 5,50 persen. Retrieved May 27, 2018, from https://www.bps.go.id/pressrelease/2017/11/06/1377/agustus-2017--tingkat-pengangguran-terbuka--tpt--

Evenson, R. (1999). Soft skills, hard sell. *Techniques: Making Education and Career Connections*, *74*(3), 29–31.

Ghufron, A., Suwarna, S., Ismara, I., Marzuki, M., Mutaqin, M., & Pramono, H. S. (2017). *Penerapan budaya kerja industri di Sekolah Menengah Kejuruan*. Yogyakarta: UNY Press.

Hamidah, S. (2013). Model pembelajaran soft skill terintegrasi pada siswa SMK program studi keahlian tata boga. *Jurnal Pendidikan Vokasi*, *2*(1), 53–62. https://doi.org/10.21831/jpv.v2i1.1016

Kaipa, P., Milus, T., Chowdary, S., & Jagadeesh, B. V. (2005). Soft skills are smart skills. Retrieved April 16, 2019, from http://kaipagroup.com/articles/softskills.pdf

Kantrowitz, T. M. (2005). *Development and construct validation of a measure of soft skills performance*. Doctoral thesis. Georgia Institute of Technology.

Klaus, P. (2010). Communication breakdown. *California Job Journal*, *28*, 1–9.

Komariah, K. (2010). Memimpikan SMK di masa depan. In *Seminar Nasional Prospek Pengembangan Pendidikan Vokasional dalam Era Globalisasi* (pp. 127–132). Bandung: Culinary Education Study Program, FPTK, Universitas Pendidikan Indonesia.

Law of Republic of Indonesia No. 20 of 2003 on National Education System (2003).

Mariah, S., & Sugandi, M. (2010). Kesenjangan soft skills lulusan SMK dengan kebutuhan tenaga kerja di industri. *Jurnal Inovasi Dan Perekayasa Pendidikan*, *3*(1), 1–22.

Pardjono, P., Sugiyono, S., & Budiyono, A. (2015). Developing a model of competency and expertise certification tests for vocational high school students. *REiD (Research and Evaluation in Education)*, *1*(2), 129–145. https://doi.org/10.21831/reid.v1i2.6517

Pusriawan, P., & Soenarto, S. (2019). Employability skills of vocational school students in Palu City for entering the work world. *Jurnal Pendidikan Vokasi*, *9*(1), 33–42. https://doi.org/10.21831/jpv.v9i1.23351

Regulation of the Minister of Education and Culture No. 34 of 2018 on the national standard of education in Vocational High School (2018). Republic of Indonesia.

Robles, M. M. (2012). Executive perceptions of the top 10 soft skills needed in today's workplace. *Business Communication Quarterly*, *75*(4), 453–465. https://doi.org/10.1177/1080569912460400

Sheikh, S. (2009). *Alumni perspectives survey: Comprehensive data report*. Reston, VA: Graduate Management Admission Council.

Supriyadi, D. (2002). *Sejarah pendidikan teknologi dan kejuruan di Indonesia*. Jakarta: Departemen Pendidikan Nasional, Direktorat Pendidikan Menengah Kejuruan.

Suryanto, D., Kamdi, W., & Sutrisno, S. (2013). Relevansi soft skill yang dibutuhkan dunia usaha/industri dengan yang dibelajarkan di Sekolah Menengah Kejuruan. *Teknologi Dan Kejuruan*, *36*(2), 107–118. Retrieved from http://journal.um.ac.id/index.php/teknologi-kejuruan/article/download/3811/709

Thompson, J. F. (1973). *Foundation of vocational education: Social and philosophical concepts*. Englewood Cliffs, NJ: Prentice-Hall.

Widarto, W. (2011). *Pentingnya pendidikan soft skills bagi siswa SMK dalam menyiapkan tenaga kerja yang diperlukan dunia usaha dan dunia insdustri*. Yogyakarta: LPPM UNY.

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (229-237)
Online: http://journal.uny.ac.id/index.php/jpv

EXAMPLE-BASED LEARNING FOR VOCATIONAL EDUCATION: ADOPTED FROM BALINESE HEURISTICS LEARNING

I Made Candiasa
Universitas Pendidikan Ganesha

Nyoman Santiyadnya
Universitas Pendidikan Ganesha

Nyoman Sukajaya
Universitas Pendidikan Ganesha

I Gede Partha Sindu
Universitas Pendidikan Ganesha

Abstract

Vocational education has a very strategic role. Graduates produced are equipped with the competence to open new job opportunities or at least ready to enter the workforce. Therefore, vocational education development, such as training facilities, teacher development, and learning process improvement, must be intensified. This study tries to develop an example-based learning model for vocational education adopted from the learning model on cultural activities that surround Balinese people's daily life. A three-stage prototyping method was used: preliminary research, prototyping stage, and assessment stage. The syntax of example-based learning models consists of six phases: (1) conveying goals and motivating students, (2) organizing students into study groups and distributing worksheets, (3) guiding learning groups to do analogies, (4) drawing conclusions, (5) doing evaluation, and (6) giving awards. The social system that occurs is active students collaborate under the principle of democracy, while the teacher's role as a facilitator, counselor or consultant, and an adequate source of information becomes a support system. The learning model developed has been tested in small classes. The expert assessment provides content validity of 0.75 and the consistency coefficient of 0.78. The model's practicality from the teacher reaches 82% and 73% of students. During the trial, the new learning model's effectiveness reached 74%, while the efficiency was only 72%. These findings indicate that the learning model is feasible to be implemented with several recommendations, including the addition of a heuristic approach to work backward and create a hierarchy of similarity levels of examples and tasks in analogy.

Keywords: *example-based learning, cooperative learning, heuristic, analogy, prototyping*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.27017*

Contact I Gede Partha Sindu
gepasi87@gmail.com
Department of Information Technology Education, Universitas Pendidikan Ganesha
Jl. Udayana No. 11, Singaraja, Buleleng, Bali 81116, Indonesia

INTRODUCTION

If the state wants to achieve a competitive advantage through its massive workforce, there is no alternative to change human resources into human resources with the proper implementation of vocational education and training (Newaz, Faruquee, & Farha, 2013). Vocational education is intended to develop skills competencies needed in the world of work (European Centre for the Development of Vocational Training (Cedefop), 2017; Oliver, 2010). Business and industry require workers who are ready to use to support the progress of their business. Very large efficiency is obtained if the labor needed by the business and industry is ready to work. The company no longer needs to issue a budget to train new workers.

Vocational education is not only crucial in providing employment opportunities for individuals but also helps in increasing company productivity (Agrawal, 2013). Qualified graduates who become workers in the company actively support the progress of the company. Innovations born of vocational education can be used as superior products by companies. A good academic climate evokes work motivation among educators and learning motivation among students. High motivation from both parties will foster creativity to produce useful products.

Vocational education is recognized as a driving force that is vital for socio-economic growth and the technological development of nations (Agrawal, 2013). Vocational education produces human resources who master knowledge and skills. Skills and knowledge are the engines of economic growth and social development of any country (Goel, 2009). Various programs offered by vocational education, such as computers, electronics, automotive, and machinery are very spurring technological developments that are needed by the country. Young people have the potential to become developers or at least as technology operators. Agility supported by intelligence possessed by young people has the potential to be honed to create products or at least modify technology products. The skills possessed and the products will have economic value that is beneficial to themselves and others through the company.

The alignment of vocational education programs and the needs of workers in the business world must be maintained. However, in reality, this is not always the case because both have dynamics of interests that are not always the same (PH, 2013). Many complaints come from graduate users because of their newly appointed workforce lack of skills at work (Bialik, Bogan, Fadel, & Horvathova, 2015). The availability of learning facilities, quantity and quality of teaching staff, and cooperation with companies or other users of graduates must be sought. The learning process must take place dynamically, not monotonously so that it can still align itself with the development of the outside world.

Learning facilities are generally sufficient because they are supported by the government or in collaboration with companies. Teachers are also generally adequate because they can work with other agencies. The effort that still needs to be done is the development of learning models. Some contemporary vocational education reformers find that the specificity of vocational education is in the competencies produced (Moodie, 2002). Vocational education requires a learning model that can produce competencies or expertise that are relevant to the needs of the workforce and able to develop according to change. For this reason, graduates not only have expertise but are also able to learn what to do (Bialik et al., 2015; Moodie, 2002). Thus, they no longer need to take part in training, which certainly requires energy, time, and costs.

The learning model developed for vocational education is still attempted to be in the frame of cooperative learning. In learning, small groups are formed, so that individuals can work together to improve productivity and achievement, both groups and individuals (Johnson & Johnson, 1991; Slavin, 2005). All students in the group must be involved in learning, both to gather information, analyze information, conduct experiments, observe and draw conclusions. If there are individuals in the group who do not feel involved or do not know how they contribute and play a role in the group, then they will not truly devote themselves to achieving goals (Sharan, 1999).

Cooperative learning is developed because educators are aware of the negative influence of competition in the classroom (Slavin, 2005). Competition tends to make children only focus on winning. Children can win even with poor performance because their

competitors have worse performance (Moodie, 2002). This condition is not favorable for achievement development. In addition, the desire to win the competition can only make the child nullify everything, even if it is detrimental to his development. To succeed in education, in a profession, and in living in a children's community, it is necessary to collaborate with colleagues. Cooperative learning, in this case, besides being able to improve learning achievement, also has several positive consequences, including developing intergroup relationships, acceptance of friends who are weak in the academic field, and increasing self-esteem (Slavin, 2005).

Education has a mission to preserve, develop, and utilize cultural heritage (Ministry of Education and Culture of Republic of Indonesia, 2015). Aside from being a material that must be studied, culture is sought to enter various school activities, including learning. The learning model is developed by paying attention to the elements of local culture to develop a character-based curriculum by adopting local wisdom. The hope is to make students comfortable learning because they feel in their own cultural environment. Besides, local area needs are easier to detect so that graduate competencies can be adjusted. Innovative learning that involves a learning community that supports the surrounding environment is able to design more effective collaborations (Squire, MaKinster, Barnett, Luehmann, & Barab, 2003).

The inclusion of cultural elements into the curriculum has been widely carried out (Lipka, Sharp, Brenner, Yanez, & Sharp, 2005; Reyhner, Gilbert, & Lockard, 2011). The selection of learning strategies also needs to consider the role of culture (Young, 2014). Especially for science education, the involvement of cultural elements in learning provides many benefits (Bang & Medin, 2010). Due to this fact, the involvement of cultural elements in vocational education is considered to provide many benefits. Students will feel comfortable learning because they are familiar with the local culture in the learning process. In addition, students are better able to see the competencies needed by the surrounding community, so that earlier they can prepare themselves to master these competencies. Thus, the hope that culture-based education gives pleasure and contributes to the overall sense of one's well-being can be realized (National Centre of Expertise for Cultural Education and Amateur Arts (LKCA), 2017).

This study tries to develop an example-based learning model for vocational education adopted from an informal learning model of Balinese people. The effort to adopt culture-based learning is made because the informal learning model has been proven to be able to teach various skills from one generation to the next. Reyhner et al. (2011) stated that education must be sought to be in a compatible culture and a supportive environment because children's education must include social, emotional, and ethical competencies, as well as academic priorities. Students feel familiar because they are used to doing culture in their daily social life. Students will also not be deprived of their culture because both in society and in school, they always interact in a cultural context. The adoption of such learning models for vocational education can accelerate the integration of students, either in professional life or in the community, where they interact with others in daily life.

RESEARCH METHOD

The product developed from this development research is an example-based learning model. The development uses a three-stage approach, namely preliminary research, prototyping stage, and assessment stage (Plomp & Nieveen, 2007). Preliminary research was carried out through a review of the literature, observations on cultural activities, and interviews with community leaders and actors in cultural activities. The results obtained were the framework or design of the learning model. The design was evaluated formatively by learning experts. If the design had been declared valid, then it was proceeded to the prototype stage, while if there were still deficiencies, then the revision was made valid.

If the design was valid, it then proceeded with the development of the prototype. The prototype contains syntax, social system, reaction system, support system, and instructional effects as well as expected nurturant effects. Prototype development took place iteratively. The initial prototype was evaluated formatively to get information about the quality of the prototype. If formative evaluation stated that the prototype is feasible, then the develop-

ment continued to the assessment or evaluation step. If there were still parts that were lacking or wrong, then a revision was made. The revised results were evaluated formatively again until declared feasible. If the model had been declared feasible, an assessment stage was performed to assess the performance of the model.

The assessment stage was done by testing the model in a real class with limited students on subjects of basic work for mechanical engineering. The parameters used to assess the model are validity, consistency, practicality, efficiency, and effectiveness (Nieveen & Plomp, 2007). Experts assessed content validity and consistency of the learning models. Content validity was analyzed by the Gregory formula (Gregory, 2000), while the consistency of the model was analyzed by the Ebel formula (Ebel, 1951). Furthermore, the practicality of the model was assessed by either the teacher or students using user acceptance testing. Finally, the efficiency of the model was assessed based on the time needed to achieve competence, and the effectiveness of the model was assessed based on the competencies achieved by students.

RESULTS AND DISCUSSION

Preliminary research found that Balinese social life is full of mutual cooperation activities. Mutual cooperation is done both to help fellow community members and to do public works for the benefit of all community members. Mutual assistance activities involve community members from various backgrounds, both in terms of age, experience, and skills. During mutual activities, the informal learning process takes place. Some skilled community members will teach members of the community who are not yet skilled or even newly involved. Culture-based learning, as previously mentioned, has been proven to be able to teach various skills from one generation to the next.

Learning takes place cooperatively. A senior citizen who has become an expert in one area, called the teacher, accompanies some juniors called students. At the beginning of the activity, the teacher gives an example of the product to be produced. The product is placed in the middle of the students. The teacher also put some products that have not finished yet that must be continued. Students observe and ask the teacher what needs to be asked. Then, the students, in each way, try to make products according to the examples given. Some continue the products that have not been finished, and some are starting from the beginning to make products. They work according to the heuristic strategy, which is rules of thumb for making progress on challenging problems (Polya, 1973). The method applied is an analogy, namely a cognitive mechanism, which allows the transfer of knowledge and inferences across different concepts or contexts (Boteanu & Chernova, 2015; Gentner, 1998).

Cooperatively, students look at examples and identify existing concepts. In groups, students discuss and complement each other to understand the concept. Next, they try to apply these concepts to create similar products or solve similar problems. Even though they are in groups, concepts are understood by students in a heuristic manner with their respective procedures. In the group, there is also agreement about the concept. However, the procedure for understanding the concept varies according to the wishes and style of each student. Conditions like this make their understanding more optimal and more contextual. The teacher only facilitates learning while observing the learning process.

During the learning process, the evaluation also takes place. Evaluation is carried out without instruments; it is carried out only based on observations of the way it works and the products produced. If the results obtained by the students are good, then the teacher gives verbal feedback, for example, good, suitable, or quite talented. Conversely, if students make mistakes in the way they work or products that do not meet the requirements, the teacher gives remedial advice or work instructions. After that, the students continue their work with the group. There is no specific time for evaluating. The evaluation takes place sporadically during the work process, once or twice, depending on the progress of student learning. Thus, the evaluation is only formative evaluation.

The learning model above was adopted for vocational education designed in the form of an example-based learning model. Learning is arranged in cooperative settings by the process of analogy as the main activity. Cooperative models are chosen with very effective considerations to improve learning achievement. The almost always use of cooperative learning

improves affective outcomes (Slavin, 2010). A meta-analysis of 164 studies that examined eight cooperative learning methods found that the eight cooperative learning models had a positive influence on learning achievement (Johnson, Johnson, & Stanne, 2000). The analogy process is maintained because it is able to help the teacher to provide a better explanation (Forišek & Steinová, 2012). In addition, the analogy is considered capable of helping students to understand invisible concepts (Genç, 2013). Therefore, the application of concepts learned is much faster.

Referring to the learning model elements of Joyce, Weil, and Calhoun (Joyce, Weill, & Calhoun, 2009), the example-based learning model contains syntax, social systems, reaction principles, support systems, as well as the impact of learning and the accompanying effects. The syntax is a sequence of activities in learning, namely the activity of teacher teaching and student learning activities. The social system includes the relationship between students and teachers and their respective roles. The reaction principle explains how the teacher views and responds to students about what is being done. The support system is the requirements and support needed so that learning can take place optimally. The instructional effect is the direct effect of the model resulting from learning content and activities, while the nurturant effect is the indirect or implied effect of the model derived from the experience generated by the model.

The syntax of example-based learning models consists of six phases, namely: (1) conveying goals and motivating students, (2) organizing students into study groups and distributing worksheets, (3) guiding the learning groups to do analogies, (4) drawing conclusions, (5) doing evaluation, and (6) giving awards. Cooperative learning groups consist of three to five students. The worksheet contains examples of problems and their solutions and tasks that students must complete with analogies from the example. The analogy is made by understanding the concepts in the examples and identifying concepts in the task, then modifying the concepts in the task based on the concepts in the examples to get the solution. Evaluation is done using performance assessments.

The social system that occurs in learning is that students actively cooperate, help, and share among members of the group with the principle of democracy under the supervision of the teacher. The principle of the reaction that occurs is that the teacher acts as a facilitator and sometimes as a counselor or consultant. Student activities are driven by examples and assignments given by the teacher. The teacher guides the group experience to identify concepts and apply them to different situations. The support system needed in learning is an adequate source of information, both stored in the library and accessible online. Job sheets guide the use of relevant information systems and expand access through connections in learning plans. The instructional impact that occurs is group management in carrying out the tasks contained in the job sheet, insight to construct knowledge, and self-discipline in collaborating. The accompanying impact that can arise from the learning model is personal responsibility, respect for others, and the formation of a mutual cooperation culture.

Validity test by three experts analyzed quantitatively using the Gregory formula resulted in a coefficient of content validity (CV) of 0.75. The three experts also gave a qualitative assessment, which stated that the model of example-based learning was appropriate for vocational education. The cooperative model chosen is considered very positive to foster cooperation, responsibility, tolerance, and appreciation. The cultural approach is considered positive to introduce culture to students. The recommendations given are, among others, to provide more opportunities for students to do heuristic activities, for example, working backward.

Three experts assessed the consistency of the learning model. The assessment results were analyzed by the Ebel formula and gave a consistency coefficient of 0.78. These results indicate that the consistency of the model is sufficient. The effect of applying the learning model at one time is not much different from the application of the model at another time. Some variables that can affect the implementation of learning, such as the condition of students, the condition of the classroom environment, or other variables have no effect on the application of the developed learning model. Thus, the teacher is no longer burdened with a heavy task to control the learning situation.

The practicality test by the teacher, both the implementing teacher and the observer

teacher, gave the practicality value of the learning model of 82%. On the other hand, students involved in the trial assessed that the practicality of the learning model reached 73%. These results indicate that the practicality of the example-based learning model developed is adequate. An important note given by the teacher is that there needs to be a hierarchy of levels of similarity between examples and assignments. This note is given for the consideration that in general, the more features are shared, the better the analogy (Glynn, 2008). At the beginning of learning, the level of similarity between examples and assignments is highest. Next, slowly, the level of similarity is reduced. One day students are expected to complete the task without the presence of an example. Reducing the level of similarity between examples and assignments must consider the conditions of students. The recommendation of the majority of students requires teacher involvement in facilitating learning.

During the trial, the average student learning completeness had reached 74%. Minimum learning completeness is achieved by an average of 72% of students at the end of learning. That is, the effectiveness of the learning model has only reached 74%, while efficiency has only reached 72%. Both the effectiveness and efficiency of learning models still need improvement efforts. This result is certainly not satisfactory, but it is good enough as a first step. Various improvements are still necessary and can be done to improve student learning completeness. One of the obvious obstacles to observation and justified by teachers is that our students are not familiar with the learning process that demands student activity. Teachers are still required to provide more information, not just become facilitators.

Teacher and student perceptions are very positive towards example-based learning models for vocational education. Students feel familiar because they are accustomed to doing mutual cooperation activities in their daily social life. Thus, other goals of vocational education can be achieved, namely helping to get acquainted with the codes of social values, cultural integration through professional socialization, and the creation of behavior, which is professional deontology (Mortaki, 2012). Students will also not be deprived of their culture because both in society and in school, they always interact in a cultural context. Learning also becomes more meaningful because social and cultural values are encouraged and supported through the use of context or personal recognition (Derderian-Aghajanian, 2010).

Example-based learning was adopted using an analogy heuristic strategy that departed from the example. An example-based heuristic strategy has been tested for its benefits in mathematics learning, among others, reviewed by Novotná, Eisenmann, Přibyl, Ondrušová, and Břehovský (2014), Reiss and Renkl (2002), and Tandiseru (2015). The adoption of local culture in the model can increase appreciation and appreciation for the noble values of local culture. Learning this way contributes to knowledge transfer, personal development and participation in society, makes students aware of aesthetics and ethics to express their feelings and give meaning, and helps them find ways of learning and communicating in their own way, thus complementing the domain of knowledge and disciplines other (Bang & Medin, 2010). These conditions can accelerate the achievement of the objectives of vocational education, namely, to foster the integration of students in professional life (Mortaki, 2012).

CONCLUSION

An example-based learning model for vocational education has been successfully developed. The learning model is declared feasible for vocational education, with the addition of a heuristic strategy working backward. The empirical test in the small class found that the practicality of the model is good.

An important recommendation from the teacher is that there needs to be a hierarchy of levels of similarity between examples and assignments. As a first step, the learning model is good enough but still needs improvement efforts.

Teachers and students perceive that the example-based learning model is suitable for vocational education that emphasizes skills development. The heuristic strategy can horn students to construct their own knowledge and skills. Student collaboration with students and students with teachers occurs in warm situations because every day, they are familiar with mutual cooperation activities. Students are helped to get acquainted with socio-cultural values, so students are not deprived of their culture. In addition to contributing to the trans-

fer of knowledge and skills, the learning model developed also contributes to personal development and participation in society. All of this helps students to give meaning to their knowledge and skills so that they are useful for themselves, the workplace, and society.

REFERENCES

Agrawal, T. (2013). Vocational education and training programs (VET): An Asian perspective. *Asia-Pacific Journal of Cooperative Education*, *14*(1), 15–26. Retrieved from https://www.ijwil.org/files/APJCE_14_1_15_26.pdf

Bang, M., & Medin, D. (2010). Cultural processes in science education: Supporting the navigation of multiple epistemologies. *Science Education*, *94*(6), 1008–1026. https://doi.org/10.1002/sce.20392

Bialik, M., Bogan, M., Fadel, C., & Horvathova, M. (2015). *Character education for the 21st century: What should students learn?* Boston, MA: Center for Curriculum Redesign.

Boteanu, A., & Chernova, S. (2015). Solving and explaining analogy questions using semantic networks. In *Proceedings of the Twenty-Ninth AAAI Conference on Artificial Intelligence* (pp. 1460–1466). Boston, MA: Association for the Advancement of Artificial Intelligence.

Derderian-Aghajanian, A. (2010). Multicultural education. *International Education Studies*, *3*(1), 154–160. https://doi.org/10.5539/ies.v3n1p154

Ebel, R. L. (1951). Estimation of the reliability of ratings. *Psychometrika*, *16*(4), 407–424. https://doi.org/10.1007/BF02288803

European Centre for the Development of Vocational Training (Cedefop). (2017). *The changing nature and role of vocational education and training in Europe. Volume 1: Conceptions of vocational education and training: An analytical framework*. Luxembourg: Publications Office of the European Union. Retrieved from http://hdl.voced.edu.au/10707/444435

Forišek, M., & Steinová, M. (2012). Metaphors and analogies for teaching algorithms. In *SIGCSE '12: Proceedings of the 43rd ACM Technical Symposium on Computer Science Education* (pp. 15–20). Raleigh, NC: Special Interest Group on Computer Science Education. https://doi.org/10.1145/2157136.2157147

Genç, M. (2013). The effect of analogy-based teaching on students' achievement and students' views about analogies. *Asia-Pacific Forum on Science Learning and Teaching*, *14*(2), 14. Retrieved from https://www.eduhk.hk/apfslt/v14_issue2/genc2/index.htm#con

Gentner, D. (1998). Analogy. In W. Bechtel & G. Graham (Eds.), *A companion to cognitive science* (pp. 107–113). Oxford: Blackwell.

Glynn, S. M. (2008). Making science concepts meaningful to students: Teaching with analogies. In S. Mikelskis-Seifert, U. Ringelband, & M. Brückmann (Eds.), *Four decades of research in science education: From curriculum development to quality improvement* (pp. 113–125). Münster: Waxmann.

Goel, V. P. (2009). *Technical and vocational education and training (TVET) system in India for sustainable development*. New Delhi: Minisitry of HRD, Government of India.

Gregory, R. J. (2000). *Psychological testing: History, principles, and applications*. Boston, MA: Allyn and Bacon.

Johnson, D. W., & Johnson, R. T. (1991). *Learning together and alone: Cooperative, competitive, and individualistic learning*. Boston, MA: Allyn and Bacon.

Johnson, D. W., Johnson, R. T., & Stanne, M. B. (2000). *Cooperative learning methods: A meta-analysis*. Retrieved from https://pdfs.semanticscholar.org/dada/0c7a2811ea0184a4326a80706901c2d534fa.pdf

Joyce, B., Weill, M., & Calhoun, E. (2009). *Models of teaching*. Upper Saddle River, NJ: Allyn & Bacon, Pearson Education.

Lipka, J., Sharp, N., Brenner, B., Yanez, E., & Sharp, F. (2005). The relevance of culturally based curriculum and instruction: The case of Nancy Sharp. *Journal of American Indian Education*, *44*(3), 31–54. Retrieved from https://jaie.asu.edu/sites/default/files/443_2005_3_lipka_et_al.pdf

Ministry of Education and Culture of Republic of Indonesia. (2015). *SMK dari masa ke masa*. Jakarta: Directorate General of Primary and Secondary Education, Ministry of Education and Culture of Republic of Indonesia.

Moodie, G. (2002). Identifying vocational education and training. *Journal of Vocational Education & Training*, *54*(2), 249–266. https://doi.org/10.1080/13636820200200197

Mortaki, S. (2012). The contribution of vocational education and training in the preservation and diffusion of cultural heritage in Greece: The case of the specialty "Guardian of Museums and Archaeological Sites." *International Journal of Humanities and Social Science*, *2*(24), 51–58. Retrieved from http://www.ijhssnet.com/journals/Vol_2_No_24_Special_Issue_December_2012/8.pdf

National Centre of Expertise for Cultural Education and Amateur Arts (LKCA). (2017). *Basis for cultural education: Guide for the future of school-based and extracurricular cultural education*. Utrecht: National Centre of Expertise for Cultural Education and Amateur Arts (Landelijk Kennisinstituut Cultuureducatie en Amateurkunst (LKCA)). Retrieved from https://www.lkca.nl/~/media/downloads/lkca/english/basis_for_cultural_education.pdf

Newaz, M. T., Faruquee, M., & Farha, S. (2013). Vocational education and training in Bangladesh: Why it is not working? *International Journal of Research Studies in Education*, *2*(4), 29–40. https://doi.org/10.5861/ijrse.2013.261

Nieveen, N., & Plomp, T. (Eds.). (2007). Formative evaluation in educational design research. In *Proceedings of the seminar conducted at the East China Normal University, Shanghai (People's Republic of China)*. Enschede: SLO - Netherlands institute for curriculum development.

Novotná, J., Eisenmann, P., Přibyl, J., Ondrušová, J., & Břehovský, J. (2014). Problem solving in school mathematic based on heuristic strategies. *Journal on Efficiency and Responsibility in Education and Science*, *7*(1), 1–6. https://doi.org/10.7160/eriesj.2014.070101

Oliver, D. (2010). Complexity in vocational education and training governance. *Research in Comparative and International Education*, *5*(3), 261–273. https://doi.org/10.2304/rcie.2010.5.3.261

PH, S. (2013). Pengembangan SMK Model untuk masa depan. *Jurnal Cakrawala Pendidikan*, *XXXII*(1), 14–26. https://doi.org/10.21831/cp.v5i1.1256

Plomp, T., & Nieveen, N. (Eds.). (2007). An introduction to educational design research. In *Proceedings of the seminar conducted at the East China Normal University, Shanghai (People's Republic of China)*. Enschede: SLO - Netherlands institute for curriculum development.

Polya, P. G. (1973). *How to solve it: A new aspect of mathematical model* (2nd ed.). Princeton, NJ: Princeton University Press.

Reiss, K., & Renkl, A. (2002). Learning to prove: The idea of heuristic examples. *Zentralblatt Für Didaktik Der Mathematik*, *34*(1), 29–35. https://doi.org/10.1007/BF02655690

Reyhner, J., Gilbert, W. S., & Lockard, L. (Eds.). (2011). *Honoring our heritage: Culturally appropriate approaches for teaching indigenous students*. Flagstaff, AZ: Northern Arizona University Press.

Sharan, S. (1999). *Handbook of cooperative learning methods*. Connecticut: Praeger Westport.

Slavin, R. E. (2005). *Cooperative learning: Theory, research, and practice*. Boston, MA: Allyn and Bacon.

Slavin, R. E. (2010). Co-operative learning: What makes groupwork work? In H. Dumont, D. Istance, & F. Benavides (Eds.), *The nature of learning: Using research to inspire practice* (pp. 161–178). Paris: OECD.

Squire, K. D., MaKinster, J. G., Barnett, M., Luehmann, A. L., & Barab, S. L. (2003). Designed curriculum and local culture: Acknowledging the primacy of classroom culture. *Science Education*, *87*(4), 468–489. https://doi.org/10.1002/sce.10084

Tandiseru, S. R. (2015). The effectiveness of local culture-based mathematical heuristic-KR learning towards enhancing student's creative thinking skill. *Journal of Education and Practice*, *6*(12), 74–81. Retrieved from https://www.iiste.org/Journals/index.php/JEP/article/view/21884/22200

Young, P. A. (2014). The presence of culture in learning. In *Handbook of research on educational communications and technology* (pp. 349–361). New York, NY: Springer New York. https://doi.org/10.1007/978-1-4614-3185-5_28

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (238-248)
Online: http://journal.uny.ac.id/index.php/jpv

THE NEED OF PRACTICAL TEACHING IN VOCATIONAL HIGH SCHOOL OF AUTOMATION AND OFFICE MANAGEMENT PROGRAM

Febrika Yogie Hermanto
Universitas Negeri Yogyakarta

Sutirman
Universitas Negeri Yogyakarta

Berlina Hidayati
Universitas Gadjah Mada

Mar'atus Sholikah
Universitas Negeri Yogyakarta

Abstract

The success of vocational education cannot be separated from the proper management of learning by its objectives. This study aims to explore the pitfalls and the needs of practical teaching in the Vocational High School of Automation and Office Management Program (AOMP) in Yogyakarta city. This research uses a descriptive method with a qualitative approach. The data obtained were analyzed by using the qualitative analysis model of Miles and Huberman with stages: data reduction, presenting data, verifying data, and concluding data. The results of this study show that the complex equations that are occurred in practical learning of the Vocational High School of AOMP are including the absence of practical teaching materials that are relevant to the industry, there is no specific time for practical learning, lack of facilities and infrastructures, deficiency tools and time to use office laboratories, and there are new types of jobs in the office workforce that are difficult to be followed. Moreover, these matters are complicated for schools to be embodied in the form of practical learning, resulting in poorly trained vocational students in doing their duty that fit the areas of expertise learned. This hardship implies that vocational students become less confident in doing their jobs in the industry either during an internship program or when working in the industry. This research is limited to pitfalls that occur in Yogyakarta City and in schools, which are the subject of this research.

Keywords: *practical learning needs, vocational high school, automation and office management program (AOMP)*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.26734*

Contact Febrika Yogie Hermanto febrikayogie.2018@student.uny.ac.id
Department of Economic Ediucation, Graduate School of Universitas Negeri Yogyakarta
Jl. Colombo No. 1, Karangmalang, Depok, Sleman, Yogyakarta 55281, Indonesia

INTRODUCTION

The high number of vocational high school graduates who have not yet worked has become an irony for vocational education in Indonesia. Kusuma (2019) states that the Indonesian Central Statistics Agency in 2019 noted that around 8.63% of unemployment in Indonesia is dominated by vocational graduates.

Whereas, vocational education is specifically designed to prepare competent graduates in adherence to the needs of the workforce (Murniati & Usman, 2009, p. 2). To prepare graduates who qualify the requirements of the industry, Clarke and Winch, 2007 (p. 9) state that the experience provided must include practical skills and techniques that support the area of expertise learned. Sutirman, Muhyadi, and Surjono (2017, p. 94) explain that vocational school's learning must be managed by doing a lot of practical activities following the need of the industry.

Based on the revised version of the 2013 curriculum, vocational learning is more directed on balance between theory and practice. There are some adjustments and additional basic competencies that need to be taught to students to increase relevance to the requirements of the industry. This concept is in line with the idea of Thomson (1972, p. 111), which states that vocational education provides information, work experience, awareness in working and trains students' psychomotor abilities following the area of expertise learned in schools and the industry.

In order to be competent, Woodruffe (1993, p. 29) states that a person must have a series of experiences that have been carried out and make him skilled for completing the tasks that are his responsibility. He also illustrates that competency is a dimension of human behavior that is constantly trained. If someone is declared competent, he must represent what he did for his work following the expected competence. Deist and Winterton (2005, p. 27) add that competency can be obtained through collective learning, both directing practice and illustrating the profession carried out to improve skills by integrating the capabilities that they have. Therefore, to improve the competency of vocational students, teachers should do practical learning so that students directly practice their skills that can be done repeatedly.

The relevant competency reference used for vocational education is the Indonesian National Work Competency Standards issued by the National Professional Certification Board in 2012. In the Indonesian National Work Competency Standards, it is explained in detail about the capability standard relating to knowledge, skills, and minimum work attitudes that must be possessed by someone to be able to work or occupy a certain position. Based on the competency reference, vocational education can focus on shaping the ability of students to meet the competency standard that must be possessed by a worker in Indonesia.

The efforts to shape the ability of students is started with providing knowledge to students, and training continuously so that they can do something that they have learned. Piaget (Bodner, 1986, p. 873) states that knowledge is obtained through experiences done by students in a certain learning process. Bozkurt (2017, p. 210) adds that knowledge was actively gained through planned mechanisms. Furthermore, referring to Vygotsky's constructivism theory, Turuk (2008, p. 246) states that knowledge acquiring is very dependent on what has been planned by the teacher to make the classroom situation active to explore students' abilities in meaning-makers and problem-solvers. Turuk (2008, p. 246) also adds that knowledge is obtained not through interactions that occur, but it is in the interaction itself. Therefore, in providing knowledge to students, it will be more effectively done by forming a suitable learning environment so that students can actively carry out the learning process and can construct their understanding following the experience they have gained (Liu & Chen, 2010, p. 64). Thus, ideally, to provide certain knowledge or competencies to vocational students, learning is packaged with certain practical activities where students can do their work repeatedly and continuously so that they can construct their understanding through practical activities in which students are fully involved in learning.

The objectives of vocational education, according to Yoto and Widiyanti (2017, p. 586), is to prepare students to enter the workforce, choose a career, build competencies, and equip useful experiences in the workforce. It is mentioned by Mardiyah and Supriyadi (2013, p. 321) that vocational schools aim to equip their students with skills that are following

their interests so that it will be useful when they work in the industry. Narwoto and Soeharto (2013, p. 223) add that vocational education is education aimed to prepare students who can work in certain fields with the competencies based on their interests.

Based on the opinion, practical learning is crucial for vocational students. Through practical learning, direct experience can be provided to vocational students to practice their abilities to be competent in their fields. To make students competent in their fields of expertise, Sutrisno and Siswanto (2016, p. 112) state that educational patterns must be made as close as to the conditions of the workforce and can be done repeatedly and sustainably. Thus, the mindset and skills of students can be suitable for the field of work that they will encounter in the workforce, so they can compete with the competencies they have in the area of expertise they are engaged in.

However, the unavailability of learning practices in line with industry needs is a major obstacle faced by vocational schools. Practical teaching materials provided by schools and the government also do not fully support students to improve their competency in the field of expertise. Besides, Widiyanto (2010, p. 104) explain that there was still a lack of laboratory facilities that could be provided by schools so the graduates were not adaptive to the workforce. It causes the graduates produced by vocational schools not having sufficient competence to enter the workforce. Judisseno (2008, p. 17) states another problem found in his study, that vocational school did not want to pay attention to the developmental needs of the industry so that it becomes a serious pitfall for vocational high schools in Indonesia, such as the reluctance or lack of trust from industry to use vocational school graduates. On the other hand, based on the argument from Setiawati and Sudira (2015, p. 326), one of the learning achievements of students in vocational schools is the attainment of competency in vocational practice that will become a provision for the workforce. Thus, it is ironic if practical learning with some facilities that should be fulfilled by the vocational school in supporting the improvement of student competencies cannot be provided so that it becomes an unemployment problem created by the vocational school because it cannot equip students to enter and compete in the professional workspace.

The problems are summarized as follows: (1) the lack of practical teaching materials provided, (2) the deficiency of workshop facilities that can be used, and (3) schools are less adaptive to industry needs also become a major obstacle experienced by the Vocational High School of Automation and Office Management Program (AOMP) for conducting practical learning. The teaching materials provided are still widely based on knowledge and are textual, and very rarely found practical teaching materials based on practical activities can make students active in the learning process with meaning-maker and problem-solver principles, moreover practical teaching materials that are in line with needs industry.

According to Vygotsky's constructivism theory, students will acquire long recorded knowledge in memory and become a certain competency that they have by arranging the active classroom situation in the learning process to explore students' abilities. It can be realized in practical learning repeatedly and sustainably. Through practical activities, students will obtain full knowledge and experience so that they will be competent in their fields. Reviewed from previous studies on vocational education, practical activities are the largest contributor in improving the ability of students needed in the industrial world. Like the research conducted by Lestari and Siswanto (2015, p. 190), namely: the learning outcomes of productive education and training significantly influence the work readiness of vocational students. Besides, Setiawati and Sudira (2015, p. 337) state that the factors that influence the learning achievement of vocational students are achievement motivation, learning discipline, the experience of internship, facilities, and infrastructure, teacher performance, and parent support.

Based on the analysis of various phenomena that occur at vocational school, it can be seen that the problem of teaching materials lies in the infrastructure variable that must be prepared to provide practical learning that fit industrial needs. The availability of practical teaching materials is very important for students, teachers, industries, and academics as an effort to improve the competency of vocational students and to be in line with industry needs. Thus, learning practices carried out in schools to improve the competency of vocational students can qualify industry needs.

It is interesting to be investigated so that it can be known with certainty what the learning needs of the practical learning in the Vocational High School of AOMP to be able to realize learning in line with the industry. In addition, this research can be used as a reference by vocational schools or other vocational institutions in preparing practical learning which is needed to improve student competencies before entering the workforce.

RESEARCH METHOD

This study was conducted using descriptive methods with a qualitative approach to accomplish the research's objective. This study is intended to investigate information regarding the practical learning needs of the Vocational High School of AOMP in Yogyakarta City.

