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The Correlation Between Digital Simulation Learning, Basic Programming, Mathematics and Students' Knowledge: Optimizing Students' Skill Program for Learning Results

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Abstract: The study aims to investigate students learning results of Mathematics, Digital Simulation, and Basic Programming subjects in Vocational High School 7 Takalar and to identify the correlation between students' learning results on Mathematics and Digital Simulation Subjects and Basic Programming Subject. The research method was ex-post facto. The number of population was 210 and the samples were 63. Data were collected using documentation and test. Hypotheses were tested after performing Prerequisite Test. Results of the study show that: (1) students' learning results in Mathematics were in the Good category. (2) students' learning results in Digital Simulation were in the Good category. (3) students' learning results in Basic Programming were in the Good category. (4) there is a strong correlation between students' learning results in Mathematics and Basic Programming. (5) there is a strong correlation between students' learning results in Digital Simulation and Basic Programming, (6) There is a Correlation between students' learning results on Mathematics and Digital Simulation subjects and Basic Programming subject.

Keywords: Mathematics, Digital Simulation, Basic Programming

INTRODUCTION

Education has a strategic role in improving the quality of human resources and achieving the national goal: to improve public welfare and educate people's lives. The improvement of education quality is the target of development in the national education sector, and it is integrated into the strategies to improve the quality of Indonesian humans holistically (Winata & Friskilia, 2018).

The improvement of human resources quality is a must in Indonesia as the globalization era demands the readiness of the society to compete globally (Atahau, 2016). A country with high quality of human resources will be more developed. Haryoko (2017) stated that education should get attention and better management related to quantity, quality, and relevancy. Therefore, each nation should provide a high quality of education (Aprilisa, 2019). Only high-quality nantions could compete in the free market in the globalization era. Therefore, the educational sector holds an important and strategic role because it is the

medium to create high-quality human resources (Rahayu, 2016).

The important facility to develop human skill is education. To optimally develop the skill, the best education should be provided. As a result, it will produce quality professionals who are sensitive to the environment and can think logically and systematically (Taufik, 2016). Education holds an important role in developing a country as it can direct humans' behavior (Santoso, 2017; Ekayani, 2017; Wijaya, et al., 2016). The development of civilization is determined by the development in education (Ifa, 2013).

One of the programs to develop education in Indonesia by the National Education Institute is establishing Vocational High School. Vocational High School is one of the upper secondary vocational education institutions provided by the government to prepare graduates ready to work in a particular field (Kurniawan, 2012). It is to fulfill the need of workers so that students should have particular skills and professionalism according to their field (Rochman, 2018). According to Tarigan et al. (2013), vocational education aims to prepare graduates ready to work, highly competent for development, and competitive in the globalization era.

The development of vocational education is driven by the community's demand that investments made in the education system must be successful. For this reason, Vocational High School must equip its graduates with the competencies needed at work so that they are able to compete (Sahade, 2018). It is in accordance with the instructional objectives of vocational secondary education, namely, students are expected to be professional, skillful, productive, and creative, and have entrepreneurial skills. For this reason, Vocational High School should equip the students with adequate basic and technical skills (Nolker & Schoenfeldt, 1983).

Yu (2009) mentioned that vocational education graduates had not met the needs of the labor market due to their low quality and professionalism.

Vocational High Schools still need to improve the quality and the skill of the workforce they produce. Some graduates have not been able to meet the demands of employment in accordance with their specialization. It is because there is a gap between the levels of their skills and the ones needed at work (Prabawati, 2012).

Empirical observations on Vocational High School graduates show that most of them are less adaptive to changes in science and technology and are difficult to train and develop themselves (Depdiknas, 2004; Notonegoro, 2010). It is confirmed by the Curriculum Center study (2007b) related to the Vocational High School curriculum policies, which state that on the one hand, adaptive subject groups increase the learning burden of students in Vocational High Schools, while on the other hand, it reduces the time allocation for productive lessons. Apart from that, the addition of material in the curriculum does not support vocational material.

Therefore, the material