The subjects of this study were productive teachers of the Vocational High School of AOMP in Yogyakarta City selected by purposive sampling. The selected teachers became the source of the data in this study representing public and private schools in Yogyakarta City originating from State Vocational High School 1 in Yogyakarta, State Vocational High School 7 in Yogyakarta, BOPKRI Vocational High School 1 in Yogyakarta, and PIRI Vocational High School 3 in Yogyakarta.

The selection of participants is based on consideration of understanding the problems faced by schools in conducting practical learning, experiencing cooperating with industry, and representing some of the positions that they have in the school.

In fulfilling the research mission, this study used deep interviews and documentation to seek information about particular topics. This study analyses the data collected through Miles and Huberman's models, namely: data reduction, data presentation, data verification, and conclusion. Data presentation uses a matrix to display data so that it can be easily understood and get its substance (Miles & Hubberman, 1994).

RESULTS AND DISCUSSION

Results

Based on the results of interviews and documentation conducted, several findings indicate the pitfalls experienced by teachers for filling the needs of practical learning in the Vocational High School of AOMP. Then, the data obtained were analyzed using Miles and Huberman model and presented in the matrix or table.

There are some practical learning problems in vocational schools that still cannot be solved by teachers and education management to construct practical experience for students following the needs of the industry. For more details, consider Table 1.

Table 1 shows that there are problems experienced by teachers in practical learning in the Vocational High School of AOMP. It does not mean that schools are not able to provide curriculum demands and industry requirements. However, it requires the involvement of certain parties in order to be able to solve the hardships occurring for learning in vocational school, such as the education service, industry service, and other government-owned institutions which is still needed to link the necessaries of schools and industries so that they can solve the complex equations occurring in the implementation of practical learning to improve vocational student competencies.

Based on Table 1, it can be seen that there are opportunities for teachers and education practitioners to fulfill the requirements for practice learning at vocational schools. First, they can create practical teaching materials in schools through integrated basic competencies. In addition to students should be given a specific time to undertake practical activities sustainably. It is intended to meet the learning needs of students in honing their competence. Second, facilities and infrastructure in schools such as office-specific laboratories, office equipment necessary for office activities must be established to support student learning practices in schools that have been adapted to the industry required.

The problem of learning this practice is almost faced by all Vocational High Schools of AOMP in Yogyakarta City. Besides, schools also have not found the right way yet to array practical learning that supports the improvement of student competencies that fit the fields of expertise in office automation and governance. Learning practices that have been carried out by teachers in schools are presented in Table 2.

Table 1. Problems of Practical Learning in Vocational High School Corresponding to Industrial Needs

Learning problems	Requirements that must be fulfilled in learning	Opportunities
No practice teaching materials corresponding to industry Separate practice learning materials between competency and others No specific time for practical activities	Conveyed the basic competence in the curriculum	Learning with integrated competencies
Practice in an industry directly based on the workforce There are new jobs that have been applied in industries, yet schools are unable to teach	Student competencies in handling specific work following industry	
No office laboratory Difficult to follow the development of tools used by industry Limited office equipment in the school	Utilization of the internet to access information on how to use office equipment needed	Facilities and infrastructures that support office learning
Office Laboratory is Computers Laboratory which is used to other skill competency programs Utilization of Laboratories for Exam Activities	The intensity of laboratory use for maximum practice	

Table 2. Practice Learning Conducted by Vocational High School

Learning Process	Requirements that must be fulfilled in learning	Opportunities
Using the teacher's lecture method Give assignments to students Presentations conducted by students Discussion of the presented material	Basic competency of theory	School and industry collaboration to integrate curriculum and learning materials
Practice each subject in the computer laboratory Conducting practice with basic competencies in each subject	Basic competence of practice	
Jobs performed by students during the internship program in the industry	Adaptive student competencies with office work	

From the detailed information in Table 2, it can be seen that schools still rely heavily on practical activities undertaken by students in industry, yet practical learning conducted at school is more likely to be achieved in delivering material, not in enhancing the competency of students. It is evident from the practice learning process that does not emphasize the achievement of student competencies that suitable for industry needs. Meanwhile, when practicing in industry, vocational students are not fully involved, and the work done is limited to technical matters.

With all the limitations possessed and underwent by teachers in schools on setting practical learning to students, some opportunities can be alternative for schools through teachers or authorities to be able to work closely with industry in planning and implementing learning practices that are appropriate with the required competencies. It is relevant to be done since cooperation in organizing vocational education stated in Presidential Instruction No. 9 of 2016 on Revitalization program of Vocational High School (VHS). The regulation states that ministries related to vocational edu-

cation such as ministries of education and culture, industry, labor, domestic, finance, research and technology, transportation, maritime affairs and fisheries, state-owned enterprises, energy and mineral resources, health and all regional heads in Indonesia are encouraged to do things considered necessary and prepare appropriate instruments to provide learning that can improve the competency of vocational students.

In addition, the Ministry of Education and Culture is specifically asked to heighten cooperation with the department and industry in organizing learning in vocational schools that are in line with the current industry required. Table 3 presents what and how the cooperation between vocational high school and industry can be perceived.

The implementation of this cooperation between schools and industry is an application on the internship program, industrial visit, special skills test, the opportunity to participate in a selection in a particular industry, and the opportunity to take part in the job fair held by the school. From some of the aforementioned cooperation, an internship program is one of the special programs to meet the needs of practical activities of students who are required to work in the industry. However, internship activities in the industry face several obstacles due to the lack of flexibility of the school to collaborate with industry, so the school cannot determine together with the industry related to the material, time, and practical experience by students.

As a result, students cannot fully explore their abilities in the industry to become certain competencies mastered by students. Besides, the implementation of industrial visits and special skills tests by schools and industries is conducted conditionally and sometimes only once or twice, not intensively. The opportunity to participate in industry selection and take part in a job fair can only be held at schools with the special job market, which has collaborated with industry.

Based on the data of interviews and documentation obtained, the collaboration between schools and industries has complex equations, namely: on the intensity and flexibility of schools in conducting and determining cooperation type with industry. Schools have difficulty determining the type of cooperation with industry because the role of related offices and local government is not optimal in facilitating the learning needs of school practice with industry requirements. There are no specific regulations from the regional government or offices that make schools flexible in establishing cooperation with industry. For example, in internship activities, schools tend to be afraid of not getting partners when asking for full student involvement in practical activities in the industry.

Table 3. Collaboration between Vocational High School and Industry

The Collaboration Hitherto	Requirement that must be Fulfilled in Learning	Opportunities
Cannot determine materials of internship program prepared by students Cannot determine the time of Internship program that fit the student's needs enhancing their competence in the industry Not many opportunities for students to learn in industry in an internship program	Internship program runs with the appropriate intensity of time and material	Rules that provide authority and connect learning between industry and schools
Limited activities to do during industry visits	Providing students understanding regarding the field of work done	
Implementation of special skills tests in school	Objective assessment according to student competency	Rules that prioritize vocational graduates to work in their fields of expertise
Opportunity to follow work selection Opportunity to join job fair in schools	Get priority opportunities	

Table 4. Practical Teaching Materials that Can be Provided

Forms of Teaching Materials	Requirements that Must be Fulfilled in Teaching Materials	Opportunities
Practice teaching materials with integrated competence	Existing competencies in curriculum and competencies required by industry	Special teaching materials for practical activities
Support independent learning process	Effectiveness of time and facilities used	
Many practical activities Similar to the duty in the industry	Existing jobs in private and public offices	Simulation or Role Playing Model
The division of work within and between groups is clear Collaboration between students in intergroup and intragroup Evaluation of group results	Conceptualized several offices with multi interactions	
There is an introduction of materials	Based on basic competencies used	

On the other hand, the industry also does not intensively pay special attention to vocational education because this is not considered to be its responsibility. The cooperative relationship that occurs between schools and industry is more likely to be the necessities of one party.

In facing challenges, there are opportunities for vocational schools such as related offices and local governments to facilitate the learning needs of student practice through the issuance of special regulations by the central and regional governments related to the authority of schools and industries in implementing practical learning in industry. In addition, the central and regional governments can issue special rules that prioritize vocational graduates to work in their areas of expertise so that high school students have more opportunities available for them. Thus, students can fully get the opportunity to improve and apply their competence in the workplace.

In fulfilling the needs of practical learning up to now it has not been able to be fully realized by the schools or related education offices, because of some problems that occur, researchers see one opportunity that is by providing practical teaching materials that are following industry requirements. The practical teaching materials that can be used by students to support the achievement of certain competencies can be seen in Table 4.

The results of interviews and documentation presented in the form of the data matrix in Table 4 imply that the practical learning needs can be circumvented by providing practical teaching materials that contain integrated basic competencies and fit the industry needs. Besides, practical teaching materials needed that support the student's independent learning process consisting of selected material based on the curriculum to enhance competencies.

Based on this, practical teaching material models that can be created are those that contain material or practical instructions using simulated learning methods or role-playing so that they can directly illustrate various types of work in the office industry and can be studied intensively by students. In this way, the needs of practical learning in vocational students of AOMP can be fully realized in the depiction of duty in the office industry.

Discussion

Based on the results of the study, it can be seen that there are still many problems that occur in the Vocational High School of AOMP related to practical learning. It starts from the lack of practical teaching materials that are relevant to the industry, there is no specific time for practical learning, deficiency of facilities and infrastructure, limited tools and time for using office laboratories, and there are new types of jobs in the industries that are difficult

to follow. It is in line with Judisseno (2008, p. 17), who states that vocational schools in Indonesia do not actively observe the development of industry needs. Practical learning in schools is applied in modest ways and facilities and tends to be far from the requirements of industrial work. It causes the industry to lack confidence in vocational school graduates to get the opportunity to work in the industry.

Murniati and Usman (2009, p. 2) specifically state that vocational education is indeed designed to prepare competent graduates following the needs of the workforce. The vocational school still has several technical hardships in enhancing student competency. Moreover, industrial challenges are difficult for schools to follow in providing practical learning to students, such as new types of work that utilize technological sophistication, competencies integrated with other competencies outside of the competencies taught at school, and students' affective abilities in doing responsibilities in the industry. If learning practices that are taught in schools are far from the demands of work in the industry, students will face technical distress to get opportunities to work in certain industries. Therefore, the number of unemployed graduates from vocational school is a common thing when viewed from the learning process and learning materials that are acquired by students.

Practical teaching materials in the Vocational High School of AOMP are very limited, especially if requested with integrated basic competencies that are in line with the requirements of work in the office. In the office sector, the application of tasks uses the full competency of office employees. As with correspondence tasks, competencies that must also be mastered by office employees are filing competencies, computer operating competencies, and general administrative competencies. Meanwhile, learning in schools, the competencies are separated based on subjects, and basic competencies taught. Based on the findings, practical teaching becomes less relevant if it must be integrated with the industry.

In line with the aforementioned idea, Sutirman et al. (2017, p. 94) and Thomson (1972, p. 111) state that vocational education aims to provide information, work experience, work awareness, and train students' psychomotor abilities following industry needs. Yoto and Widiyanti (2017, p. 586), Mardiyah and Supriyadi (2013, p. 321), and Narwoto and Soeharto (2013, p. 223) clearly mention that vocational education goals prepare students to be able to enter the workforce, choose a career, build a career, build a career, competence, and equip experiences that will be useful in the industry from the subjects they have learned. Therefore, schools are still having trouble to create appropriate practice learning, because no practice teaching material is suitable for work in the industry.

This issue occurs since there is indeed no practice teaching material that is suitable for employment in the industry. The main problem of other problems, such as there is no specific time for practical learning, deficiency of facilities and infrastructure, and the limited tools and time to use office laboratories. It has become a unity of problems that are relevant to each other because it is indeed a result of the absence of practical teaching materials that are relevant to the needs of the business world or industry. It also makes practice learning as long as it is carried out only to achieve basic competencies according to the national curriculum and not to consider the needs of the industry. Therefore, the competencies possessed by vocational students are not yet fully trusted by the industries, because they consider that schools are less adaptive to the needs of the industry for producing graduates.

In learning at the Vocational High School of AOMP, four types of competencies should be given to students, namely: (1) basic competency theory, (2) basic competency practice, (3) understanding the different fields of work performed and (4) the novelty of office work that follows developments. Competencies that must be mastered by each employee or prospective worker are listed in Indonesian National Work Competency Standards issued by the National Professional Certification Board in 2012. By complying with these standards, schools can innovate learning to advance competencies required by vocational graduates so they can be accepted and competed in the industry.

Besides, schools can collaborate with industry to design and implement practical learning. The application of cooperation must consider the requisites of learning in schools and industry. In this way, learning in vocational schools can take place by the demands of the curriculum and industry, for example, there

is a novelty of types and equipment of job, so the fulfillment of office equipment training in schools can be dealt by active and comprehensive cooperation between schools and industries. Clarke and Winch (2007, p. 9) state that the proximity between the school and industry partners will support the learning practices that are beneficial to students' experiences in the field of expertise. Yoto and Widiyanti (2017, p. 585) present examples of collaboration between schools and industry by building together learning based on the class cooperation model. The statement of Yoto and Widiyanti (2017, p. 596) implies that through class cooperation, Vocational High School graduates will become more confident and ready to compete in the world of work, and the problem of unemployment in Indonesia can be resolved.

Based on the results of the study, the problem of cooperation with industry has not been solved yet in achieving the competency of vocational students of AOMP. Practical cooperation is only on the internship activities, industrial visits, special skills tests, opportunities to participate in selection in certain industries, and opportunities to take part in Job Fairs held by schools. Opportunities to take part in job fairs and certain job selections are only provided by Vocational High Schools that have a special job market and actively collaborate with industry. This problem arises because the special job market owned by schools cannot fully provide the demands of cooperation in the provision of learning that involves industry.

In addition, the special job market of vocational school also still has difficulty in assisting vocational school graduates in applying for and in being accepted to work in the industry. The Regulation of the Minister of Manpower and Transmigration No. 07 of 2008 accounts that the role of the special job market of vocational school is to establish cooperation among the industry with the missions of creating practical learning and work placements that match their field of expertise. Directorate of Vocational Development (n.d.) adds that special job market of vocational school activities other than those aforementioned programs are synchronizing curriculum, establishing cooperation with the Department of Manpower and Transmigration on internship program, working placement for graduates, creating job vacancies, and creating a database of graduates who have or have not worked.

Based on this issue, there are two point opportunities that can be done by education providers through the relevant ministries or government to support learning in Vocational High Schools: (1) issuance of special regulations regarding the authority of schools and industries in implementing practical learning in industry through central and regional governments, (2) issuance of special regulations that prioritize vocational graduates applying and working in their area of expertise. Deist and Winterton (2005, p. 27) state that to obtain a certain competency, the teacher or education provider can apply collective learning with hands-on practice and show a depiction similar to reality to increase students' skills. Piaget (Bodner, 1986, p. 873) explains in more detail that competence is acquired from knowledge taught through a structured process based on the student experience in a learning process. Referring to the theory of constructivism, Vygotsky (Turuk, 2008, p. 246) states that competence is obtained through knowledge planned by the instructor to present an active classroom situation to explore the abilities of students. Woodruffe (1993, p. 29) adds that a person is considered competent if he has a series of experiences that make him skilled in completing his task as his responsibilities.

Regarding the Regulation of the Minister of Manpower and Transmigration No. 07 of 2008, Directorate of Vocational Development (n.d.), and the aforementioned competency theories, cooperation between schools and business parties is one of solutions to improve vocational student competencies, but the communication ineffectiveness between school and industry has a direct impact on students during the implementation of practical activities in the industry. It is impossible to solve the pitfall of cooperation in a relatively short time, but it can be overcome by learning practices that can describe the atmosphere and work of the office exactly as it is in reality and apply it flexibly in school. It can be realized through the creation of practical teaching materials that contain integrated basic competencies and appropriate with industry needs. It aims to support the students' independent learning process, especially the content of books and practical instruction using simulation learning methods or role-playing. This teaching material is intended so that students can study it intensively and obtain a real illustration of jobs in the office industry.

Moreover, these practical teaching materials are expected to increase their knowledge, experience, and competency through practical activities conceptualized similar to work in the industry. Thus, the practical learning needs of Vocational High School of AOMP can be met by schools, and students can prepare themselves to be able to compete in the industry.

CONCLUSION

The needs of practical learning in the Vocational High School of AOMP are still not fully provided by the school. This study pinpointing issues that occur in practical learning is the absence of practical teaching materials relevant to industry, lack of specific time for practical learning, deficiency of supporting facilities and infrastructure, limited tools and time to use office laboratories, and there are new type of job in office work that is difficult for schools to follow.

The solution to the difficulties in the provision of practical learning is cooperation between schools and industry. Besides, another important problem faced by schools related to cooperation with industry is cooperation formed through the special job market of Vocational High Schools, which are inflexible in designing and implementing learning with industry.

These constraints hamper schools in seeking opportunities for students through learning practices following industry criteria. As a result, students are less trained to do the work in the area of expertise they are engaged. These difficulties cause vocational students to become less confident in doing their work in the industry. The impact is that vocational high school students and graduates are deemed inadequate to meet the qualifications and competencies during internship activities or when working in the industry.

Referring to those obstacles, the alternative in providing practical learning in the Vocational High School of AOMP is creating practical teaching materials that can describe the atmosphere and office work like a reality that can be learned independently by students. With practical teaching materials intended to provide knowledge and experience on student learning that can improve competence. Adequate competence can be used to work both at the time of the internship program and when they have graduated.

The limitation of this study is restricted in the cases in Yogyakarta City and schools as research subjects. Future studies should use other research methods and other regions, and broad research subjects so they can describe more comprehensively the practical learning needs of Vocational High School of AOMP in Indonesia.

ACKNOWLEDGMENTS

This study is sponsored by the Indonesia Endowment Fund of Education, abbreviated as LPDP. We thank the productive teachers of the Vocational High School of Automation and Office Management Program (AOMP) in Yogyakarta City as the participants of this study. We also acknowledge Tangguh Okta Wibowo, a student of the doctoral program at Gadjah Mada University, who gives some recommendations to finish this article.

REFERENCES

Bodner, G. M. (1986). Constructivism: A theory of knowledge. *Journal of Chemical Education*, *63*(10), 873–878. https://doi.org/10.1021/ed063p873

Bozkurt, G. (2017). Social constructivism: Does it succeed in reconciling individual cognition with social teaching and learning practices in mathematics? *Journal of Education and Practice*, *8*(3), 210–218. Retrieved from https://www.iiste.org/Journals/index.php/JEP/article/view/35117/36121

Clarke, L., & Winch, C. (2007). *Vocational education: International approaches, developments and systems*. London: Routledge.

Deist, F. D. Le, & Winterton, J. (2005). What is competence ? *Human Resource Development Internatonal*, *8*(1), 27–46. https://doi.org/10.1080/1367886042000338227

Directorate of Vocational Development. (n.d.). Tentang BKK [About special job market]. Retrieved November 6, 2019, from https://bkk.ditpsmk.net/about

Judisseno, R. K. (2008). *Jadilah pribadi yang kompeten di tempat kerja*. Jakarta: PT. Gramedia Pustaka Utama.

Kusuma, H. (2019). Lulusan SMK masih dominasi pengangguran di RI. *Detik Finance*. Retrieved from https://finance.detik.com/berita-ekonomi-bisnis/d-4537723/lulusan-smk-masih-dominasi-pengangguran-di-ri

Lestari, I., & Siswanto, B. T. (2015). Pengaruh pengalaman prakerin, hasil belajar produktif dan dukungan sosial terhadap kesiapan kerja siswa SMK. *Jurnal Pendidikan Vokasi*, *5*(2), 183–194. https://doi.org/10.21831/jpv.v5i2.6384

Liu, C. C., & Chen, I. J. (Crissa). (2010). Evolution of constructivism. *Contemporary Issues in Education Research*, *3*(4), 63–66. https://doi.org/10.19030/cier.v3i4.199

Mardiyah, S. U. K., & Supriyadi, E. (2013). Evaluasi praktik kerja industri kompetensi keahlian pemasaran SMKN 1 Pengasih, Kulon Progo. *Jurnal Pendidikan Vokasi*, *3*(3), 320–333. https://doi.org/10.21831/jpv.v3i3.1846

Miles, M. B., & Hubberman, A. M. (1994). *Qualitative data anaysis*. Riverside County, CA: SAGE Publications.

Murniati, A. R., & Usman, N. (2009). *Implementasi manajemen strategik dalam pemberdayaan sekolah menengah kejuruan*. Bandung: Citapustaka Media Perintis.

Narwoto, N., & Soeharto, S. (2013). Faktor-faktor yang berpengaruh terhadap prestasi belajar teori kejuruan. *Jurnal Pendidikan Vokasi*, *3*(2), 222–233. https://doi.org/10.21831/jpv.v3i2.1603

Presidential Instruction No. 9 of 2016 on Revitalization program of Vocational High School (VHS) for the improvement of Indonesian human resources' quality and competitiveness (2016). Republic of Indonesia.

Regulation of the Minister of Manpower and Transmigration No. 07 of 2008 concerning manpower placement (2008). Republic of Indonesia.

Setiawati, L., & Sudira, P. (2015). Faktor-faktor yang mempengaruhi prestasi belajar teknik komputer dan informatika. *Jurnal Pendidikan Vokasi*, *5*(3), 325–339. https://doi.org/10.21831/jpv.v5i3.6487

Sutirman, S., Muhyadi, M., & Surjono, H. D. (2017). Problems in learning of electronic filing at vocational school in Yogyakarta Special Region, Indonesia. *Journal of Education and Practice*, *8*(5), 94–99. Retrieved from https://www.iiste.org/Journals/index.php/JEP/article/view/35470/36490

Sutrisno, V. L. P., & Siswanto, B. T. (2016). Faktor-faktor yang mempengaruhi hasil belajar siswa pada pembelajaran praktik kelistrikan otomotif SMK di Kota Yogyakarta. *Jurnal Pendidikan Vokasi*, *6*(1), 111–120. https://doi.org/10.21831/jpv.v6i1.8118

Thomson, J. F. (1972). *Foundations of vocational education: Social and philosophical concepts*. Englewood Cliffs, N.J.: Prentice-Hall.

Turuk, M. C. (2008). The relevance and implications of Vygotsky's socio-cultural theory in the second language classroom. *Annual Review of Education, Communication, and Language Sciences (ARECLS)*, *5*, 244–262. Retrieved from https://pdfs.semanticscholar.org/3987/5cacea3cc95ae54e504af6259ae64912adb0.pdf

Widiyanto, W. (2010). Strategi pengembangan kurikulum berbasis kompetensi DUDI untuk SMK. *Jurnal Pendidikan Ekonomi Dinamika Pendidikan*, *V*(2), 103–116. https://doi.org/10.15294/dp.v5i2.4920

Woodruffe, C. (1993). What is meant by a competency? *Leadership & Organization Development Journal*, *14*(1), 29–36. https://doi.org/10.1108/eb053651

Yoto, Y., & Widiyanti, W. (2017). Vocational high school cooperation with P.T. Astra Honda Motor to prepare skilled labor in industries. *International Journal of Environmental & Science Education*, *12*(3), 585–596. https://doi.org/10.12973/ijese.2017.1249p

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (249-257)
Online: http://journal.uny.ac.id/index.php/jpv

THE LEVEL OF USE OF INFORMATION AND COMMUNICATION TECHNOLOGY AT VOCATIONAL HIGH SCHOOL

Purnamawati
Universitas Negeri Makassar

Anas Arfandi
Universitas Negeri Makassar

Nurfaeda
Universitas Negeri Makassar

Abstract

Learning in the 4.0 era uses the concept of 4C (Communication, Collaboration, Critical Thinking, and Problem Solving, Creativity, and Innovation). This concept is linear to the use of information and communication technology (ICT). Technology literacy is involved in all subjects of learning. This phenomenon triggers the teachers, the students, and the school environment to play an active role so that technological progress has meaningfulness in increasing student competence. This study aims to: (1) describe the level of the use of ICT use, (2) determine the factors that influence the use of ICT, and (3) describe the ability of teachers to use ICT in the learning process. This research is a mixed-method with a sequential explanatory strategy. The data collected use questionnaires, interviews, observations, and documentation. The results obtained: (1) the level of ICT utilization in the learning process is at level 4, which means Managed and Measurable. (2) the factors that influence the use of ICT in the learning process in Makassar City Vocational High School based on the Resiliency Maturity Assessment Framework screen components namely data application factors, and (3) the ability teachers in utilizing ICTs in the learning process at Vocational High School in Makassar City meet the criteria very well.

Keywords: *ICT utilization, resiliency maturity assessment framework (RMAF), capability maturity model (CMM), vocational high school (SMK)*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.27117*

Contact Purnamawati purnamawati@unm.ac.id
Department of Electronics Engineering Education
Universitas Negeri Makassar
Kampus II Parangtambung, Jl. Daeng Tata Raya, Gedung EK Fakultas Teknik, Tamalate, Kota Makassar, Sulawesi Selatan 90224, Indonesia

INTRODUCTION

The progress of information, communication, and technology (ICT) provide opportunities in education by developing learning and training models through the use of advanced ICT. It is intended to find solutions to overcome the weaknesses of the learning process. In the aspect of culture and work attitude, ICT can change employees' performance: workers who initially worked paper-based are switched to working on a digital basis. Their discipline in working is no longer based on entry hours, but it is assessed based on their performance (Ahmad, 2018). Thus, the era of the industrial revolution 4.0 provides new experiences for educators in improving graduate competencies.

The industrial revolution 4.0 continues to advance into a new civilization in the development of Information, Communication, and Technology (ICT). It affects all components, including education in Indonesia. This era has an impact on the necessity of changes in learning patterns in schools that were still traditionally paper-based to be ICT-based.

The presence of ICT in education has an impact on the realization of a learning activity that is active, fun, and encourages students to be actively involved. The integrity of ICT in delivering messages is very significant. ICT in education has changed the paradigm of providing subject matter to students. One example of the use of ICT in education is the use of computers/laptops, internet networks, and also smartphones as sources or learning media.

The existence of facilities and infrastructure plays an essential role in the application of ICT-based learning. Regulation of the Minister of National Education No. 19 of 2005, on National Standard of Education explains that facilities and infrastructure are the national education standards related to the minimum criteria of learning spaces, places to exercise, places of worship, libraries, laboratories, workshops, playgrounds, places of creation and recreation, and other learning resources, needed to support the learning process, including the use of information and communication technology. It shows that the provision of facilities and infrastructure to support the use of ICT is now a standard requirement. The utilization of ICT in the learning process, as well as the application of ICT in learning, has become a standard that must be implemented by each school.

For the educational system, ICT is useful for providing a quality education which is in line with constructivism as a contemporary learning paradigm (Lamanauskas, 2008). Besides, teacher preparation equipped with ICT tools and facilities is one of the main factors in the success of technology-based teaching and learning (Deebom & Zite, 2016; Eady & Lockyer, 2013; Ghavifekr & Rosdy, 2015; Mas'ud & Surjono, 2018; Sangrà & González-Sanmamed, 2010). The outcome of the learning is to improve the quality of graduates who can compete in advanced tertiary education or globally in the industrial world. One example of the use of ICT facilities and infrastructure in learning is e-learning.

Moreover, Hanum (2013) outlines the need for better preparation to implement e-learning. E-Learning, which is prepared better, is more effective, and students can own working skills in preparing graduates of Vocational High School (*Sekolah Menengah Kejuruan* or SMK) who are ready to work and have expertise in technology and information by using e-learning.

A survey in the Department of Computer and Network Engineering (*Teknik Komputer Jaringan* or TKJ) in the vocational high school indicates that the average aspects of ICT management are adequate (40-60%). This value indicates that the awareness of the importance of ICT infrastructure to support the TKJ Department in Malang is very good (Elmunsyah, 2014).

Digital learning resources support information processing by helping students to develop mental representations through a mixture of media elements presented to them. Digital learning resources include content and, sometimes, learning activities. They combine multimedia elements, including text, images, video, and audio, to present information (Eady & Lockyer, 2013; Mas'ud & Surjono, 2018; Rahim, 2016).

In addition, Vernanda, Abdullah, and Rohendi (2018) analyze internet literacy for vocational teachers using six indicators, namely (1) availability of internet access tools, (2) location of internet access, (3) location of internet access and intensity of internet access, (4) internet utilization in education, (5) use of the internet for social media, and (6) use of the internet for research, and for sharing knowledge and information. The level of internet

literacy maturity of vocational education teachers has reached level 2, which means that vocational teachers have used the internet many times to help them with their daily activities and have a repetition pattern in term of internet utilization.

The uses of ICT in learning namely: (1) Utilizing multimedia facilities already available to facilitate activities carried out during the learning process, (2) Utilizing the internet for the distance learning process (virtual classrooms) (3) students can demonstrate with existing multimedia devices (Ab Hadi, Mohamad, & Jaafar, 2010; Rusman, Kurniawan, & Riyana, 2011). This statement, according to the opinion of Supiandi and Lisa (2018), ICT can be applied innovatively at all stages of learning activities teaching, starting from making lesson plans, preparing materials, presenting materials, applying lessons, to evaluating. The use of ICT, school management, and education personnel in schools can improve school administration and efficient information flow to support the achievement of educational standards and the process of decentralization of education in Indonesia.

On the preliminary observations at SMK in Makassar, teachers use a computer-based learning approach in the teaching and learning process. Every classroom has installed ICT devices, such as LCD, projectors, and audio systems. The urgency of this research is to find out how far the ICT-based learning has been implemented in SMK.

RESEARCH METHOD

The method comprises of the design of the research, population, and sample, sampling techniques, procedures, instruments (including the construct, validity, and reliability), data collection tools, and data analysis techniques. This type of research is a mixed methods research, which is a step of study by combining two forms of approach in research, namely qualitative and quantitative.

The research was conducted at five public Vocational High Schools (*Sekolah Menengah Kejuruan Negeri* or SMKN) in Makassar City, namely: SMK 2, SMK 3, SMK 4, SMK 5, and SMK 7. Those schools provide study programs of Computer and Network Engineering Study Program (*Teknik Komputer dan Jaringan* or TKJ), Software Engineering (*Rekayasa Perangkat Lunak* or RPL), Animation, and Multimedia. The instruments used in the research are observation, interviews, and questionnaires. The research subjects are the school principals, heads of department, ICT productive teachers, and students of the ICT department.

Resilience Maturity Assessment Framework (RMAF) was used in analyzing the research data. RMAF is one of the models and evaluations to measure the level of ICT utilization in terms of technology, application, data, personal as well as process usage. An approach that can be used to see the level of ICT use in education is the Capability Maturity Model (CMM) approach. RMAF is one of the frameworks for evaluating the maturity of ICT services in an organization (Bhamidipaty, Lotlikar, & Banavar, 2007).

RMAF has six key screens to determine the maturity level of ICT services in a school, such as a strategy, individual/group, process, application and data, technology, and facilities. Furthermore, it explained that the implementation of each RMAF main screen in schools is: (1) Facilities, (2) Technology, (3) Applications and Data, (4) Processes, and (5) Personal/ Organization.

Furthermore, CMM analysis was used to determine the ICT maturity model. A maturity model (capability) is a process that can help define and understand the processes of an organization. In the case of the Maturity Model maturity scale, according to Kumta and Shah (2002), there are five levels/scale of maturity, namely:

Scale 1: Initial

This scale has begun to recognize the process of information technology in the company. However, there is no standardization done individually and not organized. The overall management approach is still not established.

Scale 2: Repeatable but Intuitive

This scale has started to have procedures in the information technology process. However, there is no formal research and communication about standard procedures. The individual still bears responsibility for the process, and the level of dependence on the ability of individuals is considerable so that errors occur.

Scale 3: Defined Process

Procedures at this scale are standardized, documented, and communicated through training. However, the implementation still depends on the individual, whether they want to follow the system or not. The procedure made is not complicated; only a formalization of existing technology.

Scale 4: Managed and Measurable

This scale can measure and monitor existing methods so that they are easily covered if deviations occur. The process is going well and is constant. Automatic and limited information technology devices are used.

Scale 5: Optimized

Existing processes at this scale have reached best practice through a process of continuous improvement. Information technology has been used and integrated to automate working processes within the company, improve quality, effectiveness, and adaptability to the company.

This study uses a qualitative descriptive analysis, referring to the Maturity Model Scale (Bhamidipaty et al., 2007; Carcary, 2013; Kumta & Shah, 2002) for SMK as presented in Table 1. To determine the maturity scale of ICT utilization using the Capability Maturity Model (CMM) scale based on the total score obtained, the following is a reference:

Total score:	
0.01 – 1.00	Level 1
0.01 – 2.00	Level 2
2.01 – 3.00	Level 3
3.01 – 4.00	Level 4
4.01 – 5.00	Level 5

Table 1. Scale Maturity Model in Vocational high School

Scale Maturity	Description	Attributes of Process and Academic Management
LEVEL 0 NOT EXISTENCE	ICT is not utilized yet for the teaching and learning process	
LEVEL 1 INITIAL	Schools have used ICT facilities in the teaching and learning process in the classroom. ICT intended here is the use of laptops and LCD projectors for teaching activities using presentation programs.	The use of ICT in the teaching and learning process.
LEVEL 2 REPEATABLE	Schools have begun to set standards for ICT-based learning procedures. The learning process has started with audio, video, and animation (multimedia learning) and taking the latest scientific references from the internet (internet-based content).	1. Utilization of ICT as a repository of knowledge. 2. Utilization of ICT as a learning tool. 3. Utilization of ICT as an educational facility in schools.
LEVEL 3 DEFINED PROCESS	Schools have established multimedia-based learning standardization and the latest scientific reference from the internet. Schools have started archiving the school documents and managing school administration using the application program.	1. Multimedia-based learning standard. 2. Standardization of educational documents.
LEVEL 4 MANAGED AND MEASURABLE	Schools have developed school management information systems that integrate educational documents, and ICT-based educational administration/management processes. The school management information system has integrated modules of subject document databases, curriculum management, personnel, student affairs, finance, facilities, and infrastructure as well as specialized services in schools.	1. Utilization of ICT as a school management facility.
LEVEL 5 OPTIMIZED	Schools begin to optimize the school management information system. The school management information systems are developed according to the needs of schools in the future.	1. Optimization of the use of ICT as a school management facility and teaching and learning facilities in schools

RESULTS AND DISCUSSION

Analysis of ICT Utilization in the Learning Process in Public Vocational High School in Makassar Using the Capability Maturity Model (CMM) Approach

Based on the data obtained, the use of ICT in the learning process at SMKNs in Makassar City is at the level of 3.68. Based on the results of the analysis using the Capability Maturity Model (CMM) scale, the level of ICT utilization in the learning process at public vocational high schools in Makassar City is at level 4 (Managed and Measurable). The result of the analysis of maturity scale (Model Maturity Scale) of ICT utilization in public vocational high school in Makassar City is presented in Figure 1.

Figure 1 shows that SMKN 4 Makassar gets a dominant score from other schools that are the subject of research, while SMKN 3 Makassar has the lowest score. SMKN 4 and SMKN 7 Makassar reach the CMM level, SMKN 2 Makassar is at level 4, while SMKN 3 and SMKN 5 are at level 3.

Table 2 shows that based on the indicators of the use of ICT as a repository of knowledge, five SMKNs in Makassar City are at an average of 3.55, or at level 4 (Managed and Measurable). The indicators of the use of ICT as learning aids at five SMKNs in Makassar are at an average of 3.60 or level 4 (Managed and Measurable). The average value of the use of ICT as an educational facility in five SMKNs in Makassar City is at an average of 3.73 or is at level 4 (Managed and Measurable).

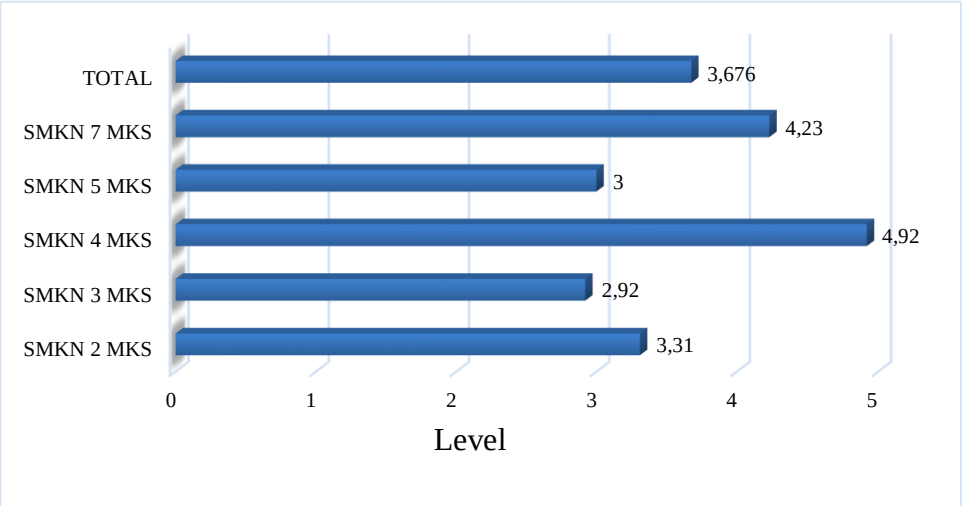


Figure 1. Graph of Utilizing ICT in the Learning Process at Vocational High School

Table 2. The ICT Utilization by the Capability Maturity Model

School	ICT as a storehouse of knowledge	ICT as learning resources	ICT as Education facilities	Average
SMKN 2	3.00	3.00	4.00	3.33
SMKN 3	2.50	2.67	2.67	2.61
SMKN 4	4.75	5.00	5.00	4.92
SMKN 5	2.75	3.33	3.00	3.03
SMKN 7	4.75	4.00	4.00	4.25
Average	3.55	3.60	3.73	3.63

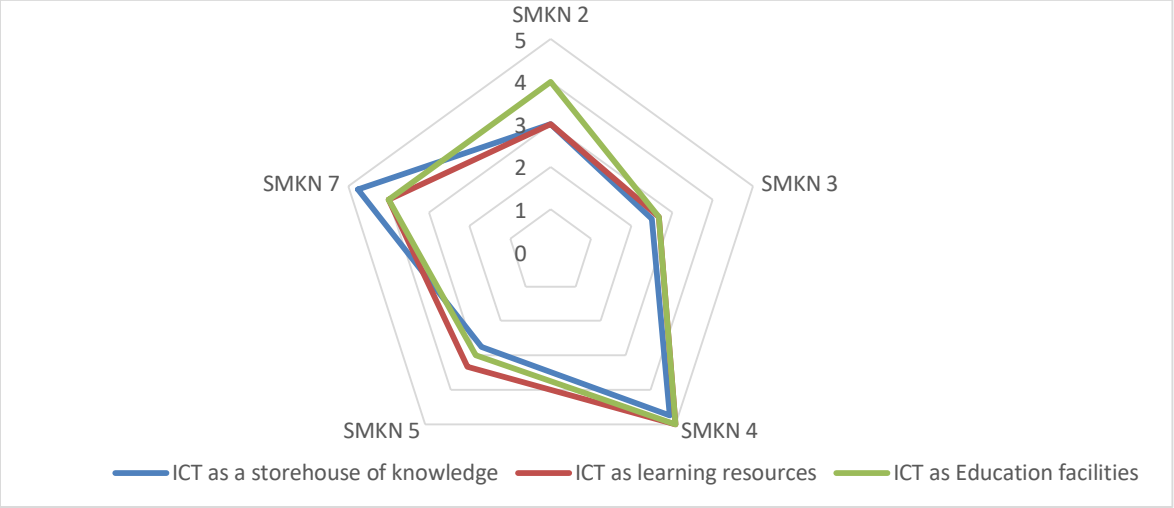


Figure 2. Graph of Each Indicator Variable

Figure 2 shows that public vocational high schools in Makassar City have used ICT as an educational facility. It is also strengthened from the results of interviews which reveal that SMKNs in Makassar have developed a school management information system that integrate educational documents, and also ICT-based educational administration/management processes. The school management information system has integrated modules of subject document databases, curriculum management, personnel, student affairs, finance, facilities, and infrastructure and specialized services at schools.

ICT-based education management information systems in new schools include (1) ICT as a science, (2) ICT as a learning aid, (3) ICT as an educational facility in schools (Sujoko, 2013, p. 72), while, the application of ICT in the field of education management refers to the Directorate of Secondary Education of the Ministry of National Education, covering: (1) ICT-based curriculum management, (2) ICT-based personnel management, (3) ICT-based student management, (4) ICT-based financial, (4) Management of preventive maintenance of ICT-based school facilities and infrastructure.

Based on previous researches, schools have begun to set standards for ICT-based learning procedures (Rahim, 2016; Sujoko, 2013; Supiandi & Lisa, 2018). The learning process has already started with audio, video, and animation (multimedia learning) and taking the latest scientific references from the internet (internet-based content).

After obtaining data from the results of previous studies, it is concluded that the use of ICT in the learning process at SMKNs in Makassar has experienced a very high increase. It has been obtained research results on the use of ICT in the learning process at SMKNs in Makassar are at level 4 (Managed and Measurable).

Factors Influencing the Use of ICT in the Learning Process in SMKNs in Makassar Based on the Component of Resilience

Based on the data obtained, there are several components of RMAF that affect the use of ICT in the learning process in SMKNs in Makassar City, which are found on the third screen (application and data screen). On this screen, there is a school, namely SMK 3 Makassar, which is still minimal in utilizing application programs in the teaching and learning process due to hardware limitations such as LCD projectors in the classroom.

Efforts to Apply ICT Utilization in Learning Processes in SMKNs in Makassar City

The implementation of the learning program by utilizing information and communication technology certainly presents its challenges for schools to make optimal use of ICT in learning. Various steps to always improve both the competency of students and the professional competence of educators continue to be done, among others, an increase in developing learning materials that are taught more

creatively so that a teacher must always follow the development of existing technology.

The efforts made by students in the application of ICT use in the learning process, based on the research findings, in SMKNs in Makassar are very good; namely, 4.27, and the percentage level is 92.85%, which is very high. Meanwhile, the efforts made by the teacher in applying ICT in the learning process in SMKNs in Makassar City are in the very good category of 4.61, and the percentage level of 92.85% is very high.

Based on previous research conducted by Husain (2014), he suggested the use of ICT in learning at Muhammadiyah Tarakan High School. The teacher's paradigm, when utilizing ICT in learning, is still limited to the use of presentations, especially power points. The purpose of internet use is still limited to finding information about the material to be conveyed rather than being used as an integrated new learning system. Likewise, social networking is still not widely used as a new learning system to further enhance the effectiveness and efficiency of the learning process (Ghavifekr & Rosdy, 2015; Hanum, 2013). The findings indicate that the majority of students exhibit higher motivation, learning skills, which is more significant in the assessment determined. Additional benefits are obtained when the teacher's work in planning and organizing teaching and learning sessions becomes more efficient. Findings show that individual students at Technical and Vocational Education and Training (TVET) can benefit from the integration of ICT into their learning (Yasak & Alias, 2015).

CONCLUSION

The level of ICT use in the learning process at SMKNs in Makassar is at level 4. It is in the Managed and Measurable category, which is in 3.68 value. It means that SMKNs in Makassar City have developed a school management information layer that integrates the document layer, and the administrative process/layer management will be ICT-based. The school management information system has integrated the database modules of lesson documents, curriculum management, personnel, student affairs, finance, facilities, and infrastructure as well as specialized services in schools.

Factors that influence the use of ICT in the learning process at SMKNs in Makassar City are the data application layer, in which this layer has one school, namely SMK 3 Makassar which is still minimal in utilizing application programs in teaching and learning processes due to hardware limitations such as LCD projector in the classroom. Furthermore, the ability of teachers in the use of ICT in the learning process at SMKN in Makassar City is a Very Good criterion, with value of 4.61 and the percentage level is 92.85%, which is in very high category. Meanwhile, the ability of students is in the very good criteria at 4.27 value, and the percentage level is 92.85%which is very high based on the percentage of research formulas.

ACKNOWLEDGMENTS

The authors express special gratitude to the Directorate of Research and Development of the Ministry of Research Technology and Higher Education of Indonesia, which funded this research.

REFERENCES

Ab Hadi, Y. M., Mohamad, B., & Jaafar, M. S. A. (2010). Study of information and communication technology (ICT) usage in technical and vocational special education programme. *Global Journal of Human Social Science Research*, *10*(1), 35–43. Retrieved from https://globaljournals.org/GJHSS_Volume10/ghss_vol10_issue1_ver1_paper11.pdf

Ahmad, I. (2018). *Proses pembelajaran digital dalam era revolusi industri 4.0*. Medan: Direktur Jenderal Pembelajaran dan Kemahasiswaan, Kementerian Riset, Teknologi, dan Perguruan Tinggi.

Bhamidipaty, A., Lotlikar, R., & Banavar, G. (2007). RMI: A framework for modeling and evaluating the resiliency maturity of IT service organizations. In *IEEE International Conference on Services Computing (SCC 2007)* (pp. 300–307). Salt Like City, UT: IEEE.

Carcary, M. (2013). IT risk management: A capability maturity model perspective. *Electronic Journal of Information Systems Evaluation, 16*(1), 3–13.

Retrieved from http://www.ejise.com/issue/download.html?idArticle=858

Deebom, T. M., & Zite, B. N. (2016). Effectiveness of Information Communication Technology (ICT) in teaching and learning in public senior secondary schools in Ogoni area, Rivers State. *International Journal of Education and Evaluation*, *2*(4), 18–26.

Eady, M., & Lockyer, L. (2013). Tools for learning: Technology and teaching strategies. In *Learning to teach in the primary school* (p. 71). Queensland: Queensland University of Technology.

Elmunsyah, H. (2014). A national education policy-based ICT model for Indonesian vocational high schools (VHS). *Global Journal of Engineering Education*, *16*(3), 136–140. Retrieved from http://www.wiete.com.au/journals/GJEE/Publish/vol16no3/06-Elmunsyah-H.pdf

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science*, *1*(2), 175. https://doi.org/10.21890/ijres.23596

Hanum, N. S. (2013). Keefetifan e-learning sebagai media pembelajaran (studi evaluasi model pembelajaran e-learning SMK Telkom Sandhy Putra Purwokerto). *Jurnal Pendidikan Vokasi*, *3*(1), 90–102. https://doi.org/10.21831/jpv.v3i1.1584

Husain, C. (2014). Pemanfaatan teknologi informasi dan komunikasi dalam pembelajaran di SMA Muhammadiyah Tarakan. *Jurnal Kebijakan Dan Pengembangan Pendidikan*, *2*(2), 184–192. Retrieved from http://ejournal.umm.ac.id/index.php/jmkpp/article/view/1917/2022

Kumta, G. A., & Shah, M. D. (2002). Capability maturity model: A human perspective. *Delhi Business Review*, *3*(1). Retrieved from https://pdfs.semanticscholar.org/0620/53d5196644f84e89876f226a1c639b7d9437.pdf

Lamanauskas, V. (2008). Effective ICT implementation as a precondition for developing general and vocational education. *Problems of Education in the 21st Century*, *5*, 5–8. Retrieved from http://oaji.net/articles/2014/457-1392223337.pdf

Mas'ud, H., & Surjono, H. D. (2018). The implementation of flipped classroom learning model using moodle to increase students' higher order thinking skills. *Journal of Educational Science and Technology (EST)*, *1*(1), 187–194. https://doi.org/10.26858/est.v1i1.6521

Rahim, M. Y. (2016). Pemanfaatan ICT sebagai media pembelajaran dan informasi pada UIN Alauddin Makassar. *Sulesana: Jurnal Wawasan Keislaman*, *6*(2), 127–135. https://doi.org/10.24252/.v6i2.1408

Regulation of the Minister of National Education No. 19 of 2005, on National Standard of Education (2005). Republic of Indonesia.

Rusman, R., Kurniawan, D., & Riyana, C. (2011). *Pembelajaran berbasis teknologi informasi dan komunikasi: Mengembangkan profesionalitas guru*. Bandung: Rajawali Pers.

Sangrà, A., & González-Sanmamed, M. (2010). The role of information and communication technologies in improving teaching and learning processes in primary and secondary schools. *ALT-J*, *18*(3), 207–220. https://doi.org/10.1080/09687769.2010.529108

Sujoko, S. (2013). Pemanfaatan teknologi informasi dan komunikasi sebagai media pembelajaran di SMP Negeri 1 Geger Madiun. *Jurnal Kebijakan Dan Pengembangan Pendidikan*, *1*(1), 71–77. Retrieved from http://ejournal.umm.ac.id/index.php/jmkpp/article/view/1511

Supiandi, M. I., & Lisa, Y. (2018). The utilization of information and communication technology (ICT) on learning in the 21st century. *International Journal of Academic Research and Development*, *3*(2), 869–

875. Retrieved from http://www.academicjournal.in/download/1762/3-2-27-207.pdf

Vernanda, D., Abdullah, A. G., & Rohendi, D. (2018). Internet literacy of vocational high school teachers. *IOP Conference Series: Materials Science and Engineering*, *306*(1), 12032. https://doi.org/10.1088/1757-899X/306/1/012032

Yasak, Z., & Alias, M. (2015). ICT integrations in TVET: Is it up to expectations? *Procedia-Social and Behavioral Sciences*, *204*, 88–97. https://doi.org/10.1016/j.sbspro.2015.08.120

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (258-269)
Online: http://journal.uny.ac.id/index.php/jpv

THE PATHWAY OF STRENGTHENING THE WORKING READINESS: A STUDY ON GRADUATE STUDENTS OF ISLAMIC ECONOMICS AND BUSINESS FACULTY OF UIN WALISONGO SEMARANG

Zuhdan Ady Fataron
Universitas Islam Negeri Walisongo Semarang

Rauly Sijabat
Universitas PGRI Semarang

Abstract

Research on working readiness is not a new thing. Nevertheless, studies related to working readiness still become interesting topic considering the empirical phenomena that indicate low working readiness. In addition, the results of previous studies have not provided conclusive conclusions about the factors that explain working readiness. This study was conducted to test the working readiness model developed in this study empirically by using the variable approach of training, apprenticeship, self-efficacy, and locus of control. Data on training, apprenticeship, self-efficacy, locus of control, and working readiness were obtained through interviews using a questionnaire conducted to the final semester students of the Islamic Economics and Business Faculty of UIN Walisongo Semarang. The research model testing was done by using SEM as an approach to the analysis technique. The test results show that training and apprenticeship are proven capable of explaining self-efficacy and locus of control. The results of this study also show that training, apprenticeship, self-efficacy, and locus of control are appropriate variables to explain variations in working readiness.

Keywords: *training, apprenticeship, self efficacy, locus of control, working readiness*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.26948*

Contact Rauly Sijabat raulysijabat@upgris.ac.id
Department of Management, Faculty of Economics and Business, Universitas PGRI Semarang
Jl. Sidodadi Timur No. 24 – Dr. Cipto, Karangtempel, Semarang, Jawa Tengah 50232, Indonesia

INTRODUCTION

The world of employment in Indonesia faces complex problems. High unemployment rates, limited creation, and expansion of employment opportunities, low employee productivity, minimum wage regulations that have not been implemented optimally, labor strikes, labor disputes, termination of employment, child labor problems are polemics that the world of employment continues to face in Indonesia (Widodo, 2015). Therefore, to escape from the labor polemic, investment to create qualified human resources, character, and global competitiveness is a must.

Manpower readiness with competency capabilities possessed is the main goal for all educational institutions. Readiness itself has the meaning as a condition that reflects the development of maturity or the level of maturity that enables someone to practice something (Chaplin, 2006). At present, hard skills are not enough to express themselves as having working readiness to enter the workforce. The knowledge gained from formal education, especially vocational education, in fact, has not been able to provide sufficient guarantees for graduates to be ready to enter the world of work and get a job (Sulistyarini, 2012). She further stated that the difficulty of vocational education graduates to penetrate job openings was more due to the readiness of vocational education graduates to work that was still low or the lack of compatibility between the skills of graduates with the needs of the world of work/industry.

Research on working readiness is not a new thing. Nevertheless, studies related to working readiness still become interesting topic considering the empirical phenomena that indicate low working readiness. The percentage of absorption data in 2014 was 13.63%, and in 2015 it was 26.88%, indicating the value of absorption has not reached more than 50%. This data absorption can be an initial step that graduates of vocational schools in Semarang do not have ready job preparation to be able to enter the workforce. Not only the findings of empirical phenomena, another interesting thing that encourages the study of working readiness is that the results of previous studies have not provided conclusive conclusions about the factors that explain working readiness.

These two things (empirical phenomena and research gap) encourage this study to develop a research model that "marries" the empirical and theoretical aspects of strengthening the working readiness of graduates of the Islamic Economics and Business Faculty of UIN Walisongo Semarang.

Working Readiness

Readiness is a pretty good ability, physically and mentally. Physical readiness means having sufficient energy and good health, while mental readiness means having sufficient interest and motivation to carry out an activity (Dalyono, 2005). Working is defined as the activity of doing something to earn a living or livelihood (Poerwadarminta, 2003). Based on this opinion, it can be concluded that working readiness is the overall condition of the individual, which includes physical, mental, and experience maturity, as well as the willingness and ability to carry out a job or activity in accordance with their area of expertise.

Self-Efficacy

The definition of self-efficacy in the "proximal personality variable" is the optimism about self-belief to overcome various challenging demands. In this case, trust in action and take responsibility for the success of an outcome. Norwich (in Azwar, 1996) defines self-efficacy as self-confidence, which is one of the personal factors that mediate the interaction between behavioral factors and environmental factors. The high perceived self-confidence will motivate individuals cognitively to act more directed, especially if the goal to be achieved is a clear goal.

Locus of Control

Locus of control is the perception of an individual's confidence in dealing with situations at work. The situation is related to the success or failure of an individual in his life. Locus of control is a source of confidence possessed by individuals in controlling events that occur both from oneself or from outside himself (Atwater & Duffy, 2005). Locus of control is divided into two factors: internal and external. Rotter (in Reffiany, 2009) measures locus of control by using indicators taken from the Internal/External scale (IE), internal

locus of control, namely the individual's belief that everything experienced and obtained by individuals comes from their own efforts and they believe that their lives are not based on luck and fate, while the external locus of control is that external elements such as luck, opportunity, and destiny are stronger in determining their lives, and their own efforts do not cause failure or success.

Training

Training contains an understanding as a systematic process to change the behavior of employees in order to support the achievement of organizational goals (Rivai, 2004). Training is closely related to the abilities possessed by employees in order to be able to finish the current job. Hariandja and Hardiwati (2002) have their own definition related to training, namely as a business that has been planned by the organization aimed at increasing employee knowledge, skills, and abilities.

Apprenticeship

Apprenticeship activities are included in the learning curriculum of the Islamic Economics and Business Faculty of Walisongo State Islamic University, Semarang. Apprenticeship is required for all final year students. The apprenticeship concept itself departs from the Link and Match policy. The Link and Match policy are closely related to industrial work practices, which in this study concept are adapted to the existing policies on the object of research by using the apprenticeship concept approach. A link has the meaning as a linkage, attachment or interactive relationship, while match has the meaning as compatibility, suitability, harmony, or equivalence. The apprenticeship concept promoted in this study has meaning as part of a job training program or an introduction to the world of work organized by the campus in an integrated manner by working directly under the leadership of the company which is used as an apprenticeship target with the aim of providing insight, recognition and experience of candidates graduates of the world of work and equip prospective graduates with certain expertise and skills. If referring to the provisions of Law of Republic of Indonesia No. 13 of 2003 on Manpower, especially articles 21-30. It is more specifically regulated in the Regulation of the Minister of Manpower and Transmigration No. PER.22/MEN/IX/ 2009 on the implementation of domestic apprenticeship. Apprenticeship has the meaning as part of an integrated job training system between training in training institutions by working directly under the guidance and supervision of instructors or workers who are more experienced in the process of producing goods and/or services in a company, in order to master certain skills or expertise.

The Effect of Training on Self-Efficacy

A low level of formal education can be an indication of the low quality of workers in Indonesia. One of these gaps can be overcome by providing training to prospective workers. Training can be a program that bridges prospective workers with the real world of work or careers (Newman & Newman, in Akbar & Tarmidi, 2012). This picture of the actual world of work will increase the confidence of prospective workers. The training obtained by prospective workers will further strengthen the self-concept of the prospective workforce itself. It is because the training capabilities/ skills are increasingly strengthened so that prospective workers will be more confident that the prospective workforce will have confidence in their own abilities (Pratama & Suharnan, 2014).

H1: Training has a positive effect on self-efficacy.

The Effect of Training on Locus Of Control

Internal locus of control is one of the internal factors that support the career maturity of prospective workers. Locus of control shows the depth of thinking of prospective workers about the actions they do with the results they will get (Pratama & Suharnan, 2014). Training allows prospective workers to obtain the ability or skills that can strengthen the desires/expectations of their careers so that the training locus of control owned by prospective workers will be stronger. Through training, abilities/skills that are not yet owned or even possessed by prospective workers will be increasingly strengthened so that in the end, the prospective workforce can empower the potential possessed by him in order to obtain the best results.

The effect of training on the locus of control has been investigated by Smith (1989), whose results indicate that mastery of training skills (coping skill training) has proven to have a significant positive effect on the locus of control.

H2: Training has a positive effect on the locus of control.

The Effect of Apprenticeship on Self-Efficacy

Industrial work practices become a program of activities that bridges prospective workers with a description of the need for skills in the world of work. Industrial work practices that have been undertaken by prospective workers will be able to provide confidence to prospective workers that their abilities/skills can be used as capital to be able to work. Industrial work practices obtained by prospective workers will increase self-confidence, eliminate anxiety, fear, and failure of prospective workers in doing the work (Conroy, 2003).

Apprenticeship is often referred to as industrial work practices. Industrial work practices are knowledge or skills that are known and mastered by prospective workers after implementing work practices in the business world or in the industrial world for a certain period of time. The results of studies conducted by Eliyani, Yanto, and Sunarto (2016) on the variables of industrial work practices and self-efficacy show that industrial work practices are proven to have a significant positive effect on self-efficacy.

H3: Apprenticeship has a positive effect on self-efficacy.

The Effect of Apprenticeship on Locus of Control

Locus of control refers to the degree to which an individual sees events in his life as a consequence of his actions that can be controlled or as something that is not related to his behavior so that it can not be controlled. Industrial work practices are expected to be a means of matching and linking (Link and Match) between the world of education and the world of industry in terms of workforce train-ing and competent human resource improve-ment (Mashudi & Widjaja, 2016).

Apprenticeship or industrial work practices carried out by prospective workers provide a real/real picture of the world of work. Real picture obtained by prospective workers allows prospective workers to measure their abilities/skills with the real abilities/skills which are needed by the world of work. Thus, prospective workers will be able to find out whether their abilities/skills will be able to solve work problems. It, of course, will strengthen the locus of control of prospective workers (Pratama & Suharnan, 2014).

H4: Apprenticeship has a positive effect on the locus of control.

The Effect of Training on Working Readiness

Herminanto (in Widodo, 2015) explained that working readiness can be interpreted as an effort to have skills that are in accordance with the needs of the community so that prospective workers can be absorbed by the business/world of work. Programmed work training makes prospective workers have: a high work ethic, discipline, responsibility, independence, self-confidence, the ability to communicate and cooperate, as well as competencies in accordance with their fields. Job training is a means to develop knowledge, skills, and attitudes, as well as the ability to communicate and cooperate. The accumulation of knowledge, skills, independence, and the ability to communicate and work together is a modality for the ability to solve problems (Hidayanto, 2002). The ability to solve problems is very needed in entering the workforce.

H5: Training has a positive effect on working readiness.

The Effect of Apprenticeship on Working Readiness

Studies on the effect of industrial work practices on working readiness have been conducted by several previous researchers. In a study conducted by Santi (2013) showed that industrial work practices proved not to have a significant positive effect on working readiness. However, this is not the case with the results of other studies. Studies conducted by Noviana (2014) and Eliyani et al. (2016) actually show that industrial work practices

programs have proven to have a significant positive effect on working readiness.

H6: Apprenticeship has a positive effect on working readiness.

The Effect of Self-Efficacy on Working Readiness

Entering the world of work requires both physical and mental readiness. In addition to the knowledge and skills and experience that prospective workers have, the mental readiness of prospective workers is needed. Bandura (1997), in social cognitive theory, suggests that self-efficacy is one's belief about the ability he has in achieving the goals to be achieved. Self-efficacy affects one's internal conditions in working readiness, so having high self-efficacy can increase the confidence of prospective workers to dare to face intense competition in the business and industrial world (*Dunia Usaha/Dunia Industri* or DU/DI). Self-efficacy can be seen from three dimensions, namely level/magnitude, strength, and generality.

A study conducted by Stevani and Yulhendri (2014) on these two variables shows that self-efficacy has a significant positive effect on working readiness. Likewise, the studies of Trisnawati (2013), Eliyani et al. (2016), and Noviana (2014) also showed that self-efficacy proved to have a significant positive effect on fears of job seekers' failure. However, a study conducted by Widyowati and Hadjam (2014) showed different results where self-efficacy had a significant positive effect on pension preparation.

H7: Self-efficacy has a positive effect on increasing the working readiness.

The Effect of Locus of Control on Working Readiness

Locus of control explains that to what extent a person believes that he is the controller of his own destiny or external factors that exist outside of him that can determine his destiny. Differences in locus of control in a person can actually cause other aspects of personality. Adolescents who have an internal locus of control have a belief that they can manage and direct their lives and are responsible for the achievement of whatever reinforcement they receive (Aji, 2010).

Several previous researchers have studied the influence of these two variables. A study conducted by Muyasaroh, Ngadiman, and Hamidi (2013) shows that the locus of control has a significant positive effect on working readiness. Likewise, the study of Pratama and Suharnan (2014), also shows that Internal locus of control had a significant positive effect on career maturity. However, the study of Widyowati and Hadjam (2014) showed different results where the locus of control had no significant positive effect on pension preparation.

H8: Locus of control has been proven to have an effect on increasing the working readiness.

This study uses previous research as a reference for developing research models and hypotheses. Table 1 summarizes the previous researches that have been reviewed in this study.

RESEARCH METHOD

The Development of the Indicators of Research Variables

The variables examined in this study are unobserved variables that require indicators as measurement tools. The indicators developed for the measurement of research variables are as follows:

Training Variable

Measurement of training variables was carried out using three indicators, developed from Gomes (2000) consisting of participant reactions (X1), learning (X2), and results (X3).

Apprenticeship Variables

Apprenticeship variables were measured using four indicators developed from Rizali, Darma, and Sidi (2009), which included compatibility (X4), conformity (X5), harmony (X6), and comparability (X7).

Self-Efficacy Variable

The self efficacy variable was measured using indicators adopted from studies conducted by Hamaheck in Rachmat (2004) and Pratama and Suharnan (2014) consisting of confidence in his ability to overcome prob-

Table 1. Previous Researches Review

Research Resource	Research Variables		Findings
Smith (1989)	Independent Variable: Coping skill training	Dependent Variables: Self Efficacy Locus of Control	- Coping skill training is proven to have significant positive effect on self efficacy - Coping skill training is proven to have significant positive effect on locus of control
Santi (2013)	Independent Variables: • Industrial work practice experience • The intensity of entrepreneurship education Dependent Variables: Entrepreneurial Readiness		- Industrial work practices are not proven to have significant positive effect on working readiness - Expertise competence is proven to have significant positive effect on working readiness
Trisnawati (2013)	Independent Variables: • Self efficacy • Image perception	Dependent Variable: Fear of failure	Self efficacy is proven to have significant positive effect on fear of job seekers' failure
Muyasaroh et al. (2013)	Independent Variables: • Industrial work practice experience • Locus of control	Dependent Variable: Working readiness	Locus of control has significant positive effect on working readiness
Noviana (2014)	Independent Variables: • Learning outcomes • Industrial Work Practices Program • Self efficacy Dependent Variables: Working readiness		- Industrial work practices programs are proven to have significant positive effect on working readiness - Self efficacy is proven to have significant positive effect on working readiness
Damasanti (2014)	Independent Variables: • Working motivation • Entrepreneurial attitude • Competence of expertise	Dependent Variable: Working readiness	- Expertise competence is proven to have significant positive effect on working readiness
Widyowati & Hadjam (2014)	Independent Variables: • Core self evaluation • Self esteem • Self efficacy • Locus of control • Emotional stability	Dependent Variable: Retirement Readiness	- Self efficacy has insignificant positive effect on pension preparation - Locus of control has insignificant positive effect on pension preparation
Stevani & Yulhendri (2014)	Independent Variable: Field Industrial practice Mediating Variables: • Skills • Self efficacy	Dependent Variable: Readiness	- Self efficacy has significant positive effect on working readiness
Pratama & Suharnan (2014)	Independent Variables: • Self efficacy • Internal locus of control	Dependent Variable: Career maturity	• Internal locus of control has **significant** positive effect on career maturity
Eliyani et al. (2016)	Independent Variables: • Competence • Productive knowledge • Family support Intervening Variables: • Self efficacy • Industrial experience Dependent Variables: Working readiness		• Competence has significant positive effect on self efficacy • Productive knowledge has significant positive effect on self efficacy • Family support has significant positive effect on self efficacy • Internship experience has been shown to have significant positive effect on self efficacy • Family support has been shown to have significant positive effect on industrial experience • Competence is proven to have insignificant positive effect on working readiness • Productive knowledge is proven to have insignificant positive effect on working readiness • Family support has been shown to have insignificant positive effect on working readiness • Self efficacy is proven to have significant positive effect on working readiness • Industrial experience has proven to have significant positive effect on working readiness
Sijabat (2018)	Independent Variables: • Training • Industrial work practices	Intervening Variables: • Self efficacy • Locus of control Dependent Variable: Working readiness	• Self efficacy has significant positive effect on working readiness • Locus of control has significant positive effect on working readiness

Source: Extracted from various studies, 2019

lems (X8), confidence in equality with others (X9), acceptance shameless praise (X10), awareness of feelings of desire and behavior that are not entirely agreed upon by the public (X11), belief in the ability to improve themelves because they feel able to express aspects of personality that they are not happy with and try to change (X12).

Locus of Control Variable

Locus of control was measured using indicators adopted from studies conducted by Rotter in Wiriani, Piatrini, Ardana, and Juliarsa (2013), and Pratama and Suharnan (2014) which includes everything that an individual achieves from his own efforts (X13), confident of his own ability (X14), individual success due to hard work (X15), everything obtained by individuals is not due to luck (X16), the ability of individuals to determine events in life (X17), individual life is determined by his actions (X18), and failures experienced by individuals due to their own actions (X19).

Working Readiness Variable

The measurement of working readiness variable was done by using indicators adopted from the study of Dinata (2013) which include having logical considerations (X20), having the ability to work together (X21), having critical attitude (X22), being responsible (X23), and ambitious to go forward (X24).

Population, Sample, and Data Collection

This study uses the final semester students of the Islamic Economics and Business Faculty of UIN Walisongo Semarang as the study population. The research sample was obtained by using a purposive random sampling approach so that a total of 110 samples was obtained. Research data covering training variables, industrial work practices, competence, self-efficacy, locus of control, and working readiness were obtained through interviews using a questionnaire with alternative answers provided by researchers in the range of 1 to 10.

Data Analysis Method

To test the models and relationships developed in this study, an analytical technique is needed. The analysis technique used in this study is Structural Equation Modeling (SEM), which is operated through the AMOS program.

RESULTS AND DISCUSSION

Full Model Analysis

In the full model testing, two stages of testing are carried out, namely the suitability of the model and the test for the significance of causality through the regression coefficient test (Ferdinand, 2006). The results of testing in the two stages are presented in Figure 1.

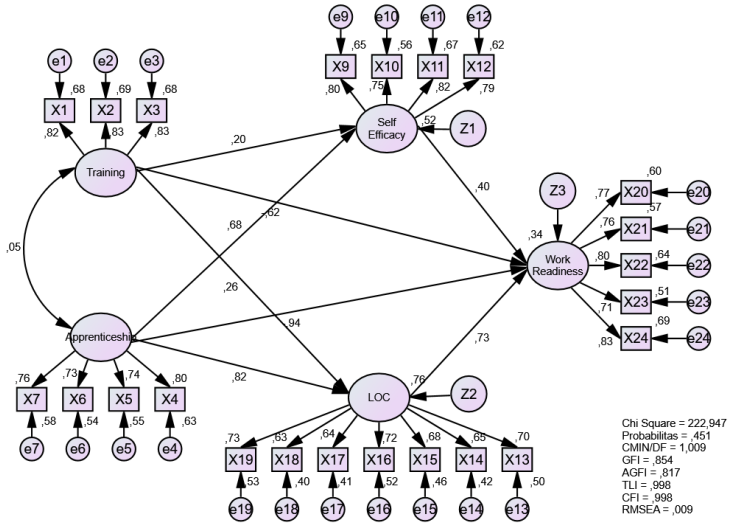


Figure 1. The Research Model Testing

Source: Primary Data Processed, 2019

Goodness of Fit Test

The first stage of testing is intended to see the suitability of the model. The results of testing the suitability of the models developed in this study are presented in Table 2.

Based on the results presented in Table 2, it can be seen that the value of Chi-Square = 222.947 with probability = 0.451 and index values which include CMIN/DF, TLI, CFI, and RMSEA are included in both categories while the GFI and AGFI indexes are included in the marginal category. Therefore, it was concluded that there was no difference between the sample covariance matrix and the estimated population covariance matrix, or in other words, the model was fit.

Causality Test

After evaluating the assumptions that must be met in using the analysis with SEM, then hypothesis testing was conducted. The testing of the four hypotheses proposed in this study was carried out by analyzing the value of the Critical Ratio (CR) (see Table 3).

The Effect of Training on Self-Efficacy Testing

The estimated parameter for testing the effect of training on self-efficacy shows a CR value of 2.245 with a probability of 0.025. Therefore the CR value (2.245) is > 2.00 and the probability value (0.025) is <0.05. It can be concluded that the training variable has a significant positive effect on self-efficacy. This finding shows that if respondents are given training, it will increase self-efficacy.

The Effect of Training on Locus of Control Testing

The estimated parameter for testing the effect of training on the locus of control shows a CR value of 3.123 with a probability of 0.002. Because the CR value (3.123) is > 2.00 and the probability value (0.000) is <0.05, it can be concluded that the training variable is proven to have a significant positive effect on the locus of control. This finding shows that if respondents are given training, it will increase the locus of control.

Table 2. Goodness of Fit Test

Goodness of Fit Indeks	Cut off Value	Result	Model Evaluation
Chi-Square (df = 221)	≤ 256.680	222.947	Good
Probability	≥ 0.05	0.451	Good
CMIN/DF	≤ 2.00	1.009	Good
GFI	0.90 ≤ GFI < 1.00	0.854	Marginal
AGFI	0.90 ≤ AGFI < 1.00	0.817	Marginal
TLI	0.95 ≤ TLI < 1.00	0.998	Good
CFI	0.95 ≤ CFI < 1.00	0.998	Good
RMSEA	≤ 0.08	0.009	Good

Source: Primary Data Processed, *2019*

Table 3. Hypothesis Testing

			Std Estimate	Estimate	S.E.	C.R.	P
Self_Efficacy	<---	Training	.202	.165	.074	2.245	.025
Self_Efficacy	<---	Apprenticeship	.685	.735	.118	6.212	***
LOC	<---	Apprenticeship	.819	.848	.129	6.565	***
LOC	<---	Training	.258	.204	.065	3.123	.002
Working readiness	<---	Self_Efficacy	.396	.284	.125	2.272	.023
Working readiness	<---	LOC	.734	.545	.245	2.224	.026
Working readiness	<---	Training	.621	.365	.092	3.967	***
Working readiness	<---	Apprenticeship	.938	.722	.262	2.756	.006

Source: Primary Data Processed, 2019

The Effect of Apprenticeship on Self-Efficacy Testing

The estimated parameter for testing the effect of apprenticeship on self-efficacy shows a CR value of 6.212 with a probability of 0.000. Therefore the CR value (6.212) is > 2.00 and the probability value (0.000) is <0.05. It can be concluded that the apprenticeship variable has a significant positive effect on self-efficacy. This finding shows that if respondents are given apprenticeship activities, it will increase self-efficacy.

The Effect of Apprenticeship on Locus of Control Testing

The estimated parameter for testing the effect of apprenticeship on the locus of control shows a CR value of 6.565 with a probability of 0.000. Because the CR value (6.565) is > 2.00 and the probability value (0.000) is <0.05, it indicates that the apprenticeship variable is proven to have a significant positive effect on the locus of control. The finding shows that if respondents are given apprenticeship activities, it will increase locus of control.

The Effect of Training on Working Readiness Testing

The estimated parameter for testing the effect of training on working readiness shows a CR value of 3.967 with a probability of 0.000. Because the CR value (3.967) is > 2.00 and the probability value (0.000) is <0.05, it indicates that the training variables are proven to have a significant positive effect on working readiness. The finding shows that if the respondent is given training activities, it will increase the respondents' working readiness.

The Effect of Apprenticeship on Working Readiness Testing

The estimated parameter for testing the effect of apprenticeship on working readiness shows a CR value of 2.756 with a probability of 0.006. Because the CR value (2.756) is > 2.00 and the probability value (0.006) is <0.05, it is concluded that the apprenticeship variable has a significant positive effect on working readiness. This finding shows that if the respondent is given apprenticeship activities, it will increase the working readiness of the respondent.

The Effect of Self-efficacy on Working Readiness Testing

The estimated parameter for testing the effect of self-efficacy on working readiness shows a CR value of 2.272 with a probability of 0.023. Therefore the CR value (2.272) is > 2.00 and the probability value (0.023) is <0.05. It can be concluded that the self-efficacy variable is proven to have a significant positive effect on working readiness. This finding shows that if the respondent has strong self-efficacy, it will increase the working readiness of the respondent.

The Effect of Locus of Control on Working Readiness Testing

The estimated parameter for testing the effect of the locus of control on working readiness shows a CR value of 2.224 with a probability of 0.026. Therefore the CR value (2.224) is > 2.00 and the probability value (0.026) is <0.05. It can be concluded that the locus of control variable has a significant positive effect on working readiness. This finding shows that if the respondent has a strong locus of control, it will increase the working readiness of the respondent.

CONCLUSION AND IMPLICATIONS

Conclusion

Referring to the results of this study, there are several things that can be concluded: (1) The results of statistical tests show that training is statistically proven to have a significant positive effect on self efficacy, that is, better training can improve self-efficacy. (2) The results of tests carried out showed that apprenticeship was statistically proven to have a significant positive effect on self-efficacy. (3) The results of tests conducted on these two variables indicate that the training was statistically proven to have a significant positive effect on the locus of control. (4) The results show that apprenticeship is statistically proven to have a significant positive effect on the locus of control. (5) The results show that training is statistically proven to have a significant positive effect on working readiness. (6) The results show that apprenticeship is statistically proven to have a significant positive effect on working readiness. (7) The re-

sults of this study indicate that self-efficacy is statistically proven to have a significant positive effect on working readiness. The results obtained from this study are that the locus of control is statistically proven to have a significant positive effect on working readiness.

Implications

The study departs from research problems regarding the low absorption of graduates in the world of work, as well as the differences in the results of previous research on the factors that can explain working readiness. These problems encourage this study to develop a working readiness model using four variables that explain, namely training, apprenticeship, self-efficacy, and locus of control. Therefore, the managerial implications proposed in this study to improve working readiness will be related to the variables of self-efficacy and locus of control pursued through training and apprenticeship.

The managerial implications proposed are as follows: The findings obtained related to apprenticeship are accepted by industrial work practices that are often not compatible with the competencies possessed, the industrial workplace is appropriate but the placement in its division or division does not match students' competencies, the industrial work practices received are not in accordance with the competencies students already have, material with industrial work practices that are not harmonious, and material with industrial work practices that are not commensurate. In addition, there are cases of students searching for companies themselves to be able to do an apprenticeship so that often the workplace or company used for practice is not in accordance with competencies. Therefore, in the future, the institution needs to facilitate the participants to get a company as an internship that is in accordance with their competencies.

Findings obtained by this study related to training include the training material is not too special. Students have received training materials in other places, the material submitted is not following developments or current conditions, students' abilities are not too improved, their abilities are still like when they entered, they still do not feel expert, their expertise is still not very improved, they cannot follow because it is made into a class with experts, the material presented is too little, and the material delivered is less detail. Thus, before the training begins, it would be better if the trainees were given a replacement test so that the abilities of the participants for each class were homogeneous. In addition, the training provided at the Work Training Center (*Balai Besar Pengembangan Latihan Kerja* or BBPLK) in Semarang has not separated hard skills and soft skills and more or even all the training provided are often hard skills. From these findings, institutions need to categorize training in the form of hard skills and soft skills and balance their availability according to the demands of the world of work.

ACKNOWLEDGMENTS

The researchers thank the Institute of Research and Community Service (*Lembaga Penelitian dan Pengabdian kepada Masyarakat* or LPPM) of Universitas PGRI Semarang for the aid in completing the study.

REFERENCES

Aji, R. (2010). *Hubungan antara locus of control internal dengan kematangan karir pada siswa kelas XII SMK N 4 Purworejo*. Undergraduate Thesis. Universitas Diponegoro.

Akbar, H., & Tarmidi, T. (2012). *Kecenderungan pemilihan karier berdasarkan gaya belajar pada siswa SMA kelas XII*. Retrieved from https://fpsi.mercubuana-yogya.ac.id/ wp-content/uploads/2012/ 06/Hanifan-Akbar-dan-Tarmidi-Kecenderungan-Pemilihan-Karir.ok_.pdf

Atwater, E., & Duffy, K. G. (2005). *Psychology for living: Adjustment, growth and behavior today* (8th ed.). Upper Saddle River, NJ: Pearson/ Prentice Hall.

Azwar, S. (1996). *Penyusunan skala Psikologi*. Yogyakarta: Pustaka Pelajar.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: W.H. Freeman and Company.

Chaplin, J. P. (2006). *Kamus lengkap Psikologi*. Jakarta: Raja Grafindo Persada.

Conroy, D. E. (2003). Representational models associated with far of failure in adolescents and young adults. *Journal of Personality*, *71*(5), 757–784. https://doi.org/10.1111/1467-6494.7105003

Dalyono. (2005). *Psikologi pendidikan*. Jakarta: Rineka Cipta.

Damasanti, I. A. R. (2014). Kesiapan kerja ditinjau dari motivasi kerja, sikap kewirausahaan, dan kompetensi keahlian busana wanita pada siswa SMKN. *Jurnal Pendidikan Sains*, *2*(2), 114–124. https://doi.org/10.17977/jps.v2i2.4504

Dinata, M. R. Y. (2013). *Peran konsep diri dan kesiapan kerja terhadap kecemasan mahasiswa tingkat akhir dalam menghadapi dunia kerja*. Undergraduate Thesis. Malang: Faculty of Psychology, Universitas Brawijaya.

Eliyani, C., Yanto, H., & Sunarto, S. (2016). Determinan kesiapan kerja siswa SMK kelas XII kompetensi keahlian akuntansi di Kota Semarang. *Journal of Economic Education*, *5*(1), 22–30. Retrieved from https://journal.unnes.ac.id/sju/index.php/jeec/article/view/13013

Ferdinand, A. (2006). Metode penelitian manajemen. In *Pedoman penelitian untuk penulisan skripsi, tesis dan disertasi ilmu manajemen*. Semarang: Universitas Diponegoro.

Gomes, F. C. (2000). *Manajemen sumber daya manusia*. Yogyakarta: Andi Offset.

Hariandja, M. T. E., & Hardiwati, Y. (2002). *Manajemen sumber daya manusia: Pengadaan, pengembangan, peng-kompensasian, dan peningkatan produktivitas pegawai*. Jakarta: Gramedia Widiasarana Indonesia.

Hidayanto, H. (2002). Belajar keterampilan berbasis keterampilan belajar. In *Jurnal pendidikan dan kebudayaan*. Jakarta: Center of Research and Development, Department of National Education.

Law of Republic of Indonesia No. 13 of 2003 on Manpower (2003). Republic of Indonesia.

Mashudi, C., & Widjaja, A. (2016). Pengaruh pengalaman praktik kerja industri (prakerin) terhadap kompetensi keahlan siswa teknik gambar bangunan di SMK Negeri 1 Pacitan. *Jurnal Kajian Pendidikan Teknik Bangunan*, *2*(2), 259–263. Retrieved from http://jurnalmahasiswa.unesa.ac.id/index.php/jurnal-kajian-ptb/article/view/15267

Muyasaroh, H., Ngadiman, N., & Hamidi, N. (2013). Pengaruh pengalaman praktik kerja industri dan locus of control terhadap kesiapan kerja siswa kelas XII SMK Negeri 1 Surakarta. *Jupe-Jurnal Pendidikan Ekonomi*, *1*(1), 1–11. Retrieved from https://jurnal.fkip.uns.ac.id/index.php/ekonomi/article/view/2127/1550

Noviana, N. (2014). Pengaruh hasil belajar mata pelajaran produktif akuntansi, program praktik kerja industri dan self efficacy terhadap kesiapan kerja siswa kelas XII program keahlian akuntansi di SMK Negeri 1 Kendal tahun ajaran 2013/2014. *Economic Education Analysis Journal*, *3*(1), 182–190. Retrieved from https://journal.unnes.ac.id/sju/index.php/eeaj/article/view/4233/3901

Poerwadarminta, W. S. (2003). *Kamus bahasa Indonesia*. Jakarta: Balai Pustaka.

Pratama, B. D., & Suharnan, S. (2014). Hubungan antara konsep diri dan internal locus of control dengan kematangan karir siswa SMA. *Persona: Jurnal Psikologi Indonesia*, *3*(3), 213–222. https://doi.org/10.30996/persona.v3i03.411

Rachmat, J. (2004). *Psikologi komunikasi*. Bandung: PT Remaja Rosdakarya.

Reffiany. (2009). *Pengaruh budaya organisasi, motivasi kerja dan gaya kepemimpinan yang diinteraksikan dengan pengendalian sikap individu (Locus of Control) terhadap prestasi kerja pada Pusat Penelitian Kelapa Sawit (PPKS) Medan*. Thesis. Graduate School of Universitas Sumatera Utara.

Regulation of the Minister of Manpower and Transmigration No. PER.22/MEN/IX/2009 on the Implementation of

Domestic Apprenticeship (2009). Republic of Indonesia.

Rivai, V. (2004). *Kepemimpinan dan perilaku organisasi*. Jakarta: PT. Raja Grafindo Persada.

Rizali, A., Darma, S., & Sidi, I. D. (2009). *Dari guru konvensional menuju guru profesional*. Jakarta: Grasindo.

Santi, M. E. (2013). Pengaruh pengalaman praktik kerja industri, kompetensi keahlian, dan intensitas pendidikan kewirausahaan dalam keluarga terhadap kesiapan berwirausaha. *Jurnal Pendidikan Humaniora*, *1*(2), 127–135. Retrieved from http://journal.um.ac.id/index.php/jph/article/view/4046/769

Sijabat, R. (2018). Rekayasa model penguatan kesiapan kerja lulusan pendidikan vokasi (Studi pada SMK di Kota Semarang). *Fokus Ekonomi : Jurnal Ilmiah Ekonomi*, *13*(2), 44–162. https://doi.org/10.34152/fe.13.2.144-162

Smith, R. E. (1989). Effects of coping skills training on generalized self-efficacy and locus of control. *Journal of Personality and Social Psychology*, *56*(2), 228–233. https://doi.org/10.1037/0022-3514.56.2.228

Stevani, S., & Yulhendri, Y. (2014). *Pengaruh praktek kerja industri (Prakerin), keterampilan siswa dan self efficacy terhadap kesiapan memasuki dunia kerja siswa Administrasi Perkantoran SMK Negeri Bisnis dan Manajemen Kota Padang*.

Sulistyarini, E. P. D. (2012). *Pengaruh motivasi memasuki dunia kerja dan pengalaman praktik kerja industri terhadap kesiapan kerja peserta didik kelas XII program keahlian akuntansi SMK Negeri 1 Tempel tahun pelajaran 2011/2012*. Bachelor Thesis. Universitas Negeri Yogyakarta, Yogyakarta.

Trisnawati, D. A. (2013). Peran self-efficacy dan persepsi citra almamater terhadap ketakutan akan kegagalan pada para pencari kerja berstatus fresh graduate. *Jurnal Hasil Riset*, 1–15. Retrieved from https://www.e-jurnal.com/2015/09/peran-self-efficacy-dan-persepsi-citra.html

Widodo, H. (2015). Potret pendidikan di Indonesia dan kesiapannya dalam menghadapi Masyarakat Ekonomi Asia (MEA). *Cendekia*, *13*(2), 293–307. https://doi.org/10.21154/cendekia.v13i2.250

Widyowati, A., & Hadjam, N. R. (2014). Peran core self evaluation dalam memprediksi persipan pensiun. *HUMANITAS: Indonesian Psychological Journal*, *11*(2), 93–102. https://doi.org/10.26555/humanitas.v11i2.2332

Wiriani, W., Piatrini, P. S., Ardana, K., & Juliarsa, G. (2013). Efek moderasi locus of control pada hubungan pelatihan dan kinerja pada Bank Perkreditan Rakyat di Kabupaten Badung. *Jurnal Ilmiah Akuntansi Dan Bisnis*, *8*(2), 99–105. Retrieved from https://ojs.unud.ac.id/index.php/jiab/article/view/10864

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (270-279)
Online: http://journal.uny.ac.id/index.php/jpv

THE EFFECT OF CRITICAL THINKING ON STUDENTS' ACCOUNTING COMPETENCY IN VOCATIONAL HIGH SCHOOL

Risa Alkurnia
Universitas Sebelas Maret

Susilaningsih
Universitas Sebelas Maret

Sudiyanto
Universitas Sebelas Maret

Abstract

The purpose of this study was to analyze the differences in the effect of critical thinking skills on students' learning competency in accounting subjects at vocational high school in Surakarta. The indicators of critical thinking ability used in this study referred to the theory developed by Ennis, while the accounting competency indicators used referred to Bloom's taxonomy. This research was experimental quantitative research. The population in this study were all students of grade X accounting at SMK 1 Surakarta totaling 96 students. The sample of this study was class X AC (Accounting) 2 as the experimental class and X AC 3 as the control class. The sampling technique used in this study was Cluster Random sampling. The data analysis technique used in the study was Analysis of Variance (ANOVA), with pre-requisite tests that had to be done before, namely normality and homogeneity tests. This study concluded that there are differences in the influence of critical thinking skills on students' competency in accounting learning.

Keywords: *critical thinking, learning competency, accounting learning, vocational high school*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.27664*

Contact Risa Alkurnia
risalprada@gmail.com
Master Program of Economic Education, Universitas Sebelas Maret
Jl. Ir. Sutami No. 36 A, Surakarta (Solo) 57126, Indonesia

INTRODUCTION

Learning is an activity carried out between students and teachers that aims to develop student competency based on educational goals. The development of student competency is essential as a provision in facing future life challenges. To develop the competence of the next generation, an educational institution, such as school, is needed. One school institution that can help the realization of educational goals is the Vocational High School (VHS).

Vocational students have different needs from senior high school students in the learning curriculum. The vocational school's curriculum has more practice than theory, while the senior high school curriculum has more theory than practice. After their graduation, VHS students are ready to work. They are independent because, in addition to studying at school, VHS students also do Industrial Work Practices (Internship) while high school graduates are not ready to work and are encouraged to continue to further education. It is in accordance with the Regulation of the Minister of Education and Culture No. 70 of 2013 concerning vocational curriculum structures that prioritize preparing students to enter the working world and develop professional attitudes. To adjust to the working world, vocational schools have several choices of fields of expertise. One of them is the area of business and expertise. The areas of business and management expertise in vocational schools generally consist of Accounting, Marketing, and Office Administration skills programs. Accounting is an accounting expertise program which its material characteristic is normatively based on the applied rules and also contains numbers so that with such characteristics, it opens a strong possibility for students to think critically when facing challenges in the working world.

Several previous studies examined critical thinking. Duron, Limbach, and Waugh (2006) stress that learning should emphasize students' ability to think critically with which it is expected that the students and teachers would obtain a fun and more meaningful learning experience. Students need critical thinking skills to be able to understand problems and find the best solutions, develop skills to deal with problems in complex global societies (Snyder & Snyder, 2008; Springer & Borthick, 2004). Another study conducted by McCarthy (2004), who examined the relationship between critical thinking and academic ability, concluded that the level of critical thinking of high achieving students is significantly higher than of low and medium students. It is because there is a relationship between critical thinking and a belief perspective, also between belief perspective with student's academic performance. However, research conducted by Jenkins (1998) shows different results about the specific study of critical thinking in the audit course. In his research, he used the Watson-Glaser Critical Thinking Appraisal (WGCTA) instrument in measuring the level of critical thinking. The research resulted in a declining in critical thinking scores. With this setback, Jenkins suggested that the things needed to be firstly concerned were including the previous semester's GPA, age, and gender.

Critical thinking skills are needed as a support to improve students' learning skills, namely communication skills, assessing and evaluating skills, so as to develop a better understanding of existing problems (Paul & Elder, 2001; Slavin, 2000; ŽivkoviĿ, 2016). In addition to improving skills, critical thinking can also make students more active and learn more, practice cooperation skills, respect others' opinions. Activeness occurs when students create a series of interrelated questions and then are able to ask and answer questions (Browne & Keeley, 2009; Fisher, 2009). Critical thinking is a cognitive process to gain knowledge because it is included in the activity of thinking. Critical thinking is a tool which is used in the process of mastery of concepts because conceptual knowledge is the result of a constructive process. Critical thinking activates the ability to analyze and evaluate evidence, identify questions, make logical conclusions, and also understand the implications of arguments (Ennis, 1993, p. 48; Facione & Facione, 1994). Students are different and diverse individuals. Some are equipped with high critical thinking skills, and some are still having low critical thinking skills (Facione & Facione, 1994; Glaser & Resnick, 2001, p. 137). The difference in terms of the thinking ability is possible to result in the varying levels of students' competency achievement.

Indicators of critical thinking, according to Ennis (1993), include giving simple explanations, building basic skills, making conclusions, giving further explanations, and also managing strategies. More detailed indicators of critical thinking are explained in Table 1.

Learning theory on critical thinking skills is built on constructivism learning theory, carried by researchers such as Dewey (1910), Vygotsky and Cole (1978), Piaget (1988), and Bruner (1966) who believe that all humans have the ability to build knowledge in their minds through the process of discovery and problem-solving. Constructivism learning theory is a learning theory in educational psychology stating that students must be able to find out and connect complex information by themselves, check new knowledge, and harmonize it with the old ones if they have not been harmonized yet (Slavin, 2000). In the constructivist view, the study is seen as the development of knowledge that comes from the individual itself (Browne & Keeley, 2009; Chukwuyenum, 2013; Zhou, Huang, & Tian, 2013). Theory of constructivism by Piaget views cognitive development as a process in which students actively build understanding through experience and interaction. The nature of constructivism is about the concept of learning process not just memorizing but the process of constructing knowledge through experience (Abimanyu, 2008; Sanjaya, 2012).

The aim of learning about constructivism in critical thinking is to gain good potential aspects in humans, such as being independent, having the ability to think and give value to a process and its result, and being responsible for taking a risk in making decisions. Developing all aspects of this potential can be achieved through a continuous learning process. The learning process required is the ability to recall and express experiences, compare similarities and differences, and appreciate an experience (Baharuddin & Wahyuni, 2007, p. 130; Suprihatiningrum, 2013, p. 22; von Glasersfeld, 2007). The aim of constructivism learning also affects the aspects of skills in communicating opinions, the aim of which is to learn to socialize to create reciprocal relationships with people around and environment (Karfi, 2002; Thobroni & Mustofa, 2011). Humans build knowledge through interactions with objects, phenomena, experiences, and environment. Preliminary knowledge is needed to instill the correct concepts as a basis. Knowledge is the result of the construction of the human mind. Knowledge is not given by others, such as teachers, but the result of process of developing the thinking carried out by each individual (Budiningsih, 2005; Sutiah, 2003). Knowledge aims to develop the ability to ask questions and find answers on their own, help them develop a complete understanding of concepts, develop their abilities to become independent and critical thinkers. Therefore, it can be seen that the theory of constructivism aims to build students' thinking ability to learn by themselves and discover what is learned through interaction, experience, and understanding which those qualities are then expected to be applied and reflected in their attitudes and skills. The referred attitudes are respecting opinions, as well as being responsible for the risk of decision making. Also, the referred skills are communication skills in asking and answering questions. Thus, they, as humans, can solve complex problems for their survival and progress.

Table 1. Critical Thinking Aspects according to Ennis

No	Ability	Sub-Ability
1.	Giving simple explanations	Focusing the questions Analyzing arguments Asking and answering questions
2.	Building basic skills	Considering reliable or unreliable sources Observing and considering report
3.	Making conclusion	Deducting and considering deduction result Inducting and considering induction result Making and deciding the consideration result
4.	Giving further explanations	Defining terms and considering the definition Identifying asumptions
5.	Setting strategies and tactics	Determining an action Interacting with others

Source: Ennis (1993)

Critical thinking is an important part of learning to be able to solve problems and find solutions (DePorter, Reardon, & Singer-Nourie, 2007). Critical thinking is included in the category of thinking skills. The level of thinking ability consists of four levels: memory, basic thinking, critical power, and creative power (Krulik & Rudnick, 1999). The lowest level of thinking is a memory which consists of skills which are almost automatic or reflexive. The next level of thinking is basic thinking skills. This concept discusses concepts such as addition, etc., including questions. Critical thinking is a discussion that discusses, connects, and improves all aspects of the discussion or problem — included in gathering, organizing, remembering, and analyzing information. Creative thinking is original and reflective. The result of this thinking skill is something complicated. The activities carried out here try to unite ideas, create new ideas, and determine their effectiveness. Creative thinking about also draws conclusions that can find new final results.

Critical thinking is the ability to think that is needed in all fields of learning, not only science but also in the social field (Errington & Bubna-Litic, 2015) and humanities (Smith, 2014) such as management and business. In accounting, students are not only expected to be able to "calculate", but also to think critically in solving various accounting problems in different contexts. GAAP to IFRS standards also influences changes from the accounting learning paradigm. Schools must prepare to understand and implement IFRS well. The first step that must be taken is that the direction of previous learning is based on ways of learning that are based on principles that encourage accounting students to make disputes, in which critical thinking plays a key role. Accounting learning that has the characteristics of the material as normative learning that provides numbers and problem-solving requires students to perform critical thinking.

Student competency is an ability that must be possessed by each student. The competencies are in the form of cognitive, affective, and psychomotor abilities (Bloom, 1956). Cognitive ability is the ability to understand a concept and more on the ability to think. Affective ability is the ability of students in the form of attitudes, values, and morals. Psychomotor ability is also an important ability in learning. Psychomotor ability can be seen in students' skills or ability to make something related to the concept of learning objectives. The competencies examined in this study are competencies in preparing financial statements. Financial statements, based on *Standar Akuntansi Keuangan* (SAK) or Financial Accounting Standard (FAS), according to Institute of Indonesia Chartered Accountants or *Ikatan Akuntan Indonesia* (2015, p. 1) are a structured presentation of the financial position and financial performance of an entity. Complete financial statements usually include an income statement, equity changes statement, financial position statement, cash flows statement and notes to the financial statements. Financial statements are a form of a report that describes the company's financial condition, company's development, and the results of operations of a company in a certain period. Based on the aforementioned description, it can be seen that the competency in preparing financial statements of students is the ability of students to prepare reports, which generally include financial position statements, income statements, equity changes statements, cash flows statements, and notes to financial statements.

Students who learn about accounting need to be able to critical thinking, since critical thinking may support the knowledge aspect, and also the students' skills aspect. This research is aimed at analyzing the effect of students' critical thinking on the students' competency in making financial statements.

RESEARCH METHOD

This research was a quantitative study with a quasi-experimental method. The study was conducted in two selected groups, which had previously been tested for homogeneity and reliability as pre-requisite tests for hypothesis testing. The hypothesis test used is the F test. The population of this study was all students of grade X Accounting SMK 1 Surakarta (96 students in total), which consisted of three Accounting classes, namely Class X AC 1 with 32 students, X AC 2 with 32 students and X AC 3 also with 32 students.

The sampling technique used in this study was Cluster Random sampling. Cluster Random sampling was a sampling technique by randomly targeting non-individual groups.

The samples of this research were class X AC 2 as experiment class and X AC 3 as control class (Sukmadinata, 2009, p. 252).

There were two data collection techniques used in this research, which were through documentation and test instruments. Each is elaborated as follows.

Documentation

Documentation was looking for data about things or variables in the form of notes, transcripts, books, newspapers, magazines, inscriptions, minutes of meetings, lengths, and agendas (Arikunto, 2009). Documentation is intended to obtain data directly from the research site, including relevant books, regulations, activity reports, photographs, documentary films, and data relevant to research (Riduwan, 2010, p. 105).

This study used documentation method to obtain data, such as the number of students, the name of the teachers, the name of the students, the students' scores, and school facilities. Documentation data were used as a complement in the preparation of this study.

Test Instrument

The test instruments were questions assessed using the rubric of assessment tests, also arranged based on sub-abilities developed by researchers according to indicators of critical thinking skills. Through this rubric, the researchers could determine whether or not the students met each indicator of critical thinking skills in solving problems contained in the problems. This categorization was based on the average value of the two classes. Students who score the same as the average score or above were categorized into high critical thinking group while students with scores below the average were categorized into low critical thinking group.

The purpose of the instrument was to get information about students' critical thinking skills. Conceptually, critical thinking is one's ability to make judgments with good reasoning. Operationally, the ability to think critically is the ability to think reasonably and logically, which helps in making rational decisions. Based on the conceptual definition, it can be concluded that the ability to think critically can be seen from matters related to making decisions or conclusions and is characterized by several indicators as follows: (1) Identifying, (2) Evaluating, (3) Concluding and (4) Clarifying as presented in Table 2.

Table 2. Lattice of Instruments Critical Thinking

No.	Indicator	Type	Number
1.	To identify	Multiple choice	1-6
2.	Evaluate	Multiple choice	7-12
3.	Conclude	Multiple choice	13-19
4.	To clarify	Multiple choice	20-25

As an instrument to measure students' ability to arrange a financial statement, the test questions must meet the criteria. The instrument must first be tested for validity, reliability, level of difficulty, and distinguishing features.

Questions Validity Test

Test validity is an integrated evaluative assessment conducted by the assessor regarding the extent to which empirical and theoretical rational evidence supports the accuracy of inference and action based on test scores or other assessments (Budiyono, 2015). The validity test in this study used the biserial correlation coefficient formula to test the validity of the test questions. Test criteria were if the value of $r_{count} > r_{table}$ with a significance level of 0.05, then the tool was valid, and vice versa. If the value of $r_{count} < r_{table}$, then the measuring instrument was invalid. The validity test results in this study showed five invalid questions and 20 valid questions, then the questions that can be used were 20 questions.

Questions Reliability Test

Test questions are considered reliable if the results of measurements with the instrument test questions are the same if it was carried out at the same person at different times or at different people (same conditions) at the same time or at different times (Budiyono, 2015). This study used the KR-21 formula to test the reliability of test questions. With the categories are the value of 0.00 to 0.20 was very low, 0.21 to 0.40 was low, 0.41 to 0.60 was enough, 0.61 to 0.80 was high, 0.80 to 1 00 was very high. The result of this reliability test on the questions in this study was 0.895, with a very high category.

Level of Questions Difficulties

The level of difficulty of the item shows the proportion of the number of participants who answer the item correctly to all test participants (Budiyono, 2015). The difficulty level is determined by the formula for the difficulty level index of items. The criterion used is the smaller the index obtained, the more difficult the question is. Conversely, the greater the index obtained, the easier the question is, with the categories: 0.00 to 0.30 is a difficult question, 0.30 to 0.70 is a medium question, 0.70-1.00 is an easy question. In this study, there are five easy questions, 12 medium questions, and eight difficult questions.

Distinguishing Power of Questions

The question items have a good distinguishing feature if the high achieving group of students has more correct answers than the low achieving group. The distinguishing feature can be used for distinguishing high and low achieving students. The benchmark used was the total score of a set of items analyzed (Budiyono, 2015). The formula is as follows.

$$D = \frac{B_a}{N_a} - \frac{B_b}{N_b}$$

The following were the criteria for using the distinguishing power index: 0.00 to 0.20: Ugly/Poor, D = 0.20 to 0.40: Enough, D = 0.40 to 0.70: Good, D = 0.70 to 1.00: very good, D = negative. The distinguishing feature results were 17 with enough criteria and eight with good criteria.

From the results of the validity test, reliability test, the level of difficulty, and distinguishing feature, there were 20 questions that can be used in this study.

RESULTS AND DISCUSSION

Based on the test results obtained, the average critical thinking ability of students was more classified as high. Data grouping students' critical thinking skills can be seen in and briefly in Table 3.

Table 3. Distribution of Critical Thinking Ability

Critical Thinking	Class AC 2		Class AC 3	
	Freq	%	Freq	%
Low	8	23.5%	10	29%
High	26	76.5%	24	71%
Total	34	100%	34	100%

Table 3 shows the categories of students who are classified as high and low critical thinking in the AC2 and AC3 classes. In both classes, the number of students classified as high critical thinking is greater. The frequency distribution is shown in Table 4.

Table 4. Distribution of Critical Thinking Frequency

Interval Class	Class AC 2		Class AC 3	
	Freq	%	Freq	%
55 – 58	6	17.6%	3	8.8%
59 – 62	5	14.7%	3	8.8%
63 – 66	11	32.4%	7	20.6%
67 – 70	7	20.6%	16	47.1%
71 – 74	4	11.8%	4	11.8%
75 - 78	1	2.9%	1	2.9%
Total	34	100.0%	34	100.0%

Table 4 explains the frequency distribution of critical thinking skills in AC2 and AC3 classes. Class AC2 raises the highest frequency is in the 63-66 interval, and in the AC3 class, the highest frequency is in the 67-70 interval. Student competency data is presented in Table 5.

Table 5. Student's Competency Data

Critical Thinking	Cog	Afec	Psycho	Ave
Low	69	69	77	71.7
High	80	84	81	81.7
Average	74.5	76.5	79	76.7

Table 5 shows student competency data in the low and high critical thinking categories of students. Competencies studied are cognitive, affective, and psychomotor. Students who have high levels of critical thinking have a tendency to achieve all three aspects of competence better than students who have low levels of critical thinking.

Prerequisite Test Results

The prerequisite test is a test needed before doing the hypothesis test. The prerequisite tests include normality test and homogeneity test. Each of the results of the analysis requirements test is presented as follows:

Normality Test

The normality test means the data analyzed have truly come from a normally distributed population. The normality test used in this study was the Kolmogorov-Smirnov sta-

tistics. As a prerequisite, the data that needed to be tested were data in the low and high critical thinking groups. The data distribution rules were declared normal if the sig value > 0.05. The results of the analysis using the Kolmogorov-Smirnov test, as presented in Table 6.

Table 6. Data of Normality Test Result

Group	*Kolmogorov-Smirnov*	
	F	**Significance**
Low Critical Thinking	0.180	0.128
High Critical Thinking	0.085	0.200

Based on the results of Kolmogorov-Smirnov test analysis on the low critical thinking group, a significance level of 0.128 > α = 0.05 is obtained. In high critical thinking, the group obtained a significance level of 0.200 > α = 0.05. From these values, it can be concluded that the data were normally distributed.

Homogeneity Test

The homogeneity test is a prerequisite test that aims to find out whether the data comes from homogeneous populates or not. The homogeneity test in this study was carried out by the Levene's test method from the average value of the three competencies and critical thinking data. The data distribution rules are declared normal if the sig value > 0.05. The results of the analysis using Levene's Test are presented in Table 7.

Table 7. Data of Homogenity Test Result

Data	*Levene's Test*		
	df 1	**df2**	**Significance**
Critical Thinking	1	68	0.711

Based on the results of Levene's Test analysis on critical thinking, data variables obtained a significance level of 0.711 > α = 0.05. From these values, it can be concluded that the data are homogeneous or have the same variance.

Hypothesis Test Results

Based on Table 8, the results of Anava test calculations using SPSS, the significance value of competency is 0.067, which is bigger than the significance level α = 0.05. Thus, the conclusion is that H0 is accepted. It means that there are no significant differences in the effect of competency of the student. The significance value of critical thinking is 0.000, which is smaller than the significance level of α = 0.05. Therefore, the conclusion is that H0 is rejected, and H1 is accepted. It means that there are significant differences in the effect of critical thinking skills. The significance value of competency of critical thinking is 0.026, which is smaller than the significance level α = 0.05. Thus, the conclusion is that H0 is rejected, and H1 is accepted. It means that there is significant interaction in the effect of critical thinking skills on student competencies.

It can be seen from the average that students who have a high level of critical thinking have a better average of competency than those with a low level of critical thinking; thus, this result supports the hypothesis in this study that there are differences in the effect of the level of critical thinking on the value of student competency.

Based on the average value of cognitive competence, the high critical thinking group is superior to the low critical thinking group. The aforementioned research results are in line with research by DePorter et al. (2007), which states that students who have good critical thinking skills will more easily develop their academic knowledge since critical thinking is an important part of education to be able to solve problems and find the solution. Critical thinking is a cognitive process for gaining knowledge because critical thinking is a high-level thinking activity. High-level critical thinking requires the ability to analyze and evaluate, identify questions, make logical conclusions, and understand the implications of arguments (Facione & Facione, 1994). Students with high critical thinking skills can be indicated to have better cognitive competence compared to groups with low critical thinking skills.

This study also proves that students who have critical thinking skills have a significant effect on students' affective competence. It can be seen from the average value of learning competence in the affective domain. Students who have high critical thinking levels get an average value of 84.29, while those who have low critical thinking levels get an average value of 69.01. A research conducted by Florea and Hurjui (2015) in the affective domain of critical thinking encourages stu-

dents to be actively involved in the learning process, to practice cooperation with groups, and to appreciate opinions (Florea & Hurjui, 2015, p. 570). Supported by the activeness, cooperation, and the attitude of respect, then the affective competence of students becomes better. It can be concluded that students who have a high level of critical thinking have affective competence in preparing financial statements better than students who have a low level of critical thinking.

In the indicators of psychomotor or skills, students with high and low critical thinking levels have different average; that is, the value of students who think critically high is superior to students who think critically low. It is supported by the fourth and fifth critical thinking indicators from Ennis (1993), which are providing further explanation and setting strategies and tactics. Giving further explanation is included in the psychomotor domain, namely communication skills. Managing strategies and tactics also include the realm of design skills. Therefore, we need critical thinking skills to achieve better psychomotor competencies. Carson (2007) states that although students know a concept, not necessarily students can know how to apply it or use it. There are still many students who find it difficult to apply the knowledge and concepts they know to solve problems. It indicates that students must practice a lot to apply their knowledge to the skills they have. Critical thinking is considered as one of the compulsory abilities needed in the 21st century (Trilling & Fadel, 2009, p. 7). It is considered as an ability that needs to be improved in one's life to be more creative and skilled in problem-solving (Ornstein & Hunkins, 2004, pp. 119–120). In everyday life, critical thinking is used for decision making, forming opinions based on reason, and defending ideas to be accepted (Bassham, Irwin, Nardone, & Wallace, 2011, p. 1). Where it is part of the psychomotor domain; hence, it can be said that high critical thinking skills significantly influence student's psychomotor competence.

CONCLUSION

Based on the results of data analysis and discussion of the results of research that had been conducted, it is concluded that students who had high levels of critical thinking, had the higher achievement of student learning competence than those with low critical thinking abilities. The referred student competencies were cognitive, affective, and psychomotor, as the basic competencies needed for preparing financial statements. Thus, teachers need to pay attention to students' critical thinking skills in accounting learning because critical thinking skills in the 21st century are highly needed in problem-solving and decision making in daily life. In subsequent studies, it is best to pay attention to aspects of different levels of education and the field of education.

ACKNOWLEDGMENTS

The authors express special gratitude to the Directorate of Research and Development of the Ministry of Research Technology and Higher Education of Indonesia, which funded this research.

REFERENCES

Abimanyu, S. (2008). *Strategi pembelajaran*. Jakarta: Direktorat Jenderal Pendidikan Tinggi, Departemen Pendidikan Nasional.

Arikunto, S. (2009). *Dasar-dasar evaluasi pendidikan* (Revised ed). Jakarta: Bumi Aksara.

Baharuddin, E., & Wahyuni, N. (2007). *Teori belajar dan pembelajaran*. Yogyakarta: Ar-Ruzz Media Group.

Bassham, G., Irwin, W., Nardone, H., & Wallace, J. M. (2011). *Critical thinking: A student's introduction*. New York, NY: McGraw Hill.

Bloom, B. S. (1956). *Taxonomy of educational objectives : The classification of educational goals, handbook I cognitive domain*. New York, NY: Longmans, Green and Co.

Browne, M. N., & Keeley, S. M. (2009). *Asking the right questions: A guide to critical thinking*. Singapore: Pearson/ Prentice Hall.

Bruner, J. S. (1966). *Toward a theory of instruction*. Cambridge, MA: Harvad University.

Budiningsih, A. (2005). *Belajar dan pembelajaran*. Jakarta: Rineka Cipta.

Budiyono, B. (2015). *Statistika untuk penelitian*. Surakarta: UNS Press.

Carson, J. (2007). A problem with problem solving: Teaching thinking without teaching knowledge. *The Mathematics Educator*, *17*(2), 7–14.

Chukwuyenum, A. N. (2013). Impact of critical thinking on performance in mathematics among senior secondary school students in Lagos State. *IOSR Journal of Research & Method in Education*, *3*(5), 18–25. Retrieved from http://www.iosrjournals.org/iosr-jrme/papers/Vol-3 Issue-5/D0351825.pdf

DePorter, B., Reardon, M., & Singer-Nourie, S. (2007). *Quantum teaching: Mempraktikkan quantum learning di ruang-ruang kelas*. (A. Nilandari, Trans.). Bandung: Kaifa.

Dewey, J. (1910). *How we think*. Lexington, KY: D.C. Heath. https://doi.org/10.1037/10903-000

Duron, R., Limbach, B., & Waugh, W. (2006). Critical thinking framework for any discipline. *International Journal of Teaching and Learning in Higher Education*, *17*(2), 160–166. Retrieved from http://www.isetl.org/ijtlhe/pdf/IJTLHE55.pdf

Ennis, R. H. (1993). *Critical thinking*. Upper Saddle River, NJ: Prentice Hall.

Errington, A., & Bubna-Litic, D. (2015). Management by textbook: The role of textbooks in developing critical thinking. *Journal of Management Education*, *39*(6), 774–800. https://doi.org/10.1177/1052562915594839

Facione, P. A., & Facione, N. C. (1994). *Holistic critical thinking scoring rubric*. Millbrae, CA: The California Academic Press.

Fisher, A. (2009). *Critical thinking: An introduction*. London: Cambridge University Press.

Florea, N. M., & Hurjui, E. (2015). Critical thinking in elementary school children. *Procedia - Social and Behavioral Sciences*, *180*, 565–572. https://doi.org/10.1016/j.sbspro.2015.02.161

Glaser, R., & Resnick, L. (2001). *National research center on student learning*. Washington, DC: Office of Educational Research and Improvement.

Ikatan Akuntan Indonesia. (2015). *Pernyataan standar akuntansi keuangan*. Jakarta: Ikatan Akuntan Indonesia.

Jenkins, E. K. (1998). The significant role of critical thinking in predicting auditing students' performance. *Journal of Education for Business*, *73*(5), 274–279. https://doi.org/10.1080/08832329809601644

Karfi, H. (2002). *Model-model pembelajaran*. Bandung: Bina Media Informasi.

Krulik, S., & Rudnick, J. A. (1999). Innovative tasks to improve critical and creative thinking skills. In L. V. Stiff & F. R. Curcio (Eds.), *Developing mathematical reasoning in grades K-12* (pp. 138–145). Reston, VA: The National Council of Teachers of Mathematics.

McCarthy, M. C. (2004). *Critical thinking disposition, belief perspective and academic performance: Examining relationship*. Doctoral thesis. Auburn University, Auburn, AL.

Ornstein, A. C., & Hunkins, F. P. (2004). *Curriculum: Foundations, principles and issues*. Boston, MA: Pearson.

Paul, R., & Elder, L. (2001). *The miniature guide to critical thinking: Concepts and tools*. Dillon Beach, CA: The Foundation for Critical Thinking.

Piaget, J. (1988). *Antara tindakan dan pikiran*. (A. Cremers, Ed.). Jakarta: PT Gramedia.

Regulation of the Minister of Education and Culture No. 70 of 2013 concerning the Basic Framework and Structure of Curriculum for Vocational High School/Vocational Madrasah Aliyah (2013). Republic of Indonesia.

Riduwan, R. (2010). *Skala pengukuran variabel-variabel penelitian*. Bandung: Alfabeta.

Sanjaya, W. (2012). *Strategi pembelajaran berorientasi standar proses pendidikan*. Jakarta: Kencana Prenada Media Group.

Slavin, R. E. (2000). *Educational psychology: Theory and practice* (6th ed.). Boston, MA: Allyn and Bacon.

Smith, G. F. (2014). Assessing business student thinking skills. *Journal of Management Education*, *38*(3), 384–411. https://doi.org/10.1177/1052562913489028

Snyder, L. G., & Snyder, M. J. (2008). Teaching critical thinking and problem solving skills. *Delta Pi Epsilon Journal*, *50*(2), 90–99.

Springer, C. W., & Borthick, A. F. (2004). Business simulation to stage critical thinking in introductory accounting: Rationale, design, and implementation. *Issues in Accounting Education*, *19*(3), 277–303. https://doi.org/10.2308/iace.2004.19.3.277

Sukmadinata, N. S. (2009). *Metode penelitian pendidikan*. Bandung: Remaja Rosdakarya.

Suprihatiningrum, J. (2013). *Strategi pembelajaran: Teori dan aplikasi*. Yogyakarta: AR-Ruzz Media.

Sutiah, S. (2003). *Buku ajar teori belajar dan pembelajaran*. Malang: UIN Press.

Thobroni, M., & Mustofa, A. (2011). *Belajar dan pembelajaran pengembangan wacana dan praktik pembelajaran dalam pembangunan nasional*. Yogyakarta: Ar-Ruzz Media.

Trilling, B., & Fadel, C. (2009). *21st Century skills: Learning for life in our times*. San Francisco, CA: John Wiley & Sons.

von Glasersfeld, E. (2007). *Learning as a constructive activity*. London: Lawrence Erlbaum Associates.

Vygotsky, L. S., & Cole, M. (1978). *Mind in society: Development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Zhou, Q., Huang, Q., & Tian, H. (2013). Developing students' critical thinking skills by task-based learning in chemistry experiment teaching. *Creative Education*, *04*(12), 40–45. https://doi.org/10.4236/ce.2013.412A1006

ŽivkoviĿ, S. (2016). A model of critical thinking as an important attribute for success in the 21st century. *Procedia - Social and Behavioral Sciences*, *232*, 102–108. https://doi.org/10.1016/j.sbspro.2016.10.034

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (280-293)
Online: http://journal.uny.ac.id/index.php/jpv

COOPERATION BETWEEN VOCATIONAL HIGH SCHOOLS AND WORLD OF WORK: A CASE STUDY AT SMK TAMAN KARYA MADYA TAMANSISWA

Muh. Juandi Arif Baitullah
Universitas Negeri Yogyakarta

Wagiran
Universitas Negeri Yogyakarta

Abstract

The purpose of this study was to find out: the school strategy, procedure, forms, and evaluation to cooperate with the world of work. The type of research is qualitative with a case study approach. The subjects in this study were the head of the department, the chairman of the special job fairs, the vice-principal of public relations, the vice-principal of curriculum, the head of competence skills, and industry that were in cooperation with the school. The methods of collecting the data were in-depth interviews and documentation. The results show that: (1) the school strategy in cooperation with industry began with industry visits, requesting permission to do industrial practice, good communication, submitting proposals related to school potential in the form of profiles, being active in participating in school promotions, utilizing the role of industry as a guest teacher, being a pre-service place and outsourcing to industry; (2) the cooperation procedure analyzed the community, in this case, the world of work, established communication, and Involved world of work; (3) the forms of cooperation were the training of skills improvement in the field of science and technology, exchange of information, curriculum synchronization and development, implementation of internships, implementation of competency and certification tests, industry visits, industrial work practices, special job fairs, recruitment; (4) the evaluation of management in the implementation of the cooperation was included in the "good" category.

Keywords*: strategy, cooperation procedures, evaluation*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.27719*

Contact Muh. Juandi Arif Baitullah
arifandi476.2017@student.uny.ac.id
Department of Technology and Vocational Education, Graduate School of Universitas Negeri Yogyakarta
Jl. Colombo No. 1, Karangmalang, Depok, Sleman, Yogyakarta 55281, Indonesia

INTRODUCTION

Improving the quality of education is a process that is carried out continuously. The improvement of education quality is expected to be implemented from elementary to higher education levels. Vocational High School (*Sekolah Menengah Kejuruan* or SMK) is one of the educational institutions built by the government of Indonesia to advance education, especially in preparation to face the demands of quality workers and improve the economy in the country. Vocational schools have distinctive characteristics that distinguish them from other high schools (*Sekolah Menengah Atas* or SMA and *Madrasah Aliyah* or MA), namely, their close relations with the world of work. At the beginning of the establishment, vocational schools are designed in such a way to make students work, continue or become entrepreneurial and, in their learning process, using learning by doing method (Hamid & Sudira, 2013, p. 3).

Based on Law of Republic of Indonesia No. 20 of 2003 on National Education System article 15 paragraph 2, vocational education is secondary education that prepares participants to study, especially to work in certain fields. However, based on data from the Central Bureau of Statistics, the number of the labor force in August 2018 was 131.01 million people, which is an increase of up to 2.95 million compared to August 2017. In line with that, the labor force participation rate also increases by 0.59%, and viewed from education level, the open unemployment rate for vocational high schools is still dominating, which is 11.24% (Central Bureau of Statistics, 2018).

Vocational education in Indonesia is getting into a new phase. Presidential Instruction No. 9 of 2016 concerning the revitalization program of vocational high schools, followed by a memorandum of understanding between the relevant ministries, apparently becomes the driving force for vocational education in the country. Even, some people call it the third vocational education reform, after the first vocational education reform in 1964, and the second reform in 1976. Vocational high school revitalization is expected to en-hance the quality of Indonesian workers who are statistically still growing below the level with the majority of basic education levels. This program is expected to give a positive impact on improving the quality of vocational secondary schools with two new orientation pillars. The first pillar strengthens the links of SMKs with business and industry in the 21st century, and the second pillar pushes local excellence into global excellence.

It is related to the principles of vocational education described by Prosser (1925) in Djojonegoro (1998, p. 38) that 16 princi-ples can be found in vocational education, and some of them are related to the role of indus-try. There are three principles, namely:

> *"Vocational education will be effective if (1) training tasks are done in the same manner, tools, and machinery as specified in the workplace, and (2) training someone in the habit of thinking, and work as needed in work itself. (3) Voca-tional education will be efficient if the environment where students are trained is a replica of the environment in which they will work".*

Based on the research by PH (2011), in building harmony (link and match) with other systems, especially harmony with the general economic system or the world of work particularly, vocational education is more directed to demand-driven than supply-driven, which is done through more actual learning that is not merely textual, more concrete than ab-stract, which refers to more reality than artifi-cial, to be more real than virtual, and all of them demand vocational education to draw closer to the world of work proactively. It is in line with Soenarto, Amin, and Kumaidi (2017) that vocational education must always adjust to the needs of the community, espe-cially industry needs, so that vocational high schools (SMKs) must establish cooperation with the industry as the users of graduates. Vocational education must be designed so graduates have the skills, abilities, knowledge, attitudes, and work habits that are appropriate to the needs of the workforce.

The government has launched a Link and Match program between SMK and industry since 2017. Until its tenth launch, Monday (3/18/2019), 5,000 vocational high schools were not covered by this program. The Director-General of Primary and Secondary Education of the Ministry of Education and Culture, Hamid Muhammad, said that his institution appreciates the link and match vocational edu-

cation program between SMK and the industry. Moreover, in Indonesia, there are 14,260 vocational high schools, and 10,600 of them are private schools. "In addition, 5,000 SMK did not cooperate with the industry. We are worried that these SMKs will produce graduates who are unable to compete for jobs," he said on the sidelines in the launching of the Link and Match vocational education program with the Java Region Industry, West Java, Indonesia, at PT Anugerah Indofood Barokah Makmur, Sukabumi (Arief, 2019).

The cooperation of vocational schools with the industry has many benefits, one of which is based on the results a research by Wibowo (2016) which concluded that the concrete steps that schools could take to reduce the gap between SMK and industries related to the competency of SMK graduates are to prepare competent workforce both in terms of hard skills and soft skills according to the industry expectations. SMK could implement program activities as follows: (1) teaching factory program, (2) management of industrial work, (3) management of industrial visits, (4) organization of industrial classes, (5) on job training programs, and (6) counseling and coaching from stakeholders related to labor.

Pillay, Watters, Hoff, and Flynn (2014) examine dimensions of effectiveness and efficiency: a case study on the industry – school partnerships. Internationally, the delivery of vocational education and training is challenged by increasing skills shortages in specific industries or rapidly changing skills requirements. The study found that some evidence of partnership activities related to efficiency and effectiveness could be assigned to the gateway school project. Nevertheless, little evidence was found that those under-lying principles were handled systematically. Some of these partnerships are loosely facili-tated by individuals who have limited infra-structure or strategic support. The implication is that partnerships in schools will benefit from applying the partnership principle re-garding implementation and management to ensure the sustainability of the partnership.

However, many problems are still found in the implementation of cooperation. An evaluation research by Syari and Ma'arif (2017) explains the problems found in the cooperation's implementation are the lack of students' enthusiasm to work in the industry, the delay in the announcement of test results, and the industry has less attention to students. Other researches also found the problem of the cooperation's continuity between SMKs and the industry, such as, a research by Arifin (2012) which aims at obtaining an empirical picture and developing the patterns of partnership cooperation between SMK and industry in strategic planning, implementation, effectiveness, results and benefits in the quality development of SMKs. These results show that generally, all vocational schools in the city of Yogyakarta have collaborated in partnership with industry partners, especially in the implementation of street vendors programs. As a form of partnership with the industry, the scenario of developing partnerships is outlined in School Development Plan (*Rencana Induk Pengembangan Sekolah* or RIPS) as a form of implementation of strategic management and partnership in school development. However, the majority of SMKs have not been able to empower all potential industry partners for the schools' development, especially in developing learning resources needed in the development of the learning process, production units, and services, as the production-based education and work-based education cannot be implemented yet.

Until the end of 2015, there were still SMKs that had not been able to maximize the procurement of infrastructure needed for direct learning (practice). Even these things sustained by the school were pioneered by Ki Hadjar Dewantara, started on July 3, 1922, in Yogyakarta. Only 30% are eligible to operate, 300 schools belonging to Tamansiswa College have been suspended due to lack of funds. "Tamansiswa College has difficulty supporting itself, due to lack of students," said Sunarno Hadiwijoyo, the Deputy Chairperson of the Noble Council of Tamansiswa Asso-ciation, on the sidelines of the meeting (or *sarasehan)* event (2/5/2012) located in the Tamansiswa Meeting Hall, Central Jakarta (Indriasari, 2012).

Besides, Indriaturrahmi and Sudiyatno (2016) believe that the role of the industry in encouraging local government policies related to the development of vocational-based local wisdom has not been adequate; there is no cooperation related to the provision of facilities and infrastructure, and curriculum development in the form of curriculum workshops.

Commonly, the cooperation between SMKs and industry is in the form of industrial work practices (Arifin, 2012a). The most prominent research findings at the school cooperation program are the implementation of street vendors, internships for teachers and technicians, curriculum validation, competency tests, and recruitment of prospective employees.

The indicators of school success in establishing cooperation are shown by (1) the formation of a special public relations team or cooperation team with main tasks and programs to be able to (successfully) build partnerships, (2) the implementation of exploratory cooperation with related parties to obtain input before implementing the program, (3) the realization of the cooperation contract as outlined in the memorandum of understanding (MoU) or cooperation agreements with related parties, (4) the realization of various activities in the successful implementation framework program such as (a) exchange of students, teachers, principals, school committees, and school leaders to add insight and competence; (b) teacher apprenticeship to other institutions to improve competence, etc (Department of National Education, 2009, p. 64).

Collier and Mcmanus (2005) examines setting up learning partnerships in vocational education and training: lessons learned. Their article reported what is helping and hindering the integration of learning partnerships in this program. Some of the issues explored include: how to build learning partnerships to encourage participation best; desirable quality of effective learning partners; and the important role played by facilitators in preparing learning partnerships.

Then, SMK Taman Karya Madya Tamansiswa Purworejo is a suitable vocational school to be a reference for other vocational schools because of the 100% graduation rate and 95% community satisfaction. Besides, it also has successfully cooperated with the largest and well-known industries in Indonesia, such as PT PLN (Persero), PT Dirgantara Indonesia, PT Bukaka Teknik Utama, PT Pama Persada Nusantara, PT Pindad, PT Mekar Armada Jaya, PT Plasindo Plasma, Jasatec Engineering Purworejo, PT Gaya Motor, UPT LLK Purworejo, and other industries that have a good impact on the absorption of graduates.

Based on the description of the problems, in this study, it is clear that the cooperation of vocational high schools with the industry starts from the school's strategy in cooperating with the industry, the procedures for cooperation with the industry, describing the forms school cooperation with the industry, and evaluation of the school cooperation implementation with the industry. Thus, from the research objectives, a flow profile starting the cooperation between the vocational school and the world of work is found.

RESEARCH METHOD

This research was conducted at SMK Taman Karya Madya Tamansiswa Purworejo with competence in Computer and Network Engineering, Electrical Utilization Installation Engineering, Mechanical Engineering, and Industrial Mechanical Maintenance Engineering. The process of data collection is divided into three phase, they are: (1) the phase before the study, (2) the phase during the study, and (3) the phase of leaving the research location. The data were collected using the following techniques: (1) interviews, (2) observations, (3) document analysis, and to meet the requirements of ontology and epistemology issues, participatory observation, interviews, audio records, video records, and potential photography naturally as part of the reality of SMK Taman Karya Madya Tamansiswa Purworejo vocational cooperation with the industry were also employed.

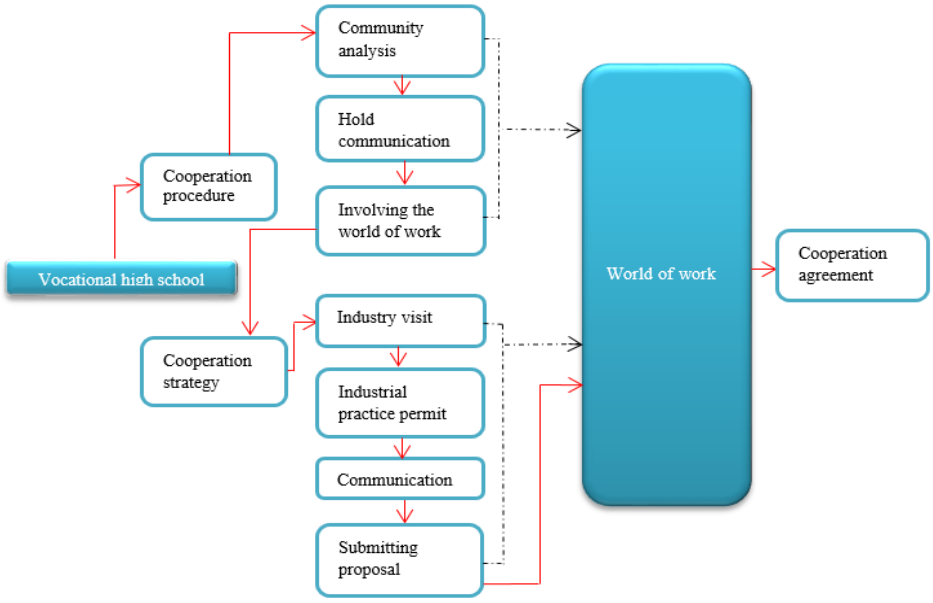
The type of data in this study are primary data and secondary data. Primary data were collected by researchers directly from data sources. The researchers used observa-tions and interviews to collect primary data. The informants in this study are (1) school principal, (2) vice chancellor for curriculum (3) chairperson of special job fairs, (4) public relations, (5) heads of Computer and Network Engineering, Electricity Utilization Installation Engineering, Mechanical Engineering, and Engineering Industrial Mechanic Maintenance, and (6) representatives of key industries. Secondary data were collected by researchers from various sources available at SMK Taman Karya Madya Tamansiswa Purworejo in the form of cooperation agreements with the working world. The study was conducted in three months, from February to April 2019, and was previously surveyed in December 2018 to January 2019.

RESULTS AND DISCUSSION

The results of this study found that the cooperation strategy with the working world of a profile in the SMK Taman Karya Madya Tamansiswa Purworejo starts from the first procedure, namely community analysis. Some activities are conducted in community analysis, such as examining various potential industries and institutions that exist around the school area which include business types, production types that include goods and services produced by companies or institutions, qualifications of available workforce, tasks performed, and expertise/skills that can be obtained at the company, practice facilities or production facilities available, making sure that the capacity or number of students acceptable for training institutions and qualifications from the world of work can be classified as large, medium or small companies, and making an assessment of all relevant skills that can be obtained in each industry, in this case, examining the right skills that stu-dents can obtain for each study program in parts or divisions and subdivisions.

The second process in maintaining schools' relations with the industry is communication. In this context, after SMK Taman Karya Madya Tamansiswa Purworejo obtained various information needed about the industry, the school then communicates with the working industries, which will be invited to work together. The next procedure involves the industry in school activities such as pro-viding motivation and direction before the de-parture of industrial work practices, introduc-ing the industrial culture, and participating in monitoring students' developments during the industrial work practices.

After the procedures for the cooperation process are carried out, it is followed by a strategy in working with the world of work (the industry). The strategy includes industrial visit activities, then proceed with obtaining permission to conduct industrial practices, and holding a communication that leads to the establishment of cooperation in this communication. SMK Taman Karya Madya Tamansiswa Purworejo explained the profile of the school, then proceed with the submission of the proposal for cooperation. The process is shown in Figure 1.



Line description:

Cooperation flow : ⟶

Coordination line : - - - - -

Figure 1. Profile of Cooperation Strategy Taman Taman Madya Tamansiswa Purworejo Vocational School

Through the aforementioned explanation, it is clear that the process of implementing cooperation between SMK Taman Karya Madya Tamansiswa Purworejo with the world of work needs to follow some procedures. All of the procedures are crucial, especially in creating good communication with all parties responsible for cooperation with the world of work, such as the Chairperson of the Special Occupation Exchange for requesting permission from the Chair of Public Relations, the Chair of Public Relations then establishes communication with the industry. Information about the results of communication is conveyed to the Principal, and the Principal made an agreement related to the cooperation to be carried out.

Then, SMK Taman Karya Tamansiswa Purworejo has a special team in cooperation with the working world. This team is in the scope of community relations work, where the task of the group is establishing and maintaining good communication between the institution and both internal and external parties related to the world of work as the whole stage of cooperation, starting from procedures and strategies in cooperation, and also the distribution of graduates of SMK Taman Karya Madya Tamansiswa Purworejo.

Community relations are supported by a special job fair, which aims to provide (1) career selection guidance for graduates so that they find jobs suitable with their interests, talents, and competencies, (2) inter-work services which include registration and data collection of job seekers, data collection of job opportunities, providing guidance to job seekers of graduates, bidding to users of the workforce regarding labor supply, implementation of verification as a follow-up to the delivery and placement that has been carried out, the implementation of labor market exhibition activities and other activities, (3) workforce planning, which includes helping to identify skills and abilities as well as identifying suitable jobs, helping to build skills for getting a job such as the ability to complete correspondence and completing requirements for applying for jobs, preparing for work interviews and developing the ability to market them-selves, (4) job market information, and (5) job analysis in terms of providing career counsel-ing and work placement information, which is aimed at making better decisions of work leading to more satisfying and productive careers for students or graduates to enter the workforce, they are ready to make decisions about better job choices for more satisfying and productive career goals.

Based on the cooperation strategy, SMK Taman Karya Madya Tamansiswa Purworejo also has several stages in coopera-tion, including the implementation of a co-operation assessment with related parties to obtain suggestions before implementing the program. The cooperation assessment is con-ducted in the form of good communication and coordination that continues to be carried out at the stage of the cooperation process, which finally turns out to be the realization of the cooperation contract as outlined in the memorandum of understanding (MoU) or cooperation agreements with the world of work. In line with the research results conducted by Isbianti (2009) stated in a series of public relations activities, the flow of information, both incoming and outgoing information, is very important. The target of information can be said in the form of internal and external communities, which, indeed, in public relations activities convey information inevitably occurs. This information can arrive at its destination through communication, so the success of this communication plays an important role for the success of public relations activities.

All processes in the strategy need good communication with the industry because all of them determine whether the industry wants to work together or not. Industrial visits and industrial work practices are the forms of cooperation that are generally carried out by SMKs, so the assessment of the vocational workforce will be invited to cooperation is taken when the process of applying industrial work practices and good communication during the industrial visit. Therefore, the school must prepare students who will be apprentices in industries to have indeed passed the separated examinations conducted by teachers at school. All of the process through the procedures and strategies are united as an effort to make the world of work knows SMK Taman Karya Madya Tamansiswa Purworejo well. Thus, from these efforts, it is hoped that the world of work will work together in supporting the course of education in SMK Taman Karya Madya Tamansiswa Purworejo.

The cooperation agreement between SMK Taman Karya Madya Tamansiswa Purworejo with the industry is not only in the form of industrial work practices but also in other forms of cooperation that have been carried out, including increasing skills training participants in the fields of science and technology, exchanging information in the form of science and technology, synchronizing and curriculum development, implementation of internships for teachers, implementation of competency testing and certification, industry visits, special job fairs, and recruitment/placement of graduates, explained as follows:

Improvement of Training Participants in the Field of Science and Technology

The role of humans in an organization is very important. As technology demands and intense competition, human resource competencies in organizations must be optimized through competency-based employee education and training. It has a positive impact when competent human resources are able to bring personal success to enhance organiza-tional performance. Human development in organizations provides quality and work capabilities that will have an effect on improving organizational performance. Thus, the higher frequency and quality of education and training will increase human resources.

Competent and quality human resources can be obtained by developing the existing human resources in the agency. One of the development activities is through education and training activities. By providing education and training, human resources are expected to be able to work more efficiently and be able to carry out tasks better so that a reliable workforce can be realized. According to PH (2013), the excellence of human resources was the key to competitiveness because human resources will determine who is able to maintain survival, development, and victory in global competition. Superior quality human resources have creative, innovative, flexible, technologically literate, skilled, and multiple intelligences.

Exchange of Information in The Form of Science and Technology

One of the exchanges of information programs in the form of science and technology is between PT Bukaka with SMK Taman Karya Madya Tamansiswa Purworejo. Thus, using technology together with other resources to integrate (assimilate) and adapt existing technology. The development of science and technology in the world of work can be a reference for SMK Taman Karya Madya Tamansiswa Purworejo to improve and think long-term, then to be able to plan how to learn in the future, so that it can be in accordance with the development of existing technology in the future. Through this cooperation, the industry also gets an overview of vocational school development in the field of technology.

A research by Suhartanta and Arifin (2010) expressed several forms of cooperation carried out by schools with stakeholders in increasing information exchange, particularly in terms of exchanging information on technological developments related to qualifications and labor competencies needed by industry to support activities in his business. Technology and information networks must be optimized as far as possible, so the information can be useful for those who need it, especially in the development of education in educational institutions to improve the quality of education.

Related to the opinion of Dean (1997), the experience of business network development was initiated through a network program project between 1991 and 1993. The pilot business network project in Australia was carried out by The National Industry Extension Service (NIES), which is a joint venture between the commonwealth government with eight territory states. From the pilot project, according to Dean, two business conceptions of the developing business can be classified, namely "hard" and "soft" networks, where soft networks are more towards informal business networks, which are basically for information exchange. Further, Dean revealed that the business network should not be forced, but the government continues to provide direction, and business people are allowed to conduct business cooperation on their own initiative.

Synchronization and Curriculum Development

SMK Taman Karya Madya Tamansiswa Purworejo cooperates with PT Main Technical Bukaka in the form of validation and synchronization, and curriculum development. The result of interview with the deputy

head of curriculum at SMK Taman Karya Madya Tamansiswa Purworejo is as follows:

> *"Synchronization and curriculum development are the main agenda once a year at SMK Taman Karya Madya Taman-siswa Purworejo. We invite the world of work, both those who are bound by the memorandum of understanding (MoU) or not to each competency expertise so that it is truly learned that we will teach according to work carried out in the world of work. Curriculum development can only be carried out by competent instructors. Discussions with industry must still be implemented intensively".*

It is expected that the synchronization and curriculum development at SMK Taman Karya Madya Tamansiswa Purworejo, with the assistance of the world of work, will pro-duce a curriculum which has a content more relevant to the competencies needed by the industry.

The results of this study are the development of previous research conducted by Jatmoko (2013), which states that revamping the curriculum is one of the important things that must be the focus to improve vocational graduates. However, this improvement must also involve all relevant elements so that the results can be significant. As an example, the results of research conducted by Yudantoko and Arifin (2016) which state that the level of competence relevance between the competency profile in the curriculum document school-based curriculum Vocational Automotive Body Repair Engineering in Bantul Regency and the competency profile of the business world and the automotive body industry sector shows a figure of 27.211% or it can be said not relevant to what is needed by the industry.

Implementation of Internships for Teachers

To increase the competence of productive teachers to miss the development of the technology developed by the industry, teachers in SMK Taman Karya Madya Tamansiswa Purworejo were sent to attend On the Job Training (OJT) in the industry in accordance with the competency to be applied in the school activity. In line with Gunadi (2013), there needs to be a partnership between the Educational Workforce Educator Institute, schools, and industry to realize the quality human resources of prospective teachers.

Each expertise competency of at least two people is sent to join the OJT every year. Thus, the teacher can know which potentials must be sharpened in learning to produce competent students according to the competencies needed. In this case, the teacher can start from the first step, which is analyzing Competency Standards and Basic Competencies to be learned. Then what indicators must be done to achieve these basic competencies and competency standards. Next, the teacher can design teaching preparation and arrange strategies and learning methods suitable to be given to students. Therefore, students can easily understand in learning these competencies, and students can be competent and apply them in the industry after graduation.

Implementation of Competency Tests and Certifications

Vocational high school is a vocational education institution that prepares skilled workers ready for work. SMK graduates also take the skills competency test to get a competency certificate that can be used to find work in the industry. Competency Certificate is written recognition proof of competency achievements in certain qualifications given by an accredited education unit or an author-ized certification body.

An SMK graduate can have more than one competency certificate, depend on the expertise program he has taken at the vocational school. For example, an SMK graduate with a Mechanical Engineering expertise program can have six certificates for the competence of Welding Engineering, Metal Fabrication Engineering, Metal Casting Engineering, Mechanical Engineering, Industrial Mechanical Maintenance Engineering, and Mechanical Drawing Engineering.

Competency certificates for vocational students are given after they have passed the skills competency test. The skills competency test is part of the national exam for vocational students, consisting of vocational theory exams and vocational practice exams. After students graduate the skills competency test, a certificate of competency is given by the Professional Certification Institute, recognized by the National Professional Certification Board.

One of the objectives of the skills competency test is to facilitate vocational cooperation with the world of work to carry out competency tests that are in line with the industry's needs. In implementing skills com-petency tests, SMK involves the world of work or international, national, or local scale institutions, which have main jobs that are relevant to the competency of the tested student skills. Hopefully, the world of work can see directly and recognize the competence of vocational students so that it can be directly absorbed as a workforce by the industry.

Examiners in the skills competency test also consist of internal examiners (teachers) and external examiners. External examiners are human resources from the world of work /industry/professional associations/institution have educational background and assessors who have competency certificates and work experience relevant to the competency expertise to be tested. The results of competency tests that are successful/competent obtain a certificate from the world of work, who failed/ did not competent is required to repeat.

World of work involved in the skills competency test implementation includes PT. Bukaka, Jasatec Engineering, and the world of work are not even bound by the MoU. The competency test is held at the SMK Taman Karya Madya Tamansiswa Purworejo. SMK Taman Karya Madya Tamansiswa Purworejo hopes through cooperation in the form of the skills competency test and certification, and it is expected that the world of work can support the activities so that they can find out about developments in the SMK.

Industrial Visits

During industry visits, students will learn about activities in the industry, and see the work processes carried out by employees, and they can also learn how the standard operating procedures must be practiced by an employee. Industrial visit is important to give insight to students as early as possible and get an overview of the world of work environ-ment before the they carry out their jobs.

The implementation of industrial visits through public relations programs is specifically for tenth-grade students because this activity is a provision for them before later attending the Dual System Education, which will be held in eleventh grade. An example of the industrial visit undertaken by SMK Taman Karya Madya Tamansiswa Purworejo is at the Wadas Lintang Kebumen Reservoir, in Kebumen, Central Java, which was attended by 64 students of the Electricity Utilization Installation Engineering expertise program.

Industrial Work Practices

Industrial work practice is an educational training and learning activity done in the world of work relevant to competence. Students do an industrial internship at the world of work for three months after receiving report cards and declaring grade XII. It is expected that students will know and feel the working climate in the industry directly. In practice, students may choose/determine the location of the industry for new industries that can be done by conducting an MoU in ad-vance or a review by the school to determine the feasibility of the industry as a place of industrial practice. According to the results of a research by Firdaus (2012), schools need to establish synergistic work with industry, in order to find an appropriate and relevant prac-tice apprenticeship with an organized exper-tise program.

Good communication between the school and industry can always maintain cooperation. It greatly helps in the implementation of further internships. Then, it always endeavors that in the implementation of internship there are no problems between students, the industry and schools, so the internship implementation always gives a good impression (Iriani & Soeharto, 2015, p. 15).

The pattern of selecting the world of work for internship places are (1) relevant and representative to the world of work to expertise competencies, (2) meeting the standard of work carried out, (3) and the world of work care for students who carry out an internship. Provisioning of participants in the apprenticeship program was done before and after the apprenticeship, which usually provided the material from relevant industries that cooperated with the world of work. As long as students do practical learning activities continually, the teacher gives the material to students by giving assignments or in the form of modules. To find out the development of students while in the industry, monitoring and evaluation by the school supervisor are done once a month.

Cooperation in industrial work practices is in line with Baiti and Munadi (2014) who found that there is a positive and significant effect between practical experience on work readiness and a variable that shows the greatest contribution to other variables in the research. Thus, it is expected that from the experience of industrial work practices, students are ready with work in the workforce. Lestari and Siswanto (2015) state that through the apprenticeship activities, schools need to continue to improve synergistic cooperative relationships with industry. This cooperation is expected to improve the quality of the results of the internship both for students and the industry. With good labor practices results, it will provide many benefits both for industry, schools, and students.

Special Job Exhibitions

The indicator of the success of a vocational education institution is not only assessed from the acquisition of the National Examination that produces a high graduation rate, but it is also determined by how much graduates that can be absorbed by the world of work. Schools usually have work programs that can provide career guidance to their students at certain times, provide information on job opportunities to prospective graduates, and have open links and matches with graduate user institutions in order to foster cooperation with institutions to improve student competencies. Special job exhibitions is a job market that provides job market information, registration of job seekers, provides counseling, and mentoring positions, as well as the distribution and placement of job seekers.

According to Pambayun and Wagiran (2014), the performance of special job exhibitions from each SMK will influence the absorption of graduates into the relevant workforce. Special job exhibitions that have good performance can carry out programs that become obligations and other programs that have been planned, have relationships with many companies or industries so that the dis-tribution of graduates becomes wider and can reduce the waiting period for graduates to get a job. Further, it can provide career guidance to both students and graduates, so they can choose and have career knowledge and are better prepared to enter the workforce.

A common special job exhibition management strategy is establishing mutually beneficial partnerships with the world of work. The affairs of graduate placement are not solely the needs and advantages of the school. However, special job exhibitions must also be able to convince partners that they will also have benefits if they can develop cooperation with special job exhibitions. The form of industrial cooperation with the Taman Karya Madya Vocational School Purworejo scholarship related to the major tasks of the special job exhibitions itself is information about employment vacancies in the industry, so that all developments, especially in the search for new workers in the industry will be conveyed directly to the Chairman of the special job exhibitions in SMK Taman Karya Madya Tamansiswa Purworejo.

Recruitment/Placement of Graduates

Graduates of SMK Taman Karya Madya Tamansiswa Purworejo are expected to working, continuing to college, or even becoming entrepreneurs. Through a good process in school activities, it is expected that the graduates are high in quality so that the absorption of the requests from the industry to use the graduates increase. The special job market for schools is obliged to facilitate/ bring together job seekers (graduates) with users (labor search companies). The absorp-tion of graduates received in the world of work in 2017/2018 is 91% working, 4% conti-nuing education, 0 entrepreneurship, and 5% not working. An example of an industry that cooperates with SMK Taman Karya Madya Tamansiswa Purworejo in the form of labor recruitment is PT Pama Persada Nusantara.

The implementation of each activity has been prepared as well as possible. Meeting with all members in the school and the internal meeting between each head of the expertise program have been planned as well as possible so each division in the school supports each other. Each activity is always started with a briefing, and evaluation is always conducted after the activity ends. The course of the activities is reported to the principal so that they can be appropriately monitored.

Researchers also found potential in supporting cooperation with the world of work, one of which is the admission of new students

is different from other schools. The enrollment for new students is earlier than other schools, and stricter selection for new prospective students based on junior high school report from semester 1-5 is appropriately maintained, so that good input is obtained. In line with that, based on the results of research conducted by Arif and Sofyan (2019), the supporting factors in vocational cooperation with industry include support from the government related to link and match, school and industry commitments, enthusiasm from students and teachers, adequate school facilities and infrastructure, as well as the high quality of human resources.

SMK Taman Karya Madya Tamansiswa Purworejo also instills a basic sense of responsibility in teaching and learning activities following the school motto "Discipline of Success". The discipline character is always attached to SMK Taman Karya Madya Tamansiswa Purworejo. As one of the main strategies in shaping students' better character, SMK Taman Karya Madya Tamansiswa Purworejo also cooperates with Kodim (a military service office) 0708 Purworejo, for coaching the younger generation through scouting activities.

Scouting activities are compulsory for class X (ten) to familiarize students' disciplinary attitudes and are also equipped with a book entitled "Fixed Procedures for Integrated Discipline Development", which explains various procedures when becoming a student at SMK Taman Karya Madya Tamansiswa Purworejo, including sanctions for violations. Every violation committed has an index record, which, if the index has reached 100, students can be expelled from school.

It is in line with the research results conducted by Wahyuna (2013), that one of the characteristics of work that they want to instill in schools is discipline. All regulations written in the rules and sanctions are regulated closely related to the inculcation of the character of work carried out. Efforts to embed the character of work are outlined in various activities, both in intra-curricular, co-curricular, and extra-curricular activities. Many parties help to inculcate this work character, both from the community, the business world, and from the relevant agencies. From institutions, there are the village, sub-district, district, and provincial governments, the Education Office, Naval Base Commander, the National Police, the Marine and Fisheries Service, the Sea Transportation Office, the Health Office, the marine and fisheries schools or shipping schools, beach SAR (search and rescue), and the world of work.

Through learning, the values of these characters do not stop at the cognitive level, but they touch the level of internalization and real experiences in the daily lives of students in the community. It is in accordance with the life teachings of Ki Hadjar Dewatara, called "*Tringa*", which includes understanding, feeling, and implement, reminding all teachings, the ideals of life that we profess require understanding, awareness, and sincerity in its implementation. Knowing and understanding are not enough if we do not feel and realize, and they have no meaning if we do not implement them and fight for them.

It is in line with the aim of developing vocational education by Sudira (2012) that, holistically, it should not be reduced only to the process of forming technical skills merely for meeting the economic needs. Vocational education and vocational training are not limited to schooling. Vocational education is education that leads to the process of enculturation and acculturation which processes the civilization of a new generation of future that takes place in schools, families, industries, businesses, and a porous open society, so that the implementation of character education in vocational schools can promote harmony between the characters developed in schools with habituation at home and society.

Then, for improving teacher competence, once a year, In House Training is still held. The material in this In House Training covers teacher professionalism improvement, development of teaching and learning strategies, classroom action research, preparation of teaching and learning instruments, improvement of teacher character, and curriculum 2013. The materials provided in the In House Training were from Sarjanawiyata Tamansiswa University, Yogyakarta. In the In House Training industry, bound cooperation also takes part in curriculum development, so that what is taught is really what is done in the industry.

One of the advantages in cooperation with the world of work is that students have more opportunities to get jobs in industries that

are bound by cooperation with SMK. Based on the latest data from the tracing data of SMK Taman Karya Madya Tamansiswa Purworejo in the 2017/2018 academic year, of the total 330 students of class XII, 280 are already working, 31 are continuing to higher education level, six graduates are becoming entrepreneurs, and 13 graduates have not worked yet. The distribution of labor in SMK Taman Karya Madya Tamansiswa Purworejo has begun since students are in class XII, so before graduating, they have joined the selection to the industry first. Even some of them have been accepted to work in the industry before graduating from SMK Taman Karya Madya Tamansiswa Purworejo. Thus, based on the success indicators in establishing cooperation/partnerships, the cooperation maintained by SMK Taman Madya Tamansiswa Purworejo with the industry/the wolrd of work is good.

CONCLUSION

The results of the study conclude that (1) the school's strategy in cooperation with industry begins with industry visits, asking permission for industry practice, establishing good communication, submitting proposals related to school potential in the form of profiles, the school's active participation in school promotions, utilizing the role of personnel from the world of work as a guest teacher, and providing sources for pre-practice and outsourcing to industry. (2) Cooperation procedures at SMK Taman Karya Madya Tamansiswa Purworejo include analyzing the community, in this case, the world of work, conducting communication, then involving the world of work. (3) The forms of coopera-tion with others are: improvement of training participants' skills in the field of science and technology, information exchange in the form of science and technology, synchronization and curriculum development, implementation of apprenticeships for teachers, implementa-tion of competency tests and certifications, industry visits, industrial work practices, special job fairs, and recruitment/graduate placement. (4) Evaluation of the management implementation of SMK Taman Karya Madya Tamansiswa Purworejo in its cooperation with the world of work is included in the good category.

ACKNOWLEDGMENTS

The researchers would like to express gratitude to a colleague, Depi Oktasari, M.Pd. for helping in writing the article, and teachers at SMK Taman Karya Madya Tamansiswa Purworejo for their help in data collecting.

REFERENCES

Arief, A. M. (2019). Vokasi industri: Ribuan SMK tak ikut program, ini kekhawatiran Kemendikbud. *Ekonomi Bisnis*. Retrieved from https://ekonomi.bisnis.com/read/20190318/257/901323/vokasi-industri-ribuan-smk-tak-ikut-program-ini-kekhawatiran-kemendikbud

Arif, D. A., & Sofyan, H. (2019). Efektivitas program pembelajaran sekolah sub T-TEP Toyota (Toyota-Technical Education Program) di SMK Negeri 2 Pengasih. *Jurnal Pendidikan Vokasi Otomotif*, *1*(2), 45–54. https://doi.org/10.21831/jpvo.v1i2.24557

Arifin, Z. (2012a). Implementasi manajemen stratejik berbasis kemitraan dalam meningkatkan mutu SMK (Studi pada SMK kelompok teknologi bidang otomotif di Kota Yogyakarta). *Jurnal Administrasi Pendidikan*, *14*(1), 60–70. Retrieved from https://ejournal.upi.edu/index.php/JAPSPs/article/view/6708/4579

Arifin, Z. (2012b). Pengembangan pola kemitraan SMK - dunia industri dalam meningkatkan mutu SMK. In *Prosiding Seminar Nasional Pendidikan Teknik Mesin* (pp. 212–221). Yogyakarta: Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Yogyakarta.

Baiti, A. A., & Munadi, S. (2014). Pengaruh pengalaman praktik, prestasi belajar dasar kejuruan dan dukungan orang tua terhadap kesiapan kerja siswa SMK. *Jurnal Pendidikan Vokasi*, *4*(2), 164–180. https://doi.org/10.21831/jpv.v4i2.2543

Central Bureau of Statistics. (2018). Agustus 2018: Tingkat pengangguran terbuka (TPT) sebesar 5,34 persen. Retrieved

from https://www.bps.go.id/pressrelease/2018/11/05/1485/agustus-2018--tingkat-pengangguran-terbuka--tpt--sebesar-5-34-persen.html

Collier, K., & Mcmanus, J. (2005). Setting up learning partnerships in vocational education and training: Lessons learnt. *Journal of Vocational Education & Training*, *57*(3), 251–273. https://doi.org/10.1080/13636820500200286

Dean, J. (1997). *Business networks and strategic alliances in Australia*. Canberra: Department of Industry, Science and Tourism, Australia.

Department of National Education. (2009). *Kurikulum sekolah menengah kejuruan*. Jakarta: Department of National Education, Republic of Indonesia.

Djojonegoro, W. (1998). *Pengembangan sumber daya manusia melalui sekolah menengah kejuruan (SMK)*. Jakarta: Balai Pustaka.

Firdaus, Z. Z. (2012). Pengaruh unit produksi, pengalaman prakerin dan dukungan keluarga terhadap kesiapan kerja siswa SMK. *Jurnal Pendidikan Vokasi*, *2*(3), 397–409. https://doi.org/10.21831/jpv.v2i3.1045

Gunadi, G. (2013). Peningkatan keterampilan produktif calon guru SMK otomotif melalui kemitraan dengan industri. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *21*(4), 301–306. https://doi.org/10.21831/jptk.v21i4.9456

Hamid, A., & Sudira, P. (2013). Penanaman nilai-nilai karakter siswa SMK Salafiyah Prodi TKJ Kajen Margoyoso Pati Jawa Tengah. *Jurnal Pendidikan Vokasi*, *3*(2), 139–152. https://doi.org/10.21831/jpv.v3i2.1592

Indriasari, L. (2012). 300 sekolah perguruan Tamansiswa mati suri. *Kompas*. Retrieved from https://edukasi.kompas.com/read/2012/05/02/21042475/300.Sekolah.Perguruan.Tamansiswa.Mati.Suri?page=all

Indriaturrahmi, I., & Sudiyatno, S. (2016). Peran dunia usaha dan dunia industri dalam penyelenggaraan SMK berbasis kearifan lokal di Kota Mataram. *Jurnal Pendidikan Vokasi*, *6*(2), 162–172. https://doi.org/10.21831/jpv.v6i2.6277

Iriani, D. S., & Soeharto, S. (2015). Evaluasi pelaksanaan praktik kerja industri siswa kompetensi keahlian jasa boga SMK N 3 Purworejo. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *22*(3), 274–290. https://doi.org/10.21831/jptk.v22i3.6835

Isbianti, P. (2009). Peran humas sebagai upaya menjalin kerja sama antara SMK dengan dunia usaha/dunia industri (DU/DI). *Jurnal Manajemen Pendidikan*, *5*(1), 41–54. Retrieved from http://staffnew.uny.ac.id/upload/198404082008122003/penelitian/JUMP.pdf

Jatmoko, D. (2013). Relevansi kurikulum SMK kompetensi keahlian teknik kendaraan ringan terhadap kebutuhan dunia industri di Kabupaten Sleman. *Jurnal Pendidikan Vokasi*, *3*(1), 1–13. https://doi.org/10.21831/jpv.v3i1.1572

Law of Republic of Indonesia No. 20 of 2003 on National Education System (2003).

Lestari, I., & Siswanto, B. T. (2015). Pengaruh pengalaman prakerin, hasil belajar produktif dan dukungan sosial terhadap kesiapan kerja siswa SMK. *Jurnal Pendidikan Vokasi*, *5*(2), 183–194. https://doi.org/10.21831/jpv.v5i2. 6384

Pambayun, N. A. Y., & Wagiran, W. (2014). Kinerja bursa kerja khusus (BKK) SMK negeri bidang keahlian teknologi dan rekayasa di Kabupaten Sleman. *Jurnal Pendidikan Vokasi*, *4*(2), 246–261. https://doi.org/10.21831/jpv.v4i2. 2550

PH, S. (2011). Peran pendidikan vokasi dalam pembangunan ekonomi. *Jurnal Cakrawala Pendidikan*, *XXX*(2), 189–203. https://doi.org/10.21831/cp.v0i2.4227

PH, S. (2013). Pengembangan SMK model untuk masa depan. *Jurnal Cakrawala Pendidikan*, *5*(1), 14–26. https://doi.org/10.21831/cp.v5i1.1256

Pillay, H., Watters, J. J., Hoff, L., & Flynn, M. (2014). Dimensions of effectiveness and efficiency: A case study on industry–school partnerships. *Journal of*

Vocational Education & Training, *66*(4), 537–553. https://doi.org/10.1080/13636820.2014.961524

Presidential Instruction No. 9 of 2016 on Revitalization program of Vocational High School (VHS) for the improvement of Indonesian human resources' quality and competitiveness (2016). Republic of Indonesia.

Soenarto, S., Amin, M. M., & Kumaidi, K. (2017). Evaluasi implementasi kebijakan Sekolah Menengah Kejuruan program 4 tahun dalam meningkatkan employability lulusan. *Jurnal Penelitian Dan Evaluasi Pendidikan*, *21*(2), 215–227. https://doi.org/10.21831/pep.v21i2.17076

Sudira, P. (2012). Pendidikan kejuruan dan vokasi berbasis Tri Hita Karana. In *Prosiding Kongres Pendidikan, Pengajaran, dan Kebudayaan* (pp. 254–255). Yogyakarta: Pusat Studi Pancasila Universitas Gadjah Mada.

Suhartanta, S., & Arifin, Z. (2010). Jejaring kerja sama sebagai upaya meningkatkan kualitas dan daya saing lulusan pendidikan kejuruan. *Seminar Internasional Asosiasi Pendidikan Teknologi Dan Kejuruan Indonesia*. Retrieved from https://ejournal.undiksha.ac.id/index.php/APTEKINDO/article/view/90/84

Syari, D. A., & Ma'arif, F. (2017). Model kemitraan dunia usaha/dunia industri di SMK Pangudi Luhur Muntilan. *E-Journal Pend. Teknik Sipil Dan Perencanaan*, *5*(4), 1–7. Retrieved from http://journal.student.uny.ac.id/ojs/ojs/index.php/sipil/article/view/6711

Wahyuna, G. F. (2013). Penamaman karakter kerja kelautan dan perikanan di SMKN 1 Sanden Bantul Yogyakarta. *Jurnal Pendidikan Vokasi*, *3*(1), 29–37. https://doi.org/10.21831/jpv.v3i1.1574

Wibowo, N. (2016). Upaya memperkecil kesenjangan kompetensi lulusan sekolah menengah kejuruan dengan tuntutan dunia industri. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *23*(1), 45–50. https://doi.org/10.21831/jptk.v23i1.9354

Yudantoko, A., & Arifin, Z. (2016). Profil kompetensi dunia kerja bidang Perbaikan Bodi Otomotif dan tingkat relevansinya dengan dunia pendidikan. *Jurnal Pendidikan Vokasi*, *6*(2), 127–142. https://doi.org/10.21831/jpv.v6i2.8334

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (294-306)
Online: http://journal.uny.ac.id/index.php/jpv

DESIGN RESEARCH ON APPLIED REALISTIC MATHEMATICS EDUCATION (RME) APPROACH IN TEACHING MATH FOR VOCATIONAL COLLEGE

Sri Imelda Edo
Politeknik Pertanian Negeri Kupang

Wahyuni Fanggi Tasik
Politeknik Pertanian Negeri Kupang

Abstract

Several studies documented that mathematics, as it is taught in general secondary education, is far away from what is needed for most fields of vocational practice. Some studies found that workplace mathematics demands are very different from traditional mathematics taught in class-rooms. Therefore, this study aims to design a learning trajectory for teaching mathematics in vocational college, oriented on the Realistic Mathematics Education (RME) approach to improve students' understanding and motivation in learning mathematics. Design research was chosen as an appropriate method to answer the research questions and achieve the research goals. Design research methods consist of three phases, namely preliminary design, experiment, and retrospective analysis. The research result shows that the learning trajectory can improve students' under-standing. Students enjoy the learning process and give a very enthusiastic response.

Keywords*: math for vocational education, RME approach for adult, learning trajectory, math for marine and fisheries, set operation*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.27839*

Contact Sri Imelda Edo
sriedo830@gmail.com
Politeknik Pertanian Negeri Kupang
Jl. Prof. Dr. Herman Johanes, Lasiana, Klp. Lima,
Kota Kupang, Nusa Tenggara Timur 85011, Indonesia

INTRODUCTION

Mathematics is one of the core courses for all diploma-level engineering and agriculture students. Moreover, mathematics plays an important role in improving students' skills in Technical Vocational Education and Training (TVET). However, research in the Vocational Education and Training (VET) sector in Australia showed that workplace mathematics demands are very different from traditional mathematics taught in classrooms (Javed, 2008). Furthermore, Malaysian Polytechnic students' achievement in the Engineering Mathematics 2 course is still moderate and less satisfactory, because the subject of Mathematics is mostly related to calculus (Hussin et al., 2018). In the Netherlands, many mathematical issues that are taken for granted in general education are useless in vocational settings, while other aspects of mathematics turn out to be very important (van der Kooij, 2011). In addition, in China, students' poor practical capability is the main problem appearing in teaching of higher vocation colleges at present (Zhang, 2014).

In Indonesia, Rusmar (2017) says that most of the students at *Politeknik Teknologi Kimia Industri* (PTKI) Medan have perceived difficulties in accepting mathematics knowledge because all of the topics included are difficult to implement in their working lives. Furthermore, students in *Politeknik Pertanian Negeri Kupang* (or Polytechnic of Agriculture, Kupang), in Indonesia, found difficulties in doing math operation, i.e., fractions, because they have lack of mathematics concept (Edo, 2016). They tend to memorize some routine procedures given by their teacher in a prior stage of study and try to look for similar examples in the textbooks or the internet to solve mathematics problems. In some interview sections, students argue that learning mathematics means memorizing an abstract formula that does not make sense to them. They have not found a real connection about mathematics with their major of study.

The set theory lies at the foundation of mathematics. The concepts in set theory, such as functions and relations, are explicitly or implicitly used in every branch of mathematics. The basic concept of all fields of mathematics is that of a set. The learning set is important for vocational college. The rough set concept can be of some importance, primarily in some branches of artificial intelligence, such as inductive reasoning, automatic classification, pattern recognition, learning algorithm, etc. The idea of the rough set can be placed in a more general setting, leading to fruitful further research and application in classification theory, cluster analysis, and measurement area (Hodgson, 1996) related to agriculture advance.

However, teachers teach set operations using symbolic forms or something abstract. They just give some examples of various types of the set with number or alphabet asset elements that do not make sense for students. Most teachers are affected by the traditional teaching approach. They tend to adopt traditional teaching modes and impart a great deal of content with high difficulty to students by a large-capacity explanation (Zhang, 2014). An important finding for the designers of the WISKUNDE program in the Netherland is the fact that mathematics, as it is taught in general secondary education, is far away from what is needed for most fields of vocational practice (van der Kooij & Strasser, 2004). Most of the vocational trainers use the mathematical routines, merely algebraic algorithms they learned themselves a long time ago.

RME is considered an auspicious approach to improve mathematics teaching and make it more relevant for vocational education. Within a realistic approach, mathematics is viewed as an activity, away from working (de Lange, 1987, 1996; Fauzan et al., 2002; Freudenthal, 1973; Gravemeijer, 1994; Treffers, 1987). RME approach starts from a realistic context, which allows students to reinvent mathematical concepts under the guidance of the teacher. Its characteristics are proper to vocational college curriculum that is more focused on technical skills than mastering theory.

Furthermore, students should be given the context which is relevant to the vocational education field, rich in math concept, interesting, and academical. It can be one of the solutions to improve students' habits in academic reading and their attitude toward mathematics. The context provides sufficient scientific information and mathematics concepts altogether. Therefore, students can deeply understand about mathematics' utilities to their field of study. One of the vocational colleges in

Indonesia is Polytechnics of Agriculture-Kupang (or *Politeknik Pertanian Negeri Kupang*), located in East Nusa Tenggara province. The college has five departments; one of them is marine and fisheries. One popular icon of East Nusa Tenggara province is a marine national park (MNP) called Savu Sea MNP.

Savu Sea MNP is one of the important habitats and migratory corridors for cetaceans and turtles, a vital nursery area for fish, and a refuge for coral reefs. It has unique oceanographic features, including deep trenches, strong currents, and areas of upwelling. Therefore, Savu Sea MNP is an essential habitat for marine biodiversity in the world. However, these resources are being threatened by unsustainable and destructive fishing pressure and increasing coastal development. Thus, students in marine and fisheries major should have enough knowledge about Savu Sea MNP's biodiversities. Set knowledge and its representation skill can be the basis for students to classify the species of mammals and turtles according to their distribution area. Therefore, conservancy effort, i.e., reducing coastal flood risk, can more focus on their habitat. Mapping their species area is one of the solutions to protect them from human threats. The government, as policymakers, would give more attention to protect the related area. Thus, Savu Sea MNP, especially the marine mammals' species and sea turtles distributed habitat, are potential context which can be used as a starting point in teaching and learning for students in fisheries and marine department.

Finally, it is a model of a mathematics learning trajectory in a set topic designed oriented on the RME approach for vocational education students. The research questions of this study are (1) how can the learning trajectory using RME approach construct and improve students understanding, (2) how can learning trajectory using RME approach improve students' motivation in learning mathematics, and (3) what is the perception of student with respect to the RME approach and its context?

A set is a collection of well-defined objects. The objects of a set are called elements or members of the set. The main property of a set is that it is well defined. It means that given any object, it must be clear whether that object is a member (element) of the set or not. Generally, as presented in Table 1, sets are named with the capital letters A, B, C, etc. The elements of a set are denoted by the small letters a, b, c, etc. When two or more sets are combined to form another set under some given conditions, then operations on sets are carried out (Math-Only-Math.com, n.d.).

In RME, the real context is used as a starting point for the development of mathematical concepts and ideas. Blum and Niss (1989) state that context is the rest of the world outside mathematics, i.e., school or university subjects or disciplines different from mathematics, or everyday life and the world around us (Zulkardi, 2002a). However, we have to be careful because the real world here is the world that is concrete for students. A concept may be concrete for a mathematician but is not necessarily concrete for children. In addition, de Lange (1996) defines a concrete real-world as "the world that comes across to children and students through mathematics in applications." It is a way to understand students' mathematical learning as it occurs in the real situation. There are five characteristics (tenets) of RME (de Lange, 1987; Gravemeijer, 1994) such as (1) the use of contexts in phenomenological exploration, (2) the use of models, (3) the use of students' creations and contributions, (4) interactivity; and (5) the intertwining of various mathematics strands or units.

Table 1. Laws on Set Operation

Identity laws:	**Commutative laws:**	**De Morgan's laws:**
$A \cup \emptyset = A$	$A \cup B = B \cup A$	$(A \cup B)' = A' \cap B'$.
$A \cap U = U$	$A \cap B = B \cap A$	$(A \cap B)' = A' \cup B'$
Domination laws:	**Associative laws:**	
$A \cup U = U$	$A \cup (B \cup C) = (A \cup B) \cup C$	
$A \cap \emptyset = \emptyset$	$A \cap (B \cap C) = (A \cap B) \cap C$	
Idempotent laws:	**Distributive laws:**	
$A \cup A = A$	$A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$	
$A \cap A = A$	$A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$	

In Realistic Mathematics Education (or RME), a context plays an important role. It distinguishes RME from other mathematics teaching approaches, such as the mechanistic and structural approaches. By employing contextual problems, the instruction is directed to the processor reinvention of mathematical concepts through both horizontal and vertical mathematics. The use of real-life problems related to students' field of study as the starting point in mathematics teaching will engage college students in meaningful mathematical activities. The problematic natures of RME contextual problems can also trigger interactivity among students. Students gain mathematics knowledge by comparing their answers to others', asking questions, justifying, and also drawing conclusions (Zulkardi, 2002b).

The term context in RME refers primarily to the described situation in which the problem is placed, and from what students can produce mathematical activity as well as practice and apply their mathematical knowledge (Gravemeijer, 1981). In RME, the context can also be mathematical, as long as the students see it as real. Edo et al. (2013) state that there are four categories of context in mathematics literacy, i.e., personal, occupational, societal, and scientific.

Before taking the class, a teacher has to prepare some teaching material using a relevant teaching approach. In order to reach learning outcomes and improve students' achievements, the teacher has to plan instructional activities and hypothesize the learning process. In designing an instructional activity, a teacher should anticipate the collective mathematical development of the classroom community, and students' reaction to each stage of the learning. It is in line with Simon (1995) who states that:

> *"A hypothetical learning trajectory consists of learning goals for students, planned instruct-tional activities, and a hypothesized learning process in which the teacher anticipates the collective mathematical development of the classroom community and how students' understanding might evolve as they participate in the learning activities of the classroom community" (Wijaya, 2008).*

As mentioned by Huffard et al. (2012), the Savu Sea and surrounding areas in the East Nusa Tenggara province is an important area for marine mammals in Indonesia. The area provides critical habitat for these species, such as migratory corridors, feeding, and also nursery areas. The area supports a broader diversity of 22 species of marine mammal, including vulnerable and endangered species, such as Blue Whale and Sperm Whale. Ombai Strait and the Timor Sea are also contained within the IMMA boundary and have been identified as a migratory corridor for the Pygmy Blue Whale. This corridor in the Savu Sea connects the migratory line between north-west Australia and Banda-Seram Seas. All marine mammals in Indonesia have been fully protected since 1999, and this area was declared as the Savu Sea Marine National Park (MNP), whose roles, one of which is protecting marine mammals. However, traditional whaling communities are still identified as a threat to the cetacean population within the region, as well as illegal, unreported and unregulated fishing, increasing marine traffic, and oil-gas exploration.

RESEARCH METHOD

For this purpose, design research was chosen as an appropriate means for answering the research questions and achieving the research goals. In this research, a set of experience-based activities was designed as a flexible approach to understand and improve educational practices of Set Theory for vocational college students in the marine and fisheries department. The phases in this design research are preliminary design, experiment, and retrospective analysis. The phase of the research method is summarized in Figure 1.

This study was conducted in the Aquaculture study program, Marine and Fisheries Department, Polytechnics of Agriculture in Kupang. Eleven students were involved in pilot experiment stage, and thirty five students in experiment stage. In addition, an expert in mathematics education, an expert in the marine conservancy, two colleagues, and a model lecturer, were participated to review the hypothetical learning trajectory (HLT) and learning material. Data were collected through (1) video and (2) written data. The videotaping during the teaching experiments was recorded by two cameras; one camera as a static camera to record the whole class activities and the other camera as a dynamic camera to record the activities in some groups of students. In addi-

tion, the written data included students' work during the teaching experiment, observation sheets, the results of assessments, including the final assessment, and some notes gathered during the teaching experiment.

Data were analyzed retrospectively, in which hypothetical learning trajectory (HLT) was compared with students' actual learning to investigate and to explain how students acquire the basic concepts of set and set operation that was elicited by marine mammals and reptile species' context. The main data needed to answer the first research question were the videotaping of the students' activities and the class discussion. The reasoning of why students given different answers was investigated from students' arguments in the class discussion. How students found the relation of sets and their properties were needed as the additional data to answer research questions. Classroom norms were analyzed based on videotaping and field notes to answer the second and third questions.

Reliability was conducted in two ways, namely: (1) data triangulation, in which the combination of the videotaping, the students' works, and some notes from either teacher or observer were chosen to check the reliability of interpretations based on one video clip or one field note, and (2) cross interpretation, in which, to reduce the subjectivity of the researchers' point of view, the parts of the data (especially the video data) were also cross-interpreted with colleagues. The methods of validity used in the data analysis are (1) HLT, as a guideline and a point of reference in answering research questions, aimed at connecting and evaluating the initial conjectures to the gathered data and prevented systematic bias, and (2) trackability of the conclusions. Hypothetical learning trajectory (HLT) is a means to support validity; the HLT was used in retrospective analysis. Meanwhile, in the trackability of the conclusions, the educational process was documented by video recordings, field notes, students'written answers. Those data were used to describe the situation and the findings in detail to give sufficient information for our reasoning. This information enables the readers to reconstruct the reasoning and to trace the arguments that underpin the conclusions.

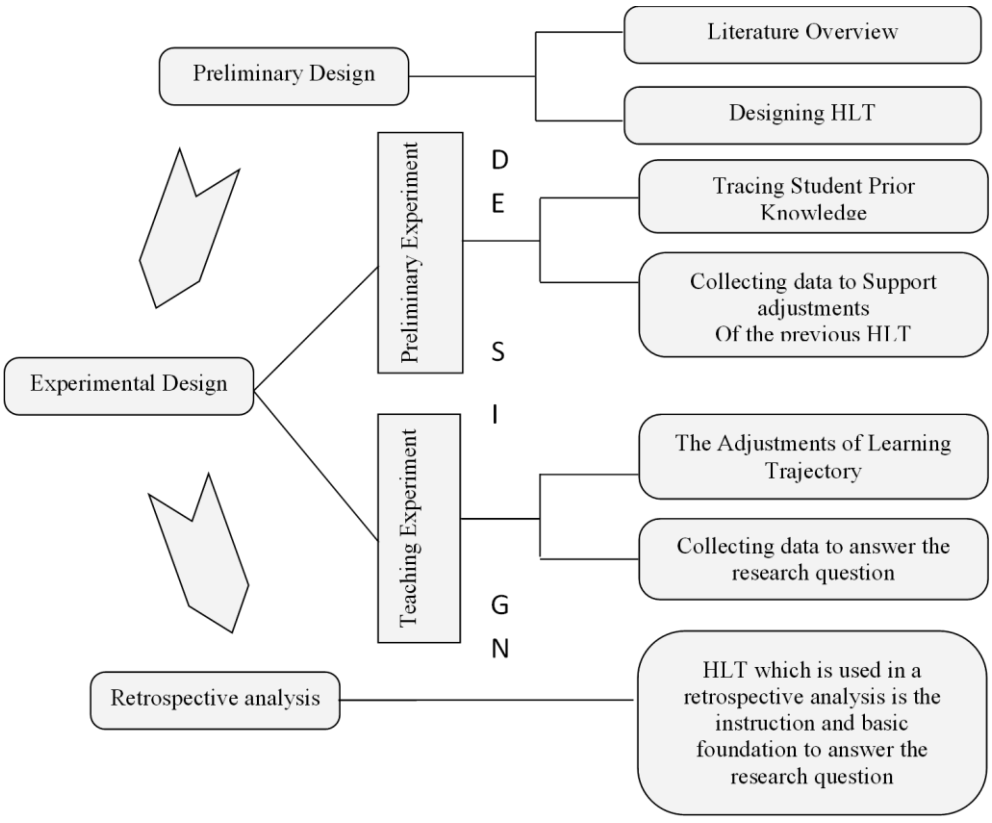


Figure 1. Design Research's Phase (Prahmana et al., 2012)

RESULTS AND DISCUSSION

In order to facilitate students' understanding of the set concept, set types, set representation, set relation refers to the set's laws, the researches designed two HLT. The first HLT covered set concept, set types, and set representation, while the second one was about laws on the set operation. The first HLT used the context of marine mammals in Savu Sea MNP, and the other HLT used the sea turtle species distribution in Savu Sea MNP.

Preliminary Design

In the preliminary design, initial ideas were implemented. They were inspired by studying literature about set theory, set operation, and laws on the set operation, the biodiversity in Savu Sea MNP, RME, and design research, as the bases for formulating initial conjectures in learning set theory. The HLT was designed based on the RME approach, which uses context as a starting point in teaching and learning. The first HLT was designed using Marine Mammals Species in Savu Sea MNP as the context, while the second distribution of marine mammal species in the Savu Sea was documented by several studies. The context is presented in Figure 2.

Moreover, a sequence of instructional activities containing conjectures of students' thinking was developed. The conjectured hypothetical learning trajectory was dynamic and could be adjusted to students' actual learning during the teaching experiments (see Table 2 and Table 3).

However, in the second HLT, students were given the text about turtle species in the Savu Sea MNP as the context. The context is starting point in the teaching and learning based on RME approach (see Figure 3).

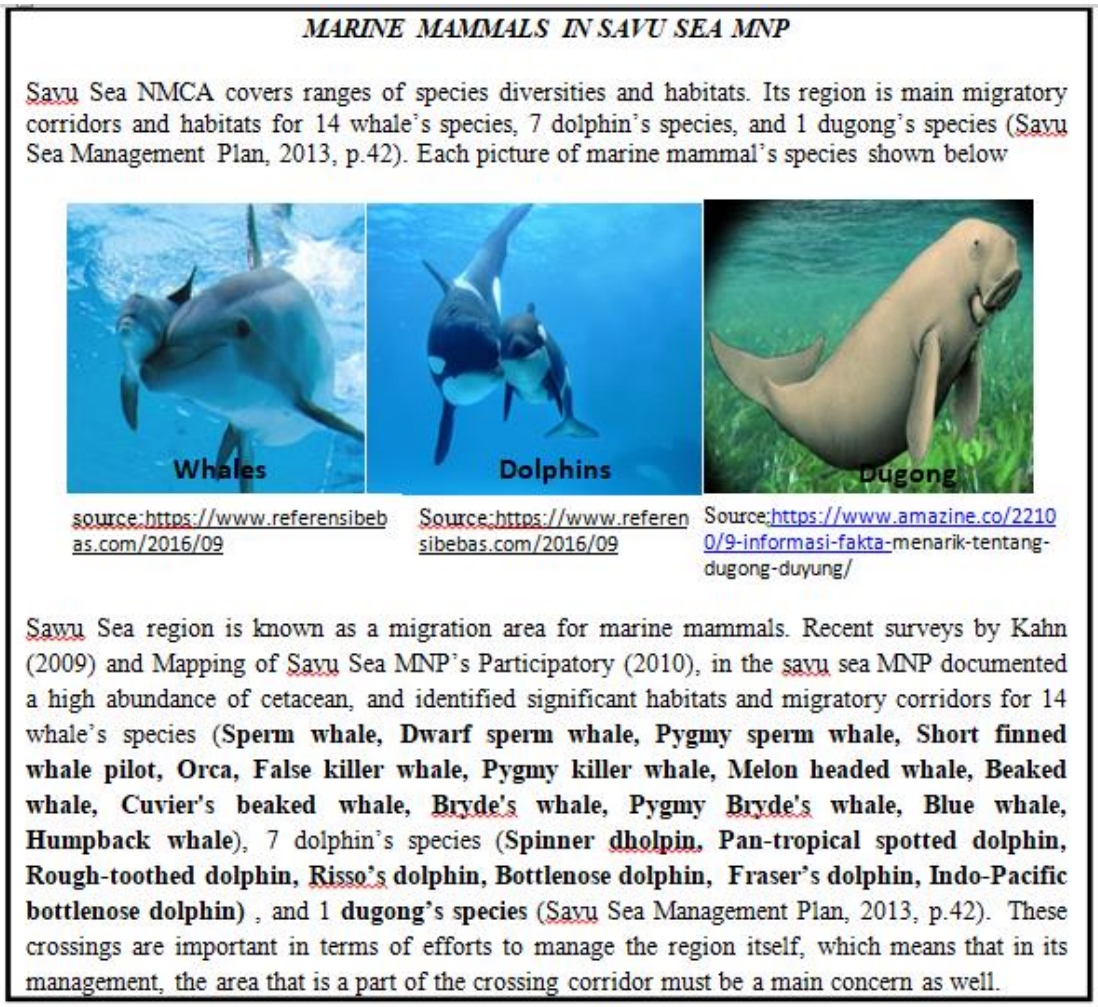


Figure 2. Context about Marine Mammals Species in Savu Sea MNP

Table 2. Learning Trajectory on Set Concept

Mathematics Goal	Activity	Description
1. Students inventing the set concept	▪ Read the context of Mammals Species found in Savu Sea MNP according to several prior studies. ▪ Students list the members of clever species of mammals found in Savu Sea MNP.	▪ Students have difference answer (some of them choose species of Whales as the clever species, while some students choose dolphin species and dugong species as the clever species. Few of them said that no clever species of mammals or all of the mammal species are the clever species, so they fell hard to list its members ▪ Their difference answer guided them to find that set is the collection of well define object.
2. Students distinguish undefined object with an empty set	▪ Students list the species of seal found in Savu Sea MNP ▪ Students solve the problem on work sheet to decide whether the collection of seal species in Savu Sea MNP is a set or not?	▪ Some students list the species of Seal and ignored whether it is not found in savu sea MNP ▪ Some students said that species of seal are not found in Savu Sea MNP. ▪ Some students who have misunderstanding about empty set and the collection of undefined objects said that collection of seal species is not a set since the collection do not have any member. ▪ Their experience guided them to find the definition of set and an empty set
3. Represent sets and set relation	▪ Students read the context and Represent the mammal species, whales species, dolphins species, and seal in certain set namely S, A, B, and C.	▪ Students represent the set in Descriptive form, Set-builder form and Roster form or Tabular form.
4. Represent sets and set relation	▪ Students read the context comprehensive and investigate the elements of S, A, B, and C to examine whether they have relation or not, and what kind of relation they have.	▪ Student invent relation among sets i.e. A and S, A and B, B and C ▪ Students find the relation between; A and S, B and S. They know that no relation between A and B, but they cannot find the relation of C as an empty set with the other set.
5. Venn Diagram	▪ Student represent the set relation (subset, disjoint, equal and equivalent) into venn's diagram.	▪ Students represent the relation between the sets more easily in venn's diagram, ▪ Using the venn's diagram, students were guided to invent that an Empty set is the subset of every other set.

Table 3. Learning Trajectory on Set Operation Laws

Mathematics Goal	Activity	Description
Students found laws on set operation.	• Students Read the provided context about Species of Sea turtles found in Savu Sea MNP • Students list the All species of Sea Turtles found in Savu Sea MNP as Universal Set Namely S, • Students list the the members of sea turtle species found in several regency around the region of savu sea MNP, such as Kupang, Sumba, Manggarai, TTS, SabuRaijua, RotenNdao, and Lembata, as some set which namely respective D, E, F, G, H, I, J • Students operate combined sets and examinee the properties of set operation.	• Students represent set in roster or tabular form • Students list the members of set operation (Union, Intersection, set difference, complement, and disjoint sets). • Students find the properties of sets when they are combined together such as, Identity laws, Commutative laws, De Morgan's, Domination, Associative, Idempotent, and Distributive laws.

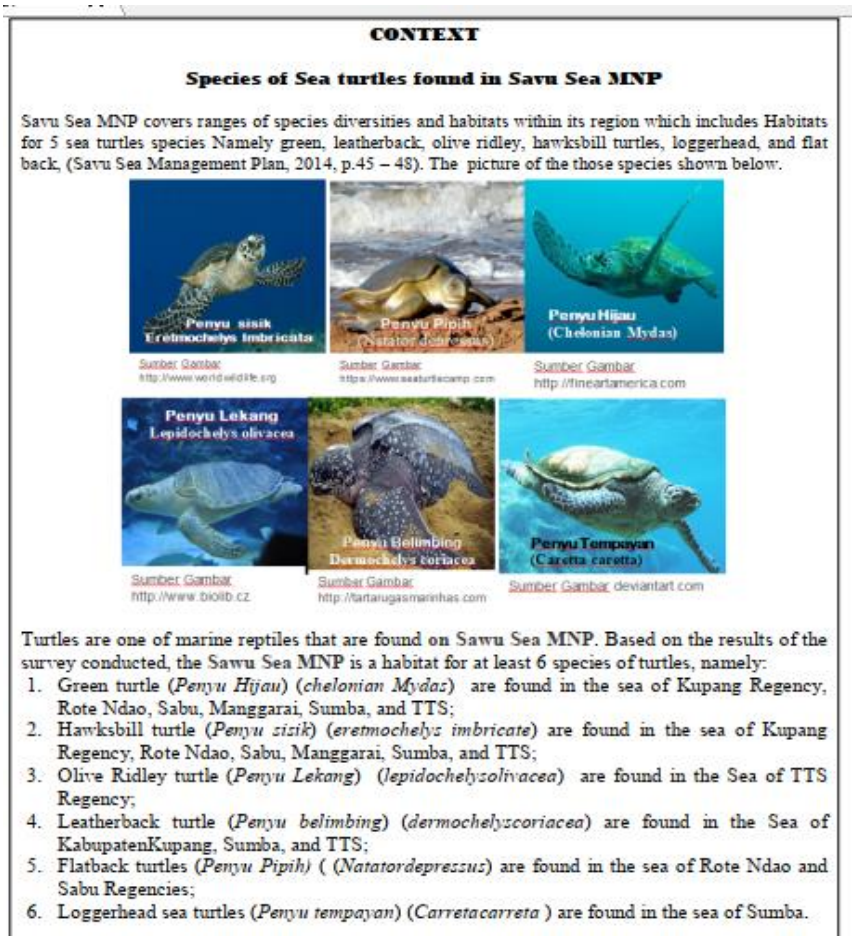


Figure 3. Context about Species of Sea Turtles Found in Savu Sea MNP

Teaching Experiment

All teaching material had been revised during the pilot experiment stage based on the input from experts, students, model lecturer, observer's field note, and analysis of teaching and learning process from videotaping and students writing. In the pilot experiment, students had difficulties inlisting the names of marine mammals' species; they took long time to write the names of whale, dolphin, and dugongs. They also spent more time and needed an ample space of paper to present sets in Venn diagrams. Thus, the names of some marine mammal species were shortly written in the teaching experiment. Further, the turtles' image was not appropriate with their species; some instruction in students' worksheets need to be revised.

The teaching experiment was conducted in a real class consisting of 32 students. At the beginning of the lesson, students in groups were given text about the context. After reading it, they were given the chance to solve the initial problem before learning set theory more deeply. They had learned about set theory when studying at junior high school. They answered the initial problem based on the information on the context, as shown in Figure 4.

Students' reasons show their unclear understanding of the definition of set. They give the same answer to friends during presentation. They cannot explain it clearly, repeat the question and focus on the existence of set elements.

Students hesitate their answer and did not feel sure if the collection of seals species in the MNP is a set or not. They only answered "It does not have any member element". Some of them did not know about dugong, so they guess that dugong is one of the seal species. In the presentation, they explained that the collection of seals species in the MNP is not a set because it does not have an element (Figure 5).

They gave the same answer to the 3rd and 4th questions without understanding that clever marine mammal species were undefined so they gave different elements of its collection. In the interview, they explained there are no seal species in the MNP, so the seal spe-

Initial Problems

Instruction!
Read the text about marine mammals in the context. In this worksheet, the marine mammal species are brief as follows;

Whale species are brief as	: Sw, Dsw, Psw, Sfpw, Orca, fkw, Pkw, Mhw, Beaked w, Cbw, Bw, Pbw, Blue W, Hw.
Dolphinsspecies are brief as	: Sd, Ptsd, Rtd, Rd, Bd, Fd, Ipbd,
Dugong species	:Dugong.

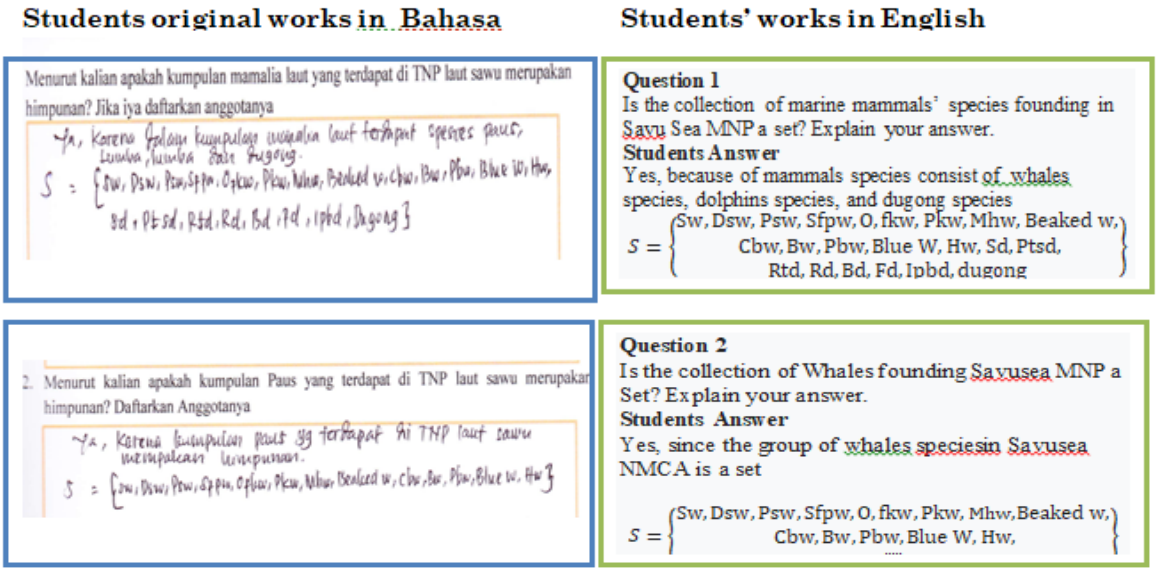


Figure 4. The Initial Problems Based on the Information on the Context

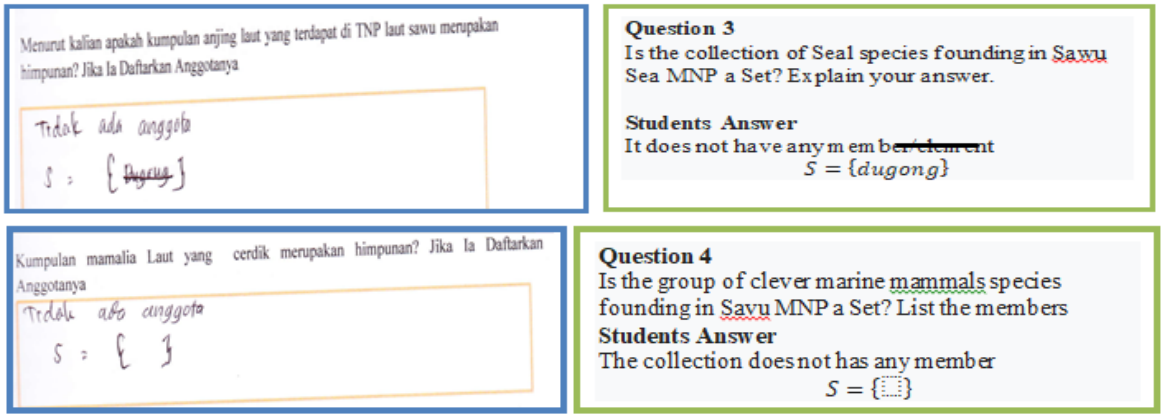


Figure 5. Students' Response of Confusion and Hesitation

cies collection is a set with no member. Their answers implied that they cannot distinguish the concept of set, collection that is not set, and empty set. They miss the concept of a set as a collection of well-defined objects. It means that collection of undefined objects is not a set.

They also miss the concept of an empty set as a set having no elements. The teacher then guides them to reinvent the concept of set based on the contradictory answer. The lesson was then continued to the next learning outcomes using the second context, distribution of sea turtle in Savu Sea MNP.

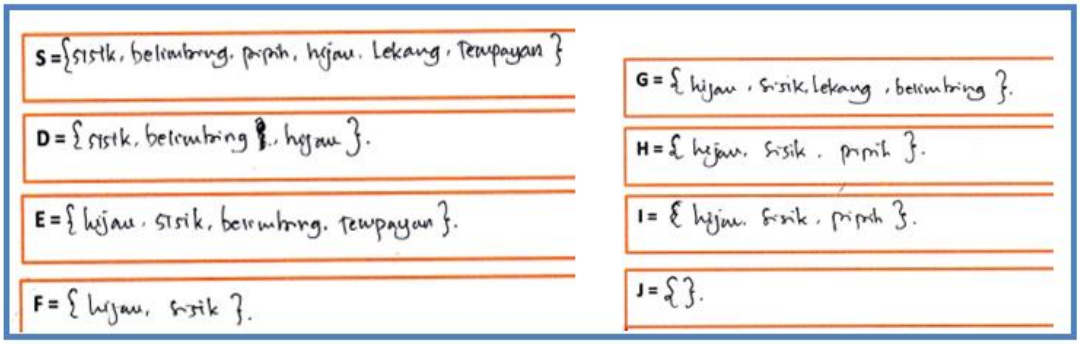
Students' answers of questions 1 and (Figure 6) show they understood all the instructions and questions on the worksheet. They answer correctly while four of 35 students gave some false answer because (1) two students not concerned in listing elements of set, (2) three students found it difficult to operate some set with complement of set, (3) two students found it difficult to operate combined set.

Instruction!
Found the solution of the problems given in worksheet based on information in the text about the Distribution of Marine Biota, especially "Sea Turtles" found in the Sawu Sea MNP
If S is a Set of sea turtles found in the Sawu Sea National Park
D Is a set of sea Turtle found in Kupang Regency
E Is a set of Turtle found in Sumba Regency.
F Is a set of Turtle found in Manggarai Regency.
G It is a set of Turtle found in TTS Regency.
H Is a set of Turtle found in SabuRaijua Regency.
I Is a set of Turtle found RoteNdao regency
J is a Set of Turtles found in Lembata Regency

Question 1

1. List the members of S, D, E, F, G, H, I, J

Students' answers



Question 2

Operate the set, then find their relation with another set.

Students' Answer

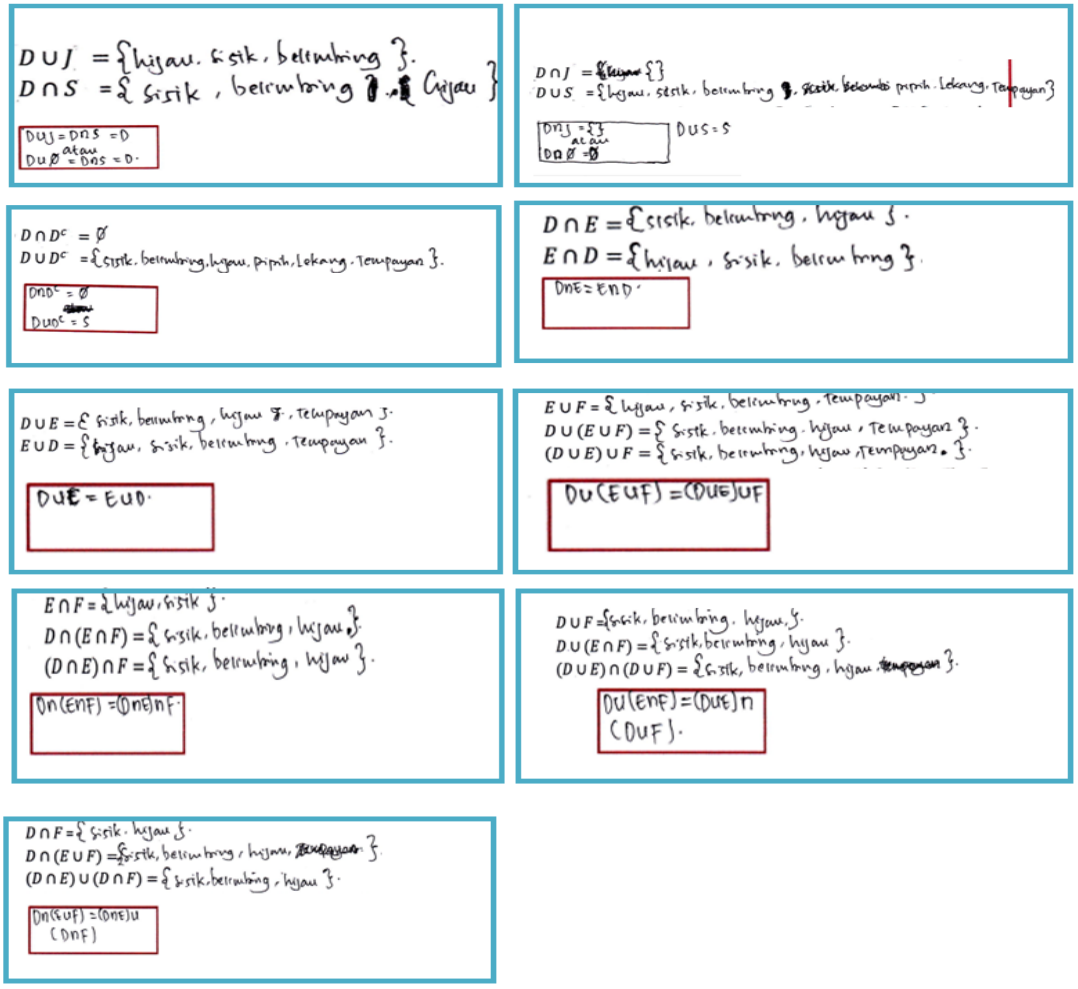


Figure 6. Students' Answers on the Worksheet

Students' Responses to RME Approach

At the end of the lesson, the students were asked to respond to the implementation of the realistic mathematics education (RME) approach in their class. They were asked to express their opinions freely on the implementation of that learning approach. Their answers, both in *Bahasa* Indonesia and Engsih, are clearly presented in Figure 7.

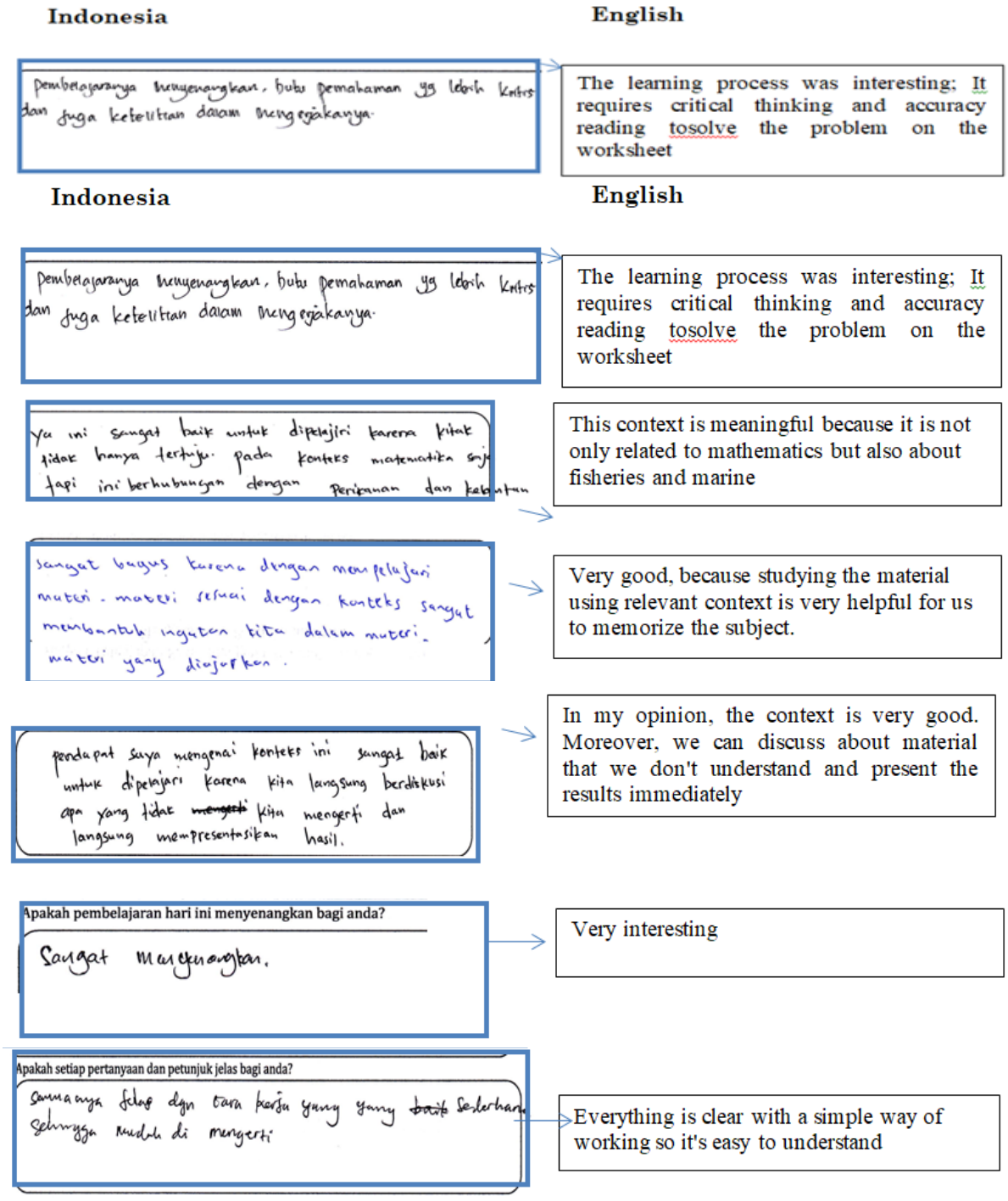


Figure 7. Students' Responses to the Implementation of RME Approach

Retrospective Analysis

The retrospective analysis of data collected from both the pilot experiment and the teaching experiment activities are then described. The result of this research is not a design that works but the underlying principles explaining how and why this design works. Consequently, the hypothetical learning trajectory served as a guideline in the retrospective analysis to investigate and explain students' acquisition of the basic concepts set and set operation as experience-based activities. Students' answers showed that they understand all of the given materials. All of the students' strategies and misconceptions predicted in HLT happened in the real class. However, 14.28% of students still gave some false answers because (1) 5.71% of them did not concern about listing elements of the set, an example of students' work. (2) 8.57% of students found it dif--ficult to operate some set with the complement of a set, (3) the rest, 5.71% student found it difficult to operate combined set. Realistic Mathematics Learning with the context of Savu Sea MNP can attract students' attention. They were more enthusiastic and excited to solve the mathematics task of student worksheets. Those contexts were very fun and meaningful for them. They were not only studied mathematics but also learned about fisheries and the marine field. Clear instructions and systematic explanation of teaching material helped them fully understand the concept of set theory and its operation laws. The use of context related to Savu Sea MNP helped them memories the materials for a long time. Presenting problems at the beginning of learning initiated students to think more openly through the discussion process. The opportunity to present their discussion results helped them to find out the truth of their works immediately.

CONCLUSION

According to student works and responses, mathematics learning trajectory inset and set operation topics using the RME approach with the context of marine mammals and sea turtles in Savu Sea MNP can explore, construct, and improve student understanding and motivation in the learning process. They enjoy the learning process and give a very enthusiastic response. They solve all of the given problems on the worksheet more easily. It means that the applied RME approach using scientific context related to students' major of study can motivate vocational education college students in learning mathematics.

ACKNOWLEDGMENTS

The researchers would like to express gratitude to the Polytechnics of Agriculture Kupang (Politeknik Pertanian Negeri Kupang), for funding this research and providing the opportunity and facility to conduct this study. Then, we also thank Yusuf Kamlasi as a teacher model and all of the students as the research subject in this research.

REFERENCES

Blum, W., & Niss, M. (1989). Mathematical problem solving, modelling, application, and links to other subjects-state: Trends and issues in mathematics instruction. In W. Blum, M. Niss, & I. Huntley (Eds.), *Modelling application and applied problem solving: Teaching mathematics in a real context*. Ellis Horwood.

de Lange, J. (1987). *Mathematics insight and meaning*. Rijksuniversiteit.

de Lange, J. (1996). Using and applying mathematics in education. In A.-J. Bishop, K. Clements, C. Keitel, J. Kilpatrick, & C. Laborde (Eds.), *International handbook of mathematics education* (pp. 49–97). Kluwer Academic Publishers.

Edo, S. I. (2016). Jenis kekeliruan akibat menghafal prosedur rutin dalam melakukan operasi penjumlahan dan pengurangan bilangan pecahan. *Mosharafa: Jurnal Pendidikan Matematika*, *5*(3), 223–234.

Edo, S. I., Ilma, R., & Hartono, Y. (2013). Investigating secondary school students' difficulties in modeling problems PISA-model level 5 and 6. *Journal on Mathematics Education*, *4*(1), 41–58. https://doi.org/10.22342/jme.4.1.561.41-58

Fauzan, A., Slettenhaar, D., & Plomp, T. (2002). Traditional mathematics education vs. realistic mathematics education: Hoping for changes. *Paper*

Presented at the 3rd International Conference on Mathematics Education and Society (MES).

Freudenthal, H. (1973). *Mathematics as an educational task*. Reidel.

Gravemeijer, K. P. E. (1994). *Developing realistic mathematics education*. Freudenthal Institute.

Gravemeijer, K. P. E. (1981). Het gebruik van contexten. *Willem Bartjen*, *1*, 51–56.

Hodgson, T. (1996). Students' ability to visualize set expressions: An initial investigation. *Educational Studies in Mathematics*, *30*(2), 159–178. https://doi.org/10.1007/BF00302628

Huffard, C. L., Erdman, M. V., & Gunawan, T. R. P. (Eds.). (2012). *Geographic priorities for marine biodiversity conservation in Indonesia*. Ministry of Marine Affairs and Fisheries and Marine Protected Areas Governance Program.

Hussin, H. B., Majid, M. B., & Ab Wahab, R. B. (2018). Relationship of secondary school mathematics achievement with engineering mathematics 2 in polytechnics. *Jurnal Konseling Dan Pendidikan*, *6*(3), 160–169. https://doi.org/10.29210/128300

Javed, S. H. (2008). *Online facilitated mathematics learning in vocational education: A design-based study*. Doctoral thesis. Victoria University, Victoria.

Math-Only-Math.com. (n.d.). *Basic concepts of sets*. https://www.math-only-math.com/basic-concepts-of-sets.html

Prahmana, R. C. I., Zulkardi, Z., & Hartono, Y. (2012). Learning multiplication using Indonesian traditional game in third grade. *Journal on Mathematics Education*, *3*(2), 115–132. https://doi.org/10.22342/jme.3.2.1931.115-132

Rusmar, I. (2017). Teaching mathematics in technical vocational education (TVET). *Proceedings of the 1st International Conference on Innovative Pedagogy (ICIP)*.

Simon, M. A. (1995). Reconstructing mathematics pedagogy from a constructivist perspective. *Journal for Research in Mathematics Education*, *26*(2), 114–145. https://doi.org/ 10.2307/749205

Treffers, A. (1987). *Three dimensions: A model of goal and theory description in mathematics instruction — the Wiskobas project*. Reidel Publishing.

van der Kooij, H. (2011). *Mathematics for technical and vocational education*. Freudenthal Institute.

van der Kooij, H., & Strasser, R. (2004). TSG 7: Mathematics education in and for work. Denmark 2004 , Denmark: IMFUFA, Department of Science, Systems and Models. In M. Niss & E. Emborg (Eds.), *Proceedings of the 10th International Congress on Mathematical Education* (pp. 319–322). IMFUFA, Department of Science, Systems and Models at Roskilde University. http://higeom.math.msu.su/~asmish/Lichnaja-2010/Version2010-11-20/Trudy/Publications/2004/icme_completebook.pdf

Wijaya, A. (2008). *Design research in mathematics education: Indonesian traditional games as means to support second graders' learning of linear measurement*. Master thesis. Utrecht University, Utrecht.

Zhang, Y. (2014). A research on applied teaching of mathematics at higher vocational colleges. *Proceedings of the 3rd International Conference on Science and Social Research*. https://doi.org/10.2991/icssr-14.2014.264

Zulkardi, Z. (2002a). *Developing a learning environment on realistic mathematics education for Indonesian student teachers*. Doctoral thesis. University of Twente, Enschede.

Zulkardi, Z. (2002b). Developing a "rich" learning environment on RME for student teachers in Indonesia. *Paper Presented in the IAMS-1 Seminar at the Faculty of Mathematics*.

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (307-317)
Online: http://journal.uny.ac.id/index.php/jpv

THE DUAL-DESIGN-BASED PNEUMATIC SIMULATOR AS SUPPORTING MEDIA FOR ELECTRO-PNEUMATIC PRACTICUM IN VOCATIONAL HIGHER EDUCATION

Sulaeman Deni Ramdani
Universitas Sultan Ageng Tirtayasa

Angga Pangestu
Universitas Sultan Ageng Tirtayasa

Haris Abizar
Universitas Sultan Ageng Tirtayasa

Abstract

This study aims to: (1) determine the process of developing a learning media simulator for electro-pneumatic systems based on dual design, (2) knowing the effectiveness of learning media in the form of electro-pneumatic system simulators based on dual design. This research is a research and development adapted from the 4D development model, namely, Define, Design, Develop, and Disseminate. The subjects of this study were students of Mechanical Engineering Education in Semester IV and V, with 30 students taking pneumatic hydraulic courses. Data collection techniques in this study used questionnaires and interviews with research instruments in the form of interview guidelines and questionnaires. The data obtained were analyzed with a descriptive quantitative method. The results show that (1) the results of the development of learning media for electro-pneumatic system simulators based on Dual Design as supporting media for electro-pneumatic practices produce three main components, namely the working system in the pneumatic electro system, wiring diagrams, and electrical circuits, (2) the feasibility results of expert validation media is 84% (Very Good), expert material validation is 92% (Very Good), and user validation is 86% (Very Good). Therefore, the learning media for electro-pneumatic system simulator is feasible as a learning media in pneumatic hydraulic courses.

Keywords*: simulator, electro pneumatic, dual design*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.27345*

Contact Sulaeman Deni Ramdani s.deni.ramdani@untirta.ac.id
Department of Mechanical Engineering Education, Faculty of Teacher Training and Education, Universitas Sultan Ageng Tirtayasa
Jl. Ciwaru Raya No. 25, Cipocok Jaya, Kota Serang, Banten 42117, Indonesia

INTRODUCTION

Education is an activity carried out to gain knowledge or insight. Education is a conscious and planned effort to create an atmosphere of learning so that students actively develop their potential to have spiritual strength, self-control, personality, noble moral intelligence, and skills. Education should provide supportive learning to help students become competent and well-adjusted individuals (Taylor & MacKenney, 2008). The development of individual potential can be obtained through formal education in higher education.

Higher education is divided into several types, one of which is vocational education. Vocational education is an education program that prepares students to become professional workforce and continue their education to a higher level (Djohar, 2007). Many factors affect students' understanding in learning, one of which is learning media.

Learning media are aids in the teaching process. Everything that can be used to stimulate students' thoughts, feelings, concerns, and abilities or skills is a learning medium (Ali, 1998). It aims to encourage an effective learning process. Thus, learning media must pay attention to the suitability of the subject matter, the accuracy of the contents of the media with the content of the subject matter, and the quality of the learning media. Learning media must be able to provide information to students to learn easily (Syaefrudin, 2016). In addition, instructional media must be able to facilitate communication between learners, teachers and other learning resources (Tafakur & Solikin, 2018). Based on its development, learning media can be classified into two groups, namely traditional media and modern technology media. Traditional media is media that is still conventional, whereas modern technology media utilizes technological developments.

One form of modern learning media is simulator. Simulation is the application process of building a model of a real system or a proposed system, conducting experiments with the model to explain the behavior of the system, study the performance of the system, or to build a new system in accordance with the desired performance (Khoshnevis, 1994). Simulators are shown to support student learning in applying the knowledge or concepts acquired to real objects. The main purpose of the simulator media is to facilitate practice in terms of understanding and operation, as well as educating students to understand the electronic circuit scheme because basically, the simulator is a hardware scheme. Simulation is a model of the results of the simplification of reality. The simulator must reflect the real situation and be operational. Simulators describe ongoing processes that are physical, verbal, or mathematical (Sadiman et al., 2010). Therefore, simulators have a very important role in learning because original tools have high prices and low levels of efficiency.

Anderson (1987, p. 181) argues that the influence of physical objects or tangible objects used in education will provide a very important stimulus for students in learning tasks involving psychomotor skills. In addition, Ahmadi (2005, p. 23) states that simulation means an imitation or an act that is only mock. Vocational education must be able to organize learning according to real conditions, and it has not been able to be done well. It has an impact on the low competency of students. Vocational schools have not optimally prepared students' skills to master technology in the workforce (Jamaludin & Khairudin, 2017). Thus, learning requires a simulator to bring situations that are similar to the real thing in class. In the application of media simulators, a problem-solving learning strategy is needed in solving problems related to the pneumatic electro system to improve students' skills and competence in understanding components and understanding the pneumatic system circuit to the maximum, so we need appropriate learning media to overcome the limitations of practical learning.

The conclusion from several related studies about the importance of learning media in the form of simulators shows that the media helps the learning process. However, the media simulator also still does not give a real picture of the material being studied. Simulator learning media by combining two types of learning media characters in the form of dual design is expected to be able to attract the attention of students and can increase knowledge significantly. This study chooses dual design because simulators in the form of dual design have not yet been developed specifically. Dual design simulators are also able to provide clear images to students to better understand the material being taught.

Pneumatic systems are used for the purpose of, among others, gripping workpieces, shifting the workpiece, positioning the workpiece, and directing the flow of goods to different directions. Moving machines are absolutely necessary in the industry (Raharjo, 2013). Automatic equipment is needed by the industry today to improve work efficiency and productivity (Kurniawan, 2008). Pneumatic systems have the advantage of high power-to-weigth ratio, high stiffness, high instant expansibility, and high speed (Li et al., 2013). Besides, pneumatic system is very interesting because it has softness of movement, high power volume rate, and strength (Rubio et al., 2009). In addition, pneumatic systems have easy maintenance, clean, low manufacturing costs, availability, and low energy consumption (Oladapo et al., 2016). It makes the pneumatic system very useful for production in the automation systems using compressed air in the industry.

The application of pneumatic systems used in mobile industries is still not widely used (Bahar, 2017). It is different from the use of hydraulic systems in the automotive industry, especially in transmission systems (Balau et al., 2011), but the electro pneumatic system is one option that can be expected to be a solution for manufacturing automated equipment (Hudallah, 2010).

Obstacles are faced by students from observations in the Department of Mechanical Engineering Education Untirta, namely: (1) learning that is difficult to understand because learning is theoretical. When the theory has been understood, students do not necessarily understand with practical learning. (2) The method used is quite good, but the application is still not optimal, (3) The media used is only an application that cannot yet explain the components and mechanism of action directly, so by using an application, students lack understanding of it. Many of them are less skilled in practice, and there are even students who have never done practical learning. Whereas, vocational education must be able to improve the skills of students (Clarke & Winch, 2007). This problem must be resolved immediately because it will affect students' skills to become weak. Finally, many students still do not understand the learning provided.

Based on those problems, an incomplete learning system occurs, especially in the students' skills. Electro pneumatic system material is one of the topics that is considered difficult (Najjari et al., 2014). It is because the electro pneumatic system uses more complicated components and circuits. In addition, the automation system with electro pneumatic technology with three main components namely, actuators, sensors or buttons, and control devices requires students to understand more deeply (Najjari et al., 2012). Thus, pneumatic system material requires the development of a comprehensive learning media (Setiadi et al., 2018).

Students' skills are influenced by the methods and media used in the learning process. The use of appropriate methods and media is reflected in the practical skills of students in learning (Fatkhurrokhman et al., 2018). Learning methods must be in accordance with the characteristics of each student, while the learning media must be able to facilitate students in understanding learning material. It is because teachers and students must have knowledge and skills both theoretically and practically (Wiyanto et al., 2017). Therefore, developing pneumatic system simulators to support electro pneumatic practicum becomes very important.

RESEARCH METHOD

This research was conducted at the Department of Mechanical Engineering Education Study Program to conduct user respondent tests. The study was conducted from April to August 2019. The research subjects were students of Mechanical Engineering Education in semester IV and VI of 30 students. The data collection method is done by observation and questionnaire. The data analysis technique used in this study is a quantitative descriptive analysis technique. This research is a development study using the 4D model, namely (1) definition, (2) design, (3) development, (4) dissemination. Each stage is elaborated as follows.

Defining Stage

In the defining phase, the researchers conducted a research observation to determine the learning conditions in pneumatic hydraulic courses with 32 students in Universitas Ageng Tirtayasa (Untirta)'s vocational engineering education. The result of observation shows that there are no practice learning media that use

instructional media in detail so that learning on competence understands components and comprehends a series of theories and simulations using the software. It has become a problem for students in the process of acquiring knowledge about hydraulics and pneumatics. Therefore, research about learning media is needed in the form of a simulator. It is because the original equipment requires expensive funds. Simulator becomes a strategic alternative to overcome these problems in an effort to improve students' knowledge and skills in pneumatic hydraulic competence. The simulator that was developed was based on a dual design on electro-pneumatic material. The dual design is the addition of mechanical media that is explaining the components and circuits.

Design Stage

Based on the results of preliminary studies that have been carried out, it is necessary to conduct a study regarding the development of instructional media in the form of a dual-designed-based electro-pneumatic simulator. The characteristic of an electro-pneumatic simulator based on dual design is the addition of mechanical functions for valves and circuits. The development of a pneumatic electro simulator based on dual design aims to improve students' understanding of the concepts and workings of components and circuits. Therefore, the development of a dual design-based media simulator is one of the strategic solutions to address these problems.

Development Stage

After making the simulator is complete, the next stage is testing. The testing step is in the form of an expert assessment of the media and material. Based on expert input, the media and material were revised to make it more precise, effective, easy to use, and have high technical quality.

Data collection was performed after the instruments validated by expert judgment. The data obtained were tabulated to make it easier to process and analyze data. The tabulated data are quantitative data. After the data were tabulated, the average score was calculated by converting the assessment score. Table 1 is a score conversion. The data that has been calculated and produced data in the form of a feasibility level are qualitative data.

Table 1. Range of Percentages and Qualitative Criteria (Source: Ali, 1998)

No.	Interval	Criteria
1.	81.25% < score ≤ 100.00%	Very good
2.	62.50% < score ≤ 81.24%	Good
3.	43.75% < score ≤ 62.49%	poorly
4.	25.00% < score ≤ 43.74%	Bad

This research was declared successful if the results obtained from the questionnaire were in the range of 62.50% <score ≤ 81.24% and 81.25% <score ≤ 100% or in the "Good" and "Very Good" criteria. If the results were in the range of 25.00% <score% 43.74% and 43.75% < score% 62.49% or in "Poor" and "Bad" criteria, then the it was inappropriate.

Dissemination Stage

The last stage is dissemination stage. It is carried out by disseminating this information to students of Mechanical Engineering Education in Faculty of Teacher Training and Education, Sultan Ageng Tirtayasa University, and publication through scientific journals.

RESULTS AND DISCUSSION

The result of the development of the instructional media simulator electro-pneumatic system is performed in this study with a development model consisting of four phases of activities, namely: (1) Defining, (2) Designing, (3) Developing, (4) Disseminating.

The results obtained at the defining phase are as follows: (1) the instructional process is difficult to understand because the learning is theoretical. When the theory has been understood, students do not necessarily understand with practical learning. (2) The method used is quite good, but its application is still not optimal. (3) The media used is only an application that cannot explain the components and mechanism of action directly, so by using an application, the students do not understand it. Based on the results of observations of lecturers, learning media of electro-pneumatic simulators is needed to facilitate electro-pneumatic learning. This research was divided into two stages, namely the stage of making learning media products and the learning media testing phase. The product produced is an electro-pneumatic system simulator and companion material in the form of an electro-pneumatic manual book.

Figure 1. Front View of the Simulator

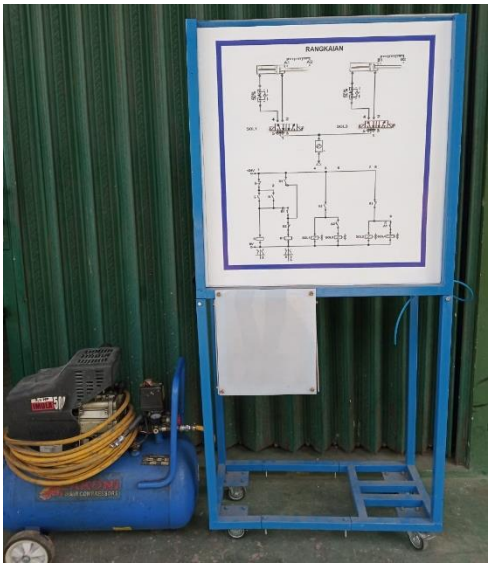


Figure 2. Rear View of the Simulator

As for the results obtained during the design process, the researchers create and prepare the designs after obtaining data from observations. The data obtained in the design process are: (1) an electro-pneumatic system simulator based on dual design, (2) testing is carried out to test the feasibility of the learning media product.

The results of the preliminary study analysis indicate that the development of the simulator aims to improve students' understanding of the components and electro-pneumatic circuit. Simulator development refers to these results to produce a pneumatic simulator based on the dual design as supporting media for electro-pneumatic practice. Figure 1 and Figure 2 show the results of the development of an electro-pneumatic simulator based on dual design, as a result of the research.

Figure 1 shows the front view of the simulator. The front view presents an electro-pneumatic circuit that can be used by students in conducting experiments on an electro-pneumatic function. Figure 2 is a dual design that is set to meet the needs of students in understanding the function and workings of the valve and actuator components with the addition of valve and cylinder characteristics that can be changed according to the circuit being made. The valve and cylinder can be shifted manually to move the working fluid flow to the desired actuator movement.

Testing is done using a questionnaire with a total of four levels of scores. Then, the media is given to media experts and material experts (teachers from SMK YPWKS Cilegon and lecturers form the department of Electrical Engineering Education of Untirta) to determine the validity of the product and the level of eligibility of the product made. Questionnaires are also given to users to assess products that are made, so they know the level of eligibility of users. The questionnaire was consulted with expert judgment so that it could be used for data collection.

The results obtained from the process of developing instructional media products in this study are electro-pneumatic simulators equipped with electro-pneumatic manuals book. They are produced through several stages as follows.

Observation of Students as Users to Find Out Their Average Height

It is aimed at making the product can be appropriately used, and students feel comfortable in learning practices. The first step is designing an electro-pneumatic simulator frame as needed with Solid Work and Photoshop software. Electrical pneumatic simulators consist of double-acting actuators, DC limit switches, 24/2 solenoid 24 volts, LED lights, 8-foot 24 Volt relays, air service units, push buttons, power supply, and compressors. The designed electro-pneumatic simulator is the development of a simulator from several previous researchers. The development carried out in this research is in the form of a simulator

display with an attractive dual design system that makes it easier for students to understand. The front view of the simulator display is presented in Figure 3. The circuit is designed to make it easier for students to understand how the original circuit works in the form of an electro-pneumatic simulator. The simulator can be designed to perform a function of moving an object by having simultaneous movements according to the series made by students.

Figure 3. Front View of the Simulator Display

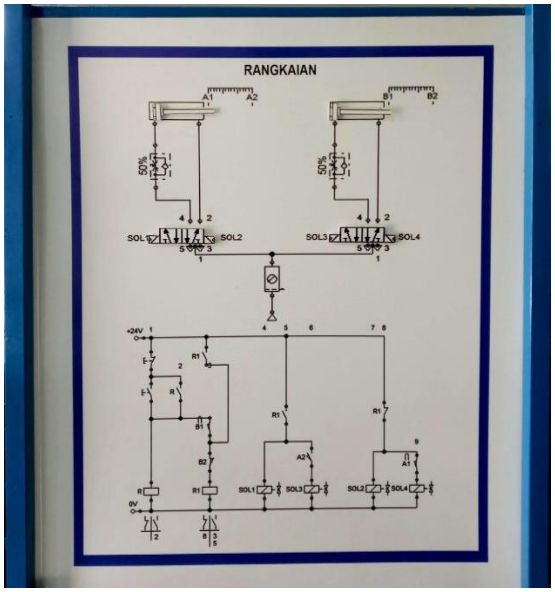


Figure 4. Rear View of the Simulator Display

One design is in front with the appearance of the original components that can be operated (Figure 3), and another design in the rear for the circuit (Figure 4). After drawing each position in accordance, then it is immediately printed. After printing is then measuring and cutting the acrylic and electro-pneumatic simulator frame. The printed sticker has component symbols directly affixed to the acrylic. After the sticker is placed on the acrylic, each component is immediately installed in accordance with their respective positions.

The rearview displays the circuit simulator with valves and cylinders which can be changed manually to show the direction of the fluid. The rearview function is essential to increase student knowledge in understanding the working principle of each component and the function of components in a series. Students can know the flow of working fluid by looking at the symbol direction of the valve, which affects the cylinder position. The dual design function is crucial to improve the basic understanding of student circuits so that, with this simulator, it can improve students' knowledge and understanding of electro-pneumatic material.

Creating a Pneumatic Electro Simulator Equipped with a Manual Book for Students

It is created for students to help them implementing learning practices referring to the syllabus for electro-pneumatic competence. The manual aims to provide information on how to operate the simulator. It presents information on various types of circuits that can be made through a simulator.

The results of the dissemination carried out during the process of data collection on the feasibility of the media are as follows. The researchers explain the learning media to student representatives as users. In addition to users, researchers also explained this learning media to teachers of pneumatic-hydraulic subjects and lecturers to support pneumatic-hydraulic subjects for later use as an alternative learning media in teaching. Figure 5 shows a student conducting experiments on the developed media. He composes a circuit to a particular function. The piston will move simultaneously to push to perform a certain function.

Figure 6 shows a student studying the function and workings of valves. When the valve is moved manually, the piston must be moved manually as well because there is a fluid flow that must be adjusted in the circuit. The existence of this simulation can improve students' understanding of the basic concept of pneumatic components.

Based on the results of the socialization, researchers get results in the form of comments related to the media, that this media is very helpful for students so that it can be used as an electro-pneumatic learning media. The eligibility criteria are derived from the average of the data obtained from respondents. The level of eligibility is determined from the average obtained and then converted to the formulated score table (Ali, 1998). There are four levels of the score on the questionnaire, with the lowest score of 1 and the highest of 4 on each answer.

Data obtained from media experts and material experts are then analyzed. Data analysis that was carried out resulted in the average score, total score, and level of eligibility. Data of media experts were analyzed so that the total score obtained on the simulator display criteria was a total score of 88, a maximum score of 108, and a percentage of 81%. These percentages are included in the Very Eligible category. Table 2 shows the data acquisition for each criterion filled out by media experts.

The mean score of all criteria is calculated to find out the overall score of the criteria taken from the validator. After knowing the average score, the results are compared with the percentage score conversion table to determine the feasibility level. Based on the average number of validator scores getting 84% of the maximum 100%, it can be categorized as "Very Good".

Based on the diagram in Figure 7, the results of feasibility data obtained by reviewing the design and technical quality of the simulator display are 81%, which is included in the category of "Very Good". The results of design criteria are 83%, which is included in the category of "Very Good ", and the results of the technical quality are 86%, included in the category of "Very Good ". These data were obtained from three media experts, namely lecturers and teachers who are experts in the field of learning media. Data obtained from the three experts were then averaged with 84% results, which means that of the three criteria, the electro-pneumatic simulator media received the category of "Very Good".

Figure 5. A Student Composing an Electro-Pneumatic Circuit on the Front of the Simulator Function

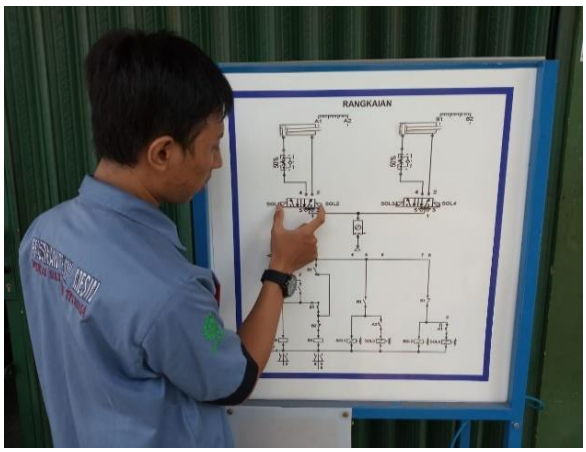


Figure 6. A Student Composing an Electro-Pneumatic Circuit on the Rear of the Simulator Function

Table 2. Data Analysis of Media Expert Assessment Results

No.	Criteria	Total Score	Total Score Maximum	Percentage (%)	Criteria
1.	Simulator Display	88	108	81%	Very good
2.	The design	80	96	83%	Very good
3.	Technical Quality	83	96	86%	Very good
Average Amount		251	300	84%	Very good

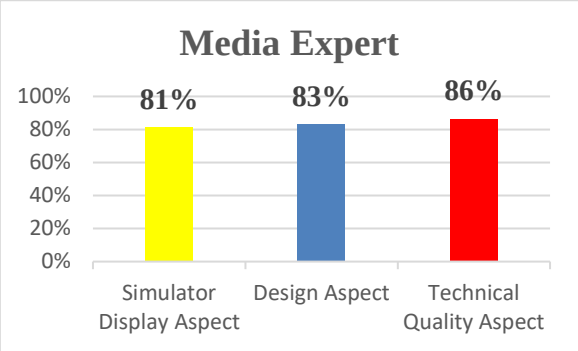


Figure 7. Diagram of Media Expert Test Validation Results

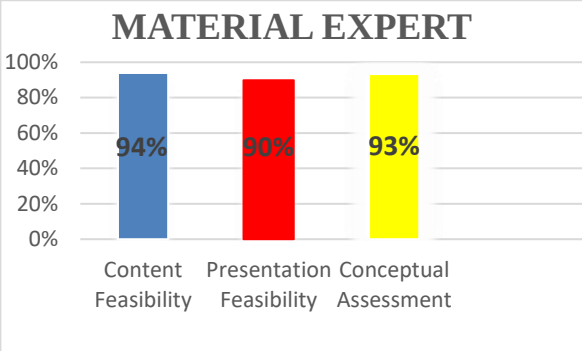


Figure 8. Diagram of Expert Test Expert Material Validation Results

Table 3. Data Analysis of Material Expert Assessment Results

No.	Criteria	Total Score	Total Score Max	Percentage (%)	Criteria
1.	Content Feasibility Aspect	124	132	94%	Very good
2.	Presentation Aspect	97	108	90%	Very good
3.	Aspect of Contextual Assessment	56	60	93%	Very good
	Average Amount	277	300	92%	Very good

Table 4. Data Analysis of User Assessment Results

No.	Criteria	Total Score	Total Score Max	Percentage (%)	Criteria
1.	Content Feasibility Aspect	830	960	86%	Very good
2.	Display Simulator Aspect	828	960	86%	Very good
3.	Design aspects	392	480	82%	Very good
4.	Technical Quality Aspects	424	480	88%	Very good
	Average Amount	2474	2880	86%	Very good

The mean score of all criteria is calculated to find out the overall score of the criteria taken from the validator. After knowing the average score, the results are compared with the percentage score conversion table to determine the feasibility level. As presented in Table 3, the average number of validator scores obtained 92% of the maximum of 100%, and it can be categorized as "Very Good".

Based on the diagram in Figure 8, data on the content worthiness and the feasibility of presentation and conceptual assessment are obtained. The result of the eligibility criteria of content is 94%, which means in the category of "Very Good". The result of the eligibility criteria of presentation is 90%, which means in the category of "Very Good", and on the result of the conceptual assessment is 93%, which means in the category of "Very Good ". These data were obtained from three material experts, namely lecturers and teachers who are experts in the electro-pneumatic system material. Data obtained from the three experts were then averaged with 92% results, which means that of the three criteria, the electro-pneumatic system simulator media received the category of "Very Good".

The mean score of all criteria is calculated to find out the overall score of the criteria taken from the validator. After knowing the average score, the results are compared with the percentage score conversion table to determine the feasibility level. As presented in Table 4, the average of the validator's scores is 86% of the maximum 100%, and then it can be categorized as "Very Good".

Based on the diagram in Figure 9, the feasibility data in terms of the feasibility of the content, simulator appearance, design, and technical quality were obtained. The result of the content eligibility criteria is 86%, which is

included in the category of "Very Good". The display criteria of the simulator obtained 86%, which means that it is included in the category of "Very Good". The design criteria obtained 82%, which means in the category of "Very Good", and the technical quality criterion obtained 88%, which means it belongs to the category of "Very Good". These data were obtained from 30 students who join and had taken the pneumatic hydraulic courses. The data obtained were analyzed with the result of 86%, which means that the four criteria of the electro-pneumatic system simulator media are in the category of "Very Good".

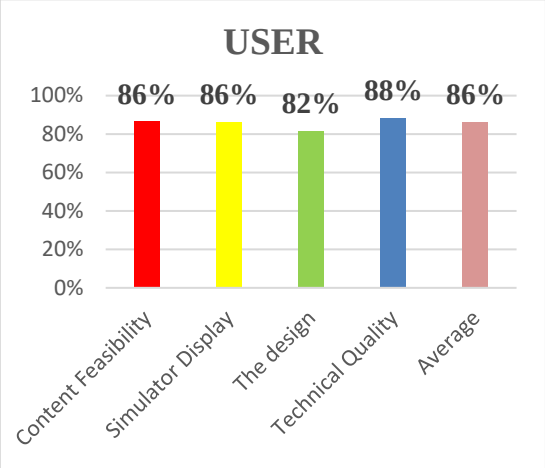


Figure 9. Diagram of Student User Validation Test Results

CONCLUSION

Based on the results of the research and discussion previously explained, it can be concluded that: (1) The development of electro-pneumatic simulator learning media produces two main components, namely (a) the working system in the electro-pneumatic system, in which, there are dual pneumatic electro system design components, namely original components that can be operated, and the working system of the airflow rate that moves on the electro-pneumatic system; and (b) electrical circuit, in which, there is an electrical system of electro-pneumatic system components that can be assembled by students or users. These two components serve as a learning media simulator for electro-pneumatic systems based on dual design. (2) The results of the feasibility test for learning media of pneumatic electro system simulators conducted by media experts are 84%, included in the category of "Very Good" in terms of the simulator display design, design, and technical quality. The results of the feasibility test on the learning media of pneumatic electro system simulators conducted by material experts are 92%, included in the category of "Very Good" in terms of the criteria of content, the feasibility of presentation, and contextual assessment. The results of the user feasibility test on the learning media of the pneumatic electro system simulator conducted by 30 students from mechanical engineering education Untirta are 86%, included in the category of "Very Good" in terms of content eligibility, simulator appearance, design, and technical quality.

The development of pneumatic simulator media based on the dual design as supporting media for electro-pneumatic practice has immense benefits for increasing students' understanding of electro-pneumatic circuit and components. Thus, the existence of this simulator is expected to be able to increase students' understanding efficiently because they do not have to present original products that require high costs. This media simulator becomes a strategic answer to create learning that is almost similar to the original and can increase the efficiency of the price and time spent.

REFERENCES

Ahmadi, A. (2005). *Strategi belajar mengajar*. Pustaka Setia.

Ali, M. (1998). *Strategi penelitian pendidikan*. Angkasa.

Anderson, R. H. (1987). *Pemilihan dan pengembangan media untuk pembelajaran*. Rajawali.

Bahar, A. (2017). Redesign sistem pneumatik silinder unloading untuk pergantian arah feeding dengan installation direction vertical, horizontal, dan inclined. *Jurnal Teknik Mesin*, *5*(2), 209–216.

Balau, A., Caruntu, C., & Lazar, C. (2011). Simulation and control of an electro-hydraulic actuated clutch. *Mechanical Systems and Signal Processing*, *25*(6), 1911–1922. https://doi.org/10.1016/j.ymssp.2011.01.009

Clarke, L., & Winch, C. (2007). *Vocational education: International approaches, developments and systems*. Routledge.

Djohar, A. (2007). Pendidikan teknologi dan kejuruan. In *Ilmu dan aplikasi pendidikan* (pp. 1285–1300). Pedagogiana Press.

Fatkhurrokhman, M., Leksono, S. M., Ramdan, S. D., & Rahman, I. N. (2018). Learning strategies of productive lesson at vocational high school in Serang City. *Jurnal Pendidikan Vokasi*, *8*(2), 163–172. https://doi.org/10.21831/jpv.v8i2.19485

Hudallah, N. (2010). Rancang bangun sistem pneumatis untuk pengembangan modul-modul gerak otomatis sebagai media pembelajaran. *Jurnal Teknik Elektro*, *2*(1), 8–22. https://doi.org/10.15294/jte.v2i1.1583

Jamaludin, J., & Khairudin, M. (2017). Pengembangan trainer elektropneumatik pada kompetensi mengoperasikan sistem kendali elektropneumatik. *Jurnal Pendidikan Teknik Elektro*, *7*(2), 108–116. http://journal.student.uny.ac.id/ojs/index.php/elektro/article/view/8662

Khoshnevis, B. (1994). *Discrete system simulation*. McGraw Hill.

Kurniawan, R. (2008). Rekayasa rancang bangun ssistem pemindahan material otomatis dengan sistem elektro pneumatik. *Jurnal Energi Dan Manufaktur*, *2*(1), 42–47. https://ojs.unud.ac.id/index.php/jem/article/view/2263

Li, B., Gao, L., & Yang, G. (2013). Evaluation and compensation of steady gas flow force on the high-pressure electro-pneumatic servo valve direct-driven by voice coil motor. *Energy Conversion and Management*, *67*, 92–102. https://doi.org/10.1016/j.enconman.2012.11.004

Najjari, B., Barakati, S. M., Mohammadi, A., Fotuhi, M. J., Farahat, S., & Bostanian, M. (2012). Modelling and controller design of electro-pneumatic actuator based on PWM. *International Journal of Robotics and Automation (IJRA)*, *1*(3), 125–136. https://doi.org/http://dx.doi.org/10.11591/ijra.v1i3.565

Najjari, B., Barakati, S. M., Mohammadi, A., Futohi, M. J., & Bostanian, M. (2014). Position control of an electro-pneumatic system based on PWM technique and FLC. *ISA Transactions*, *53*(2), 647–657. https://doi.org/10.1016/j.isatra.2013.12.023

Oladapo, B. I., Balogun, V. A., Oyegoke, S., Adeoye, A. O. M., Ijagbemi, C. O., Afolabi, S. O., Daniyan, I. A., Akinola, S. O., Simeon, A. P., & Uchegbu, I. D. (2016). Experimental analytical design of CNC machine tool SCFC based on electro-pneumatic system simulation. *Engineering Science and Technology, an International Journal*, *19*(4), 1958–1965. https://doi.org/10.1016/j.jestch.2016.08.010

Raharjo, R. (2013). Rancang bangun belt conveyor Trainner sebagai alat bantu pembelajaran. *Jurnal Teknik Mesin*, *4*(2), 15–26.

Rubio, E. R., Hernandes, L., Aracil, S. R., Roque, S., & Guerra, J. A. (2009). Implementation of decoupled model-based controller in a 2-DOF pneumatic platform used in low-cost driving simulators. *2009 Electronics, Robotics and Automotive Mechanics Conference (CERMA)*, 338–343. https://doi.org/10.1109/CERMA.2009.22

Sadiman, A., Rahardjo, R., Haryono, A., & Rahardjito, C. (2010). *Media pendidikan (Pengertian, pengembangan, dan pemanfaatannya)*. Raja Grafindo Persada.

Setiadi, A., Yuliatmojo, P., & Nurhidayat, D. (2018). Pengembangan aplikasi Android untuk pembelajaran pneumatik. *Jurnal Pendidikan Vokasional Teknik Elektronika*, *I*(1), 1–5.

Syaefrudin, N. (2016). Pengembangan media pembelajaran trainer kit sensor dan aktuator untuk meningkatkan hasil belajar. *Jurnal Pendidikan Teknik Mekatronika*, *6*(3), 258–267.

Tafakur, T., & Solikin, M. (2018). Electronic spark advance ignition system simulator as instructional media for assisting electrical practices on automotive field. *VANOS Journal of Mechanical Engineering Education*, *3*(1), 43–50. https://doi.org/10.30870/vanos.v3i1.3377

Taylor, G. R., & MacKenney, L. (2008). *Improving human learning in the classroom theories and teaching practices*. Rowman & Littlefield Education.

Wiyanto, T., Samani, M., & Sugiyono, S. (2017). The developing teaching practice model as an effort to improve the quality of mechanical engineering vocational school teachers. *Jurnal Pendidikan Vokasi*, *7*(3), 349–363. https://doi.org/https://doi.org/10.21831/jpv.v7i3.17923

Jurnal Pendidikan Vokasi
Volume 9, No 3, November (318-328)
Online: http://journal.uny.ac.id/index.php/jpv

VISUALIZING THE STAGES OF THE EDUCATIONAL RESEARCH METHODOLOGY INTO ANIMATION INFOGRAPHICS FOR VOCATIONAL STUDENTS

Ketut Agustini
Universitas Pendidikan Ganesha

Gede Saindra Santyadiputra
Universitas Pendidikan Ganesha

Nyoman Sugihartini
Universitas Pendidikan Ganesha

Abstract

Visualizing something abstract into a concrete object can help students improve their mastery of concepts in learning. The purpose of this study is to visualize the stages of the educational research methodology into an animation infographic media. The method used refers to the instructional development model. The target subjects of this study were students of informatics engineering education study program who had taken courses in educational research methodology. In order to get valid, practical, and effective media, several tests were carried out, such as formative evaluation and effectiveness testing with Hake formula. The results show that the dynamic infographic media produced has gone through expert judgment as follows. (1) Testing by content experts score 1 (very high), testing by the learning design experts scored 0.92 (very high), and testing by learning media experts scored 0.90 (very high). (2) The result obtained from the practicality testing is 86.5%, or it is included in the practical category. (3) The testing of the effectiveness of using the Hake formula obtained N-gain results of 0.8, which belongs to the effective category. It shows that animation infographic media produced is valid, practical, and effective to be used in improving the concept mastery of the stages of educational research methodology in informatics engineering education study program.

Keywords: *visualizing, animation infographics, stages of educational research methodology, vocational education*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i3.22017*

Contact Ketut Agustini
ketutagustini@undiksha.ac.id
Department of Informatics Engineering Education, Faculty of Engineering and Vocation, Universitas Pendidikan Ganesha
Jl. Udayana No. 11, Banjar Tegal, Buleleng, Bali 81116, Indonesia

INTRODUCTION

Learning is the process of acquiring knowledge. This process makes people who previously do not know about something to become aware of it. How to obtain knowledge varies. Humans use different styles depending on learning styles that are considered easy to understand. Some styles chosen by a person are called learning modalities. There are two categories related to "how learners learn", namely, how learners can absorb information easily (modality) and how students manage and process that information (brain dominance). Therefore, learning styles are a combination of these two categories, namely how students absorb, organize, and process information. According to de Porter and Hernacki, learning styles, based on one's modality, are divided into three groups, namely, visual modalities (learning by seeing), auditory modalities (learning by listening), and kinesthetic (learning by moving and touching). Furthermore, it is also explained that one of the most effective learning styles in the world of education is visual modality (Suhara, 2013).

Several results of the research state that the three learning styles are effective in improving students' abilities, both visual, auditory, and kinesthetic. Based on the results of hypothesis testing, it shows that t count > t table, i.e., 9.83> 2.00 on the degree of freedom n - 1 = 48 with a confident level of 95%. Thus, the three learning styles are effective in improving students' abilities (Suhara, 2013). In addition, among the three learning styles, the visual learning style turned out to be more dominant than auditory or kinesthetic. There are 50.94% of students more likely to have a visual learning style. This result was obtained through a survey of students using a questionnaire that had been adapted from de Porter (Siwi, 2016).

Visual modality is a learning style in which ideas, concepts, data, and other information are packaged in the form of images and techniques. Students who have visual modalities have a high interest when they are shown images, graphics, organizational graphics such as nets, concept maps, and map ideas, plots, and other visual illustrations. Some techniques used in visual modalities are to improve thinking and learning skills, and prioritizing vision (visual). In the visual modality, many models and learning methods are needed that are used with the emphasis on modeling. Learning media are objects related to the lesson, or by showing the tools directly to students or also describing them in front of the board (Rusman, 2012). The body language and facial expressions of the instructor are also very important to convey the subject matter. They tend to sit in the front so they can see the subject-matter shown clearly. They think of using images in the brain and learning faster by using visual displays, such as diagrams, illustrated textbooks, interactive CDs, digital content and videos, and also information which is packaged in graphical forms. In the classroom, visual children prefer to read and record up to the details to get information.

The requirement to master the learning style of visual modalities is that students must love reading. Reading is the main thing that must be carried out by a student because reading can make students more independent in acquiring knowledge. Nevertheless, in reality, it is very rare for students to have an interest in reading. It can be seen from the Indonesian reading index which is issued by the Central Bureau of Statistics (2012), which explains that 96.68% of the population is 10-year old kids who over prefer watching television, and only 17.66% are reading. This problem becomes more serious when students want to learn something complex, and there are courses which have very solid, descriptive and varied material such as educational research methodology courses.

On the other hand, mastery of graduate concepts and competencies can be improved through quality learning services by utilizing Information and Communication Technology (ICT) (Tandirerung & Hadi, 2014; Zyainuri & Marpanaji, 2013). It becomes one of the most important parts in supporting the learning process. The use of ICT in the world of education has changed the pattern and interaction of learning (Hanum, 2013; Sindu & Paramartha, 2018). Many educational technology experts have developed various learning-support media. They work with information and communication technology experts. Products produced such as Augmented Reality (AR), Video Blog (Vlog), Interactive Whiteboard, and media infographics. Learning must provide opportunities for students to actively try to construct their own knowledge and competencies

that must be possessed. It becomes a demand and even a serious concern of the learning designers. The role that must be performed by students is as a publisher, audience, and peer reviewer of knowledge. The role of the lecturer is only as a facilitator and stimulator of student activities for learning. Therefore, students must be facilitated to carry out the learning process in order to construct their own knowledge and master the competencies that must be mastered (Ackermann, 2012; Agustini et al., 2017; Gredler, 2009).

On the other hand, mastering the concepts and competencies of graduates can be improved through quality learning services according to the types of research they choose. Based on interviews with one of the educational research methodology subject lecturers at Universitas Pendidikan Ganesha, there were three problems in learning, namely, (1) some students are confused in distinguishing research topics. They have not been able to distinguish between experimental topics, technology and vocation education, educational engineering, and informatics engineering. In fact, distinguishing research topics can be done by differentiating the research methodology. (2) There is a tendency for students to be lazy and do not want to find their own references, so they do not understand the procedures in each of the existing research methods. It can be seen from the many questions about research methods that are repeatedly asked by different students when conducting research guidance. The student's laziness is the impact of low student interest in reading. (3) The absence of media that comprehensively discusses each research procedure in one unit of educational research methodology.

The impacts of these problems are that (1) it takes time to determine the type of research due to the confusion, and (2) the research stages used by students are mostly untrue, which results in high costs in the thesis-making process. Both of them lead to the obstruction of the students' thesis preparation process.

Based on these problems, it is crucial and urgent to develop media. A solution is needed to attract students' interest so that they can understand the existing research methods and procedures correctly. The solution that can be done is to develop visual media in the form of infographic animation. This media can convey reliable information to become simpler but does not eliminate the true meaning. Many types of visualization can be used to represent the same data set. Therefore, it is essential to identify the appropriate visualization for the data set by considering graphics features such as position, size, shape, and color.

There are five types of visualization categories, namely time-series, statistics, maps, hierarchies, and networking. Time-series visualization emphasizes a form of a timeline that can be used as a timepiece by documenting a set of values over time. Time-series visualization shows interactive graphs that present things that change over time. The form of infographics which is visualized in time-series can be used in showing a development clearly and is easily remembered. Statistical visualization emphasizes the disclosure of trends based on how numbers are distributed. Examples that are oftenly used are histograms and box-and-whisker plots. Statistical visualization conveys statistical features such as average, median, an outlier. Visualization maps emphasize the representation of geographical data. Time and space can be described through the use of flow maps. Visualization maps can use lines of various sizes, including width and color, to help encoding information. Visualization hierarchies emphasize hierarchical data sets that have a large number of members. Visualization hierarchies can be realized using node-link diagrams, adjacency diagrams, and enclosure diagrams. Visualization hierarchies can have an impact on infographic visualization that is effective in communicating hierarchical data. Visualization of networking emphasizes visualization that explores relationships between nodes. The node representation can be various. Nodes can be represented as problems, activities, solutions, and so on. Three common types of visualization of networking include force-directed layouts, arc diagrams, and also matrix views. Nowadays, visualizing networking can describe a difficult concept easily with just one form of an infographics. In addition to the visualization category, there are also two types of graphics used in forming infographics, namely theme graphics and reference graphics (Ru & Ming, 2014).

Furthermore, according to Ru and Ming (2014), there are three important steps that have been proven effective in applying infographics in a learning medium. The first step is

knowledge-conversion. Knowledge has powerful characters, and infographics can be used to show the strength of that knowledge. As a characteristic of infographics, knowledge must first be changed from the abstract form into something that can be seen in plain view by determining which categories to use in making infographics. Then, carrying out activities by marking important content that will be used in the infographics is needed. Next, choose the right color and image. This selection is very important to do in the first stage. The final step in this first step is to try to combine these things and make an infographic that might look simple or even complicated. However, good infographics are not seen from simple or complex forms of visualization. Rather, a good infographic is infographics that are easy to understand and not confusing.

The second step is reviewing the infographics. This step is a detailed step in the infographics that was generated in the first step. What that needs to be done is to determine the type of infographic, whether it includes the type of the graphics theme or reference graphics. Types of graphics themes usually visualize a model or have certain characteristics. Usually, each infographic has this type except statistical infographics. Choosing a theme which matches the infographic design is important. When infographics contain a theme, students can immediately guess what knowledge they will receive without needing to tell them. This type of reference graphics is very rarely found in an infographic and is something that is not mandatory. The types of infographics that contain reference graphics usually contain icons that are used as visual markers in their infographics. It is applied in infographics that have very much content in it. In order to avoid the formation of a messy design, this type of infographic is considered necessary to use icons to be able to represent these contents. Sometimes, words are not even needed if we can choose the type of strong icons. Doing this step as often as possible can increase the speed and accuracy in choosing the type of infographic that matches the characteristics of the knowledge we want to explain.

The third step is to tell the story. This step is the final step, where infographics are clearly formed. These infographics can be directly given to students while telling things related to that knowledge. Here, the teacher can become the person who guides students to see infographics so that the infographic viewpoint can be seen from the same point. Infographics is considered to represent tens of thousands of words. Therefore, it can be both a strength and a weakness. The disadvantage is when students see from a different perspective so that it will have an impact on different thinking and understanding. It is where the teacher's guidance is emphasized. Students must get the right guidance and find the knowledge behind the infographic.

Until now, the implementation of infographics can be differentiated from two applicable forms (Hassan, 2016). The first is static infographics, and the second is animated infographics, or it can also be called motion infographics. Static infographics or static infographics are infographics which are designed to be printed like posters and diagrams that are usually found in articles, magazines or newspapers, and advertisements. The use of static infographics in digital media can be found on websites and Videotron without entering any movement, or there are no animated elements or features.

In contrast, animated infographics, or we can also name it motion infographics, are infographics which are designed with the intention of screenplaying-view and are displayed on the screen. Examples of motion graphics videos are the videos on websites such as YouTube and Vimeo, TV ads, museum exhibitions, and also kiosks. Animated infographics have elements that usually move constantly and have data which are displayed in the form of animation. Movement or motion is usually made on a computer using animation software. Both static and animated infographics prove effective in increasing knowledge and understanding. Possible reasons for this effectiveness are that the visual and graphic explanations which are seen by learners are really interesting, creating visual interest, and providing interesting data about learning material. It reinforces the results of the theory of Multiple Intelligence and Neil Fleming's VAK model, in which it is found that humans can learn and understand information through three types of stimuli, namely Visual, Auditory, and Kinesthetic (VAK) stimuli. The infographics which are used in this study are animated infographics which can offer these stimuli with more emphasis on visual stimuli.

Research related to animated infographics is used as a reference in developing animated infographic media. It is research conducted by Bellei et al. (2016), which results in a cost-effective approach in developing animated infographic media. The approach taken is a pedagogical approach that refers to educational outcomes. The use of animation for education has been widely published; several studies describe in-house collaboration by developing the use of resources from instructors and students. In the results of their research, they presented a unique, innovative, and also cost-effective method for producing animated infographic media. The realization of the approach refers to collaborative activities between teachers and students. According to them, the collaborative development process offered can provide results in the form of original, high-quality, and effective additional teaching products that are widely reviewed and pedagogically interesting for all students involved.

Research by Mulyate et al. (2013) also develops infographic products in the form of infographic books "Recipes of various appetizers and conclusions for Western devices for children". The product testing results are in the positive domain. Children can accept infographics. They feel helped by the information presented, especially in getting more specific types of food that are liked by children.

Another research conducted by Susetyo et al. (2015) measures the effectiveness of infographics as supporting Social Sciences subjects in 5th-grade students. The results obtained the increased absorption of students to the lessons conveyed and the hange in value to be better than the previous generation. In addition, the use of infographics proved effective with the results displayed from the hypothesis test.

RESEARCH METHOD

The method which is used in the development of infographic media is Research and Development (R & D) Method. The stages referred to are the Instructional Development Model (*Model Pengembangan Instruksional* or MPI), according to Suparman (2012), who adapted Dick and Carey (2005). The steps taken were identifying the media infographic needs, designing media and storyboards, implementing design and storyboarding, evaluating formative stages through limited trials including expert judges, effectiveness tests and practicality tests, and finally analyzing user responses.

Formative evaluation is carried out through several stages of testing, such as one-to-one testing of experts (content experts, learning design experts, and learning media experts). In addition, the one-to-one learner is also conducted, namely students. Small group tests were carried out for eight to 20 students. Large group tests were carried out to 15 to 30 students. The question is limited to classes that are similar to the actual class (Suparman, 2012).

In order to determine the effectiveness of the product, an evaluation was carried out using the design of the pretest-posttest control group design to a group of students who had taken the Education Research Methodology (ERM) course. The types of data, data sources, methods, instruments, and evaluation times can are presented in Table 1.

Table 1. Map of Method

Type of Data	Data Source	Method	Instrument	Time
Formative Evaluation Data	Judges/expert	*One-to-one judges/expert evaluation*	Content questionnaire & language, design questionnaire, media questionnaire	After the development stage, the draft is complete
	Student (3 student)	*One-to-one leaner evaluation* with interview	Interview questionnaire	After *expert evaluation* revision was completed
	Students who have taken ERM (8 until 20 students)	Small group evaluation	Small group questionaire	After a one-to-one learner evaluation was revised
	Student who have taken ERM (15 until 30 students)	Field trial	Field trial questionaire;	After the group evaluation was revised

Source: MPI model (Suparman, 2012)

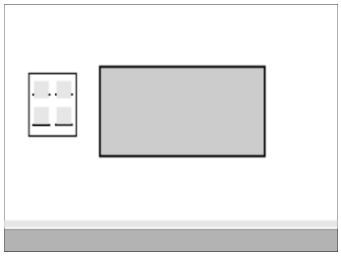
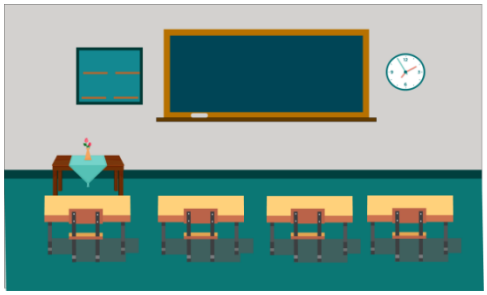
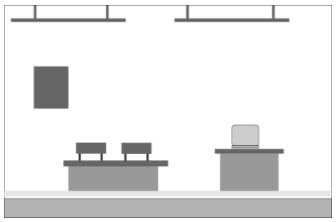
RESULTS AND DISCUSSION

The identification result of media and infographics requirement comes from the interviews and observations of students in a classroom. The result shows that (1) students require a lot of time in doing a research because they still have confusion to differentiate the research topics, (2) the Educational Research and Methodology course has a solid and descriptive material that tends to make the student lazy to search many resources about research methodology, (3) there are no instructional media that comprehensively discuss about each research procedure in a unit of education research methodology. Due to those problems, there are some media that need to be developed. The developed media include (1) infographic-based media material for MPP course, (2) 2D-animated video, (3) media that can deliver the methodology procedure material in a simple way, (4) for students, this media can help them to understand about research methodology procedure, while for lecturers, this media can help them in their lecturing process, (5) the media in the form of video can be shown in e-learning which owned by education research methodology lecturer, (6) the media can be shared to everyone that want to learn more about education research methodology.

Table 2. Design Result and Character Implementation in Media

No	Character	Design Images	Interface Implementation in Media
1	Profesor 2D		
2	Teacher 2D		
3	Judges 2D		
4	Principal 2D		
5	Female student 2D		
6	Male student 1 2D		
7	Male student 2 2D		

Table 3. Design Result and Supporting Image Implementation

No	Image Name	Design Images	Interface Implementation of Images
1	Class room		
2	Test room		

The media's and storyboard's design and implementation result consist of the main characters, nature of the characters, and the problems. The video consists of four synopses, including (1) stage of research experiment synopsis, (2) stage of technology and vocation education synopsis, (3) stage of informatics engineering research synopsis, and (4) stage of educational engineering research synopsis. The character that is successfully created can be seen in Table 2. Table 2 illustrates the characters, design drawings, and implementation image. There are seven characters in this infographic video, which are, (1) professor, (2) teacher, (3) examiner, (4) headmaster, (5) female students, and (6) male students.

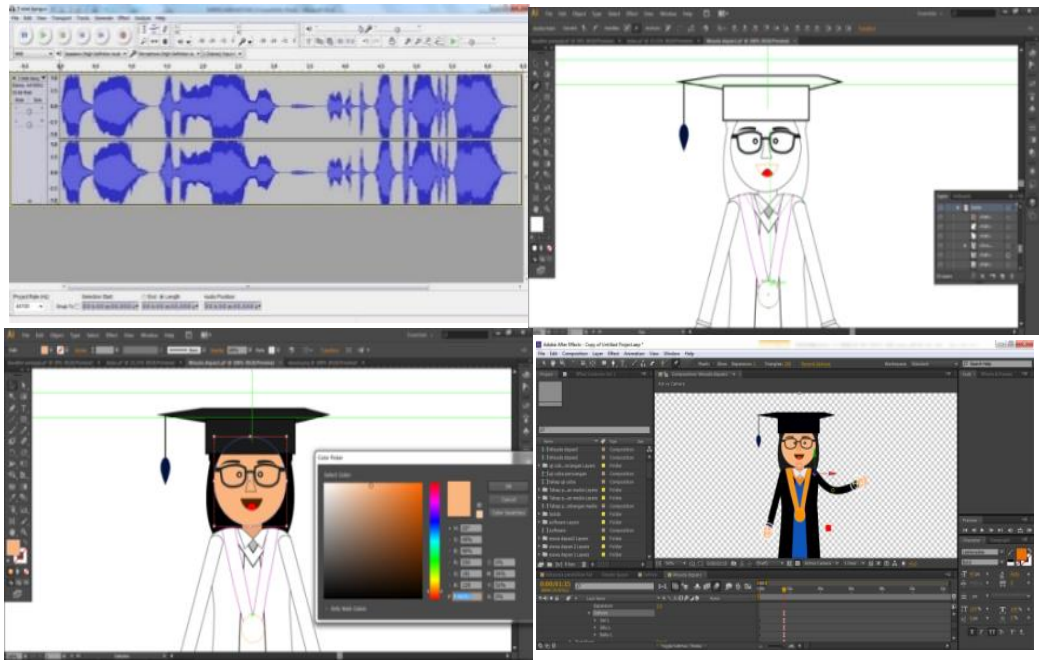
Then, supporting images are also produced in the form of two dimensions, as shown in Table 3. Table 3 contains supporting images such as classrooms and also testing rooms.

The creating process is through development stages, such as audio recording stage, modeling stage, texturing stage, rigging stage, animation stage, rendering stage, and video editing stage. Figure 1(a) and (b) are the result of each stage. It shows that all of the characters of the developed design in every stage is in accordance with the characteristic of the learning process in details. Characterizations were created to make this infographics animation media more unique.

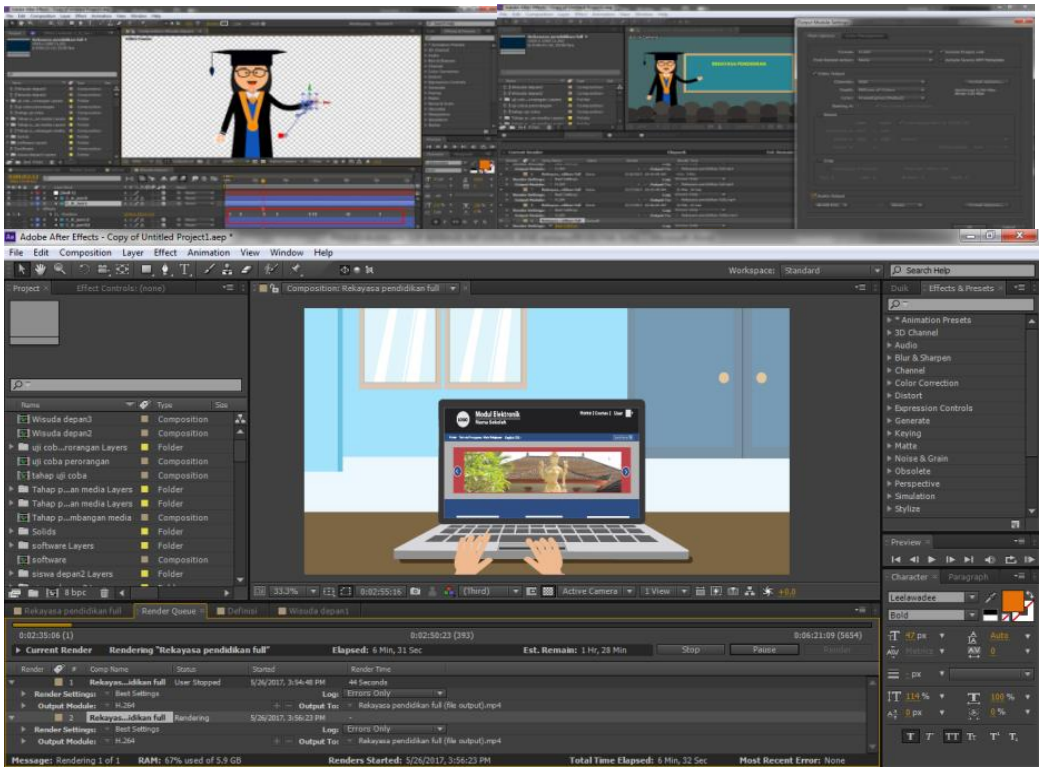
The results of the formative evaluation stage in the expert judgment section (validity test) consist of the results of the tests on content experts, learning design experts, and learning media experts. Each expert test was conducted on two content experts, learning design, and media using the Gregory formula. The test for content experts obtains a score of 1 (very high), while the test of the learning design experts is 0.92 (very high), and the test for learning media experts is 0.90 (very high).

The practicality test results were carried out on 36 students. They are divided into four groups of respondents, with each group consisting of nine randomly-selected students. The practicality test results from user response analysis found a percentage of 86.5% converted into the conversion table stated as "practical".

Moreover, pre-test and post-test were conducted on 20 of the same users when testing user responses. The pre-test and post-test questions used were 20 multiple-choice questions. There are four stages in Animation Infographics in the whole questions: the stages of experimental research, technology and vocation education, informatics engineering research, and educational engineering research. The subject of the experimental research, technology and vocation education, in-formatics engineering research, and educational engineering contained five questions for each.



(a)



(b)

Figure 1.(a) & (b). Results at the Stage of Development of Animation Infographic Media

During the pre-test, the total value of the experimental research stage seen from the user's answer is 70, the score of the technology and vocation education stage is 41, the score of the informatics engineering is 35, and educational engineering is 40. It means that the stage of experimental research's score is 84, the stage of technology and vocation education is 54, the stage of informatics engineering research is 39, and the stage of educational engineering research is 60. Its representation can be seen in Figure 2.

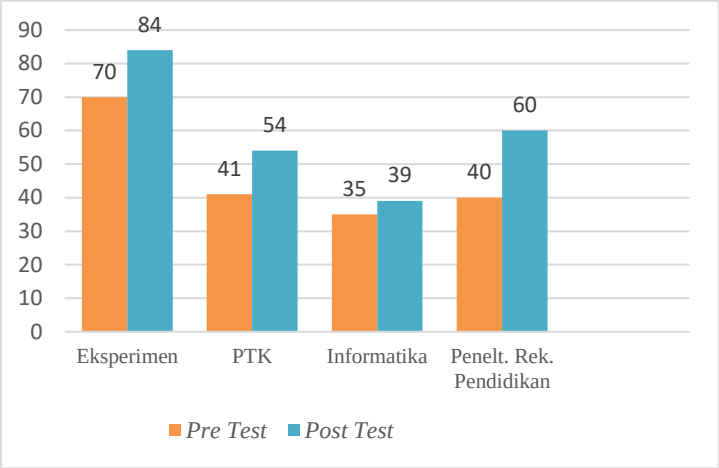


Figure 2. Pretest and Posttest Comparison Value

From the results of the pre-test and post-test analysis, the average percentage increase in the value of 31.62% from the original is 58.5 to 77. The next step is to find the value of N-Gain or Normalized Gain to determine the level of increase in the post-test results. The formula for calculating N-Gain using the formula of the difference between the value of the post-test and the pre-test is divided by the difference in the maximum value with the value of the post-test. After the calculation is obtained, the N-Gain value is 0.8, so that the rate of increase in the results of the post-test goes to the high criteria referring to the four criteria table of normalized gain by Hake (1999), as shown in Table 4. Based on these results, the media infographic animation stages of the study are able to improve the understanding and knowledge of users; in this case, the students of informatics engineering education programs.

Table 4. Interpretation on the Value of g

Range of g Value	Description
$0.7 < g \leq 1$	effective
$0.3 < g \leq 0.7$	Effective enough
$0.0 < g \leq 0.3$	Less effective

Source: Hake (1999)

Infographics, as a messenger media, can be an alternative solution that can be used to improve students' understanding of mastering complex material concepts more easily and quickly. Arigia et al. (2016) in Lankow's book entitled "*Kedasyatan cara bercerita visual*", said that the advantages of visual communication through infographics are that image visualization is able to replace explanations that are too long, and replace complex and full numbers tables (Lankow et al., 2014). With the visualization of the stages of educational research methodology, that pre-viously looks complex and a little confusing, it turns out to be easier and clearer to be done step by step in each type of research.

It is also in line with some previous studies, such as Arigia et al. (2016), Miftah et al. (2016) Susetyo et al. (2015), and Taufik (2012), which mention that the humans' eyes are faster at capturing information presented in visual (graphic) than in textual form, then they tend to put greater attention to reading the contents of the message delivered.

CONCLUSION

It is concluded that the animated media infographics have gone through the stages of instructional development models that refer to Dick and Carey. The results of the formative evaluation, which experts have carried out are as follows. Testing by the content expert obtains a score of 1 (very high), testing by the learning design expert obtains a score of 0.92 (very high), and testing by the learning media expert obtains a score of 0.90 (very high). Then, the result of practicality testing is 86.5%, which is categorized in the practical category, and the result of the effectiveness testing using the Hake formula is the N-gain of 0.8, which is in the effective category. It shows that the Animated Infographic media produced is valid, practical, and effective to improve the mastery of the concept of the educational research methodology course in informatics engineer-

ing education. In order to find out the effect of the product on learning outcomes, it is advised to conduct experimental research or classroom action research so it can move from becoming confusing to be clearer to step up on the stages in each type of research.

REFERENCES

Ackermann, E. (2012). *Piaget's constructiv ism, Papert's constructionism: What's the difference?* (pp. 1–11). https://learn ing.media.mit.edu/content/publications/ EA.Piaget _ Papert.pdf

Agustini, K., Santyadiputra, G. S., & Sugihartini, N. (2017). Efektivitas desain instruksional berstrategi blended learning dengan pendekatan konstruktivistik. *Seminar Nasional Riset Inovatif 5*, 73–79. http://fhis.undiksha. ac.id/wp-content/uploads/2017/12/ PROSIDING-SENARI-2017.pdf

Arigia, M. B., Damayanti, T., & Sani, A. (2016). Infografis sebagai media dalam meningkatkan pemahaman dan keterlibatan publik Bank Indonesia. *Jurnal Komunikasi*, *8*(2), 120–133. https://doi.org/10.24912/jk.v8i2.63

Bellei, M., Welch, P., Pryor, S., & Ketheesan, N. (2016). A cost-effective approach to producing animated infographics for immunology teaching †. *Journal of Microbiology & Biology Education*, *17*(3), 477–479. https://doi.org/10.1128/ jmbe.v17i3.1146

Central Bureau of Statistics. (2012). *Proporsi penduduk berumur 10 tahun ke atas yang membaca selama seminggu terakhir menurut provinsi, jenis bacaan, dan tipe daerah, 2012*. Central Bureau of Statistics of Republic of Indonesia. https://www.bps.go.id/statictable/2014/ 08/20/1521/proporsi-penduduk-berumur-10-tahun-ke-atas-yang-membaca-selama-seminggu-terakhir-menurut-provinsi-jenis-bacaan-dan-tipe-daerah-2012.html

Gredler, M. E. (2009). *Learning and instruction: Theory into practice* (6th ed.). Pearson.

Hake, R. R. (1999). *Analyzing change/gain score*. http://www.physics.indiana.edu/ nsdi/AnalyzingChange-Gain.pdf

Hanum, N. S. (2013). Keefektifan e-learning sebagai media pembelajaran (studi evaluasi model pembelajaran e-learning SMK Telkom Sandhy Putra Purwokerto). *Jurnal Pendidikan Vokasi*, *3*(1), 90–102. https://doi.org/10.21831/ jpv.v3i1.1584

Hassan, H. G. (2016). *Designing infographics to support teaching complex science subject: A comparison between static and animated Infographics*. Master thesis. Iowa State University, Ames, IA.

Lankow, J., Ritchie, J., & Crook, R. (2014). *Infografis: Kedasyatan cara bercerita visual* (A. T. K. Widodo (trans.)). Gramedia.

Miftah, M. N., Rizal, E., & Anwar, R. K. (2016). Pola literasi visual infografer dalam pembuatan informasi grafis (infografis). *Jurnal Kajian Informasi Dan Perpustakaan*, *4*(1), 87–94. https:// doi.org/10.24198/jkip.v4i1.11635

Mulyate, K., Tanudjaja, B. B., & B., B. S. (2013). Perancangan buku kumpulan infografis resep aneka hidangan pembuka dan penutup ala barat untuk anak-anak. *Jurnal DKV Adiwarna*, *1*(2), 1–11. http://publication.petra.ac.id/ index.php/dkv/article/view/1059

Ru, G., & Ming, Z. Y. (2014). Infographics applied in design education. *2014 IEEE Workshop on Advanced Research and Technology in Industry Applications (WARTIA)*, 984–986. https://doi.org/ 10.1109/WARTIA.2014.6976439

Rusman, R. (2012). *Belajar dan pembelajaran berbasis komputer: Mengembangkan profesionalisme guru abad 21*. Alfabeta.

Sindu, I. G. P., & Paramartha, A. A. G. Y. (2018). The effect of problem-based e-learning content on the learning achievement in basic computer system course (DSK) of the student of informatics engineering education department. *Jurnal Pendidikan Vokasi*, *8*(1), 24–32. https://doi.org/10.21831/ jpv.v8i1.18098

Siwi, M. K. (2016). Analysis characteristics of learning styles VAK (Visual, Auditory, Kinesthetic) student of banks and financial institutions course. *Inter national Conference on Education For Economics, Business, and Finance (ICEEBF) 2016*, 437–446.

Suhara, A. M. (2013). *Keefektifan model VAK dalam pembelajaran menulis deskriptif*. Universitas Pendidikan Indonesia.

Suparman, A. (2012). *Desain instruksional modern*. Erlangga.

Susetyo, H. R., Bahruddin, M., & Windarti, T. (2015). Efektivitas infografis sebagai pendukung mata pelajaran IPS pada siswa siswi kelas 5 SDN Kepatihan di Kabupaten Bojonegoro. *Jurnal Desain Komunikasi Visual*, *4*(1). https://jurnal.dinamika.ac.id/index.php/ArtNouveau/article/view/762

Tandirerung, V. A., & Hadi, S. (2014). Implementasi e-learning program keahlian TKJ di SMK DIY pasca pembubaran RSBI. *Jurnal Pendidikan Vokasi*, *4*(1), 96–110. https://doi.org/10.21831/jpv.v4i1.2538

Taufik, M. (2012). Infografis sebagai bahasa visual pada surat kabar Tempo. *Techno.COM*, *11*(4), 156–163. https://doi.org/10.33633/tc.v11i4.1010

Zyainuri, Z., & Marpanaji, E. (2013). Penerapan e-learning moodle untuk pembelajran siswa yang melaksanakan prakerin. *Jurnal Pendidikan Vokasi*, *2*(3), 410–426. https://doi.org/10.21831/jpv.v2i3.1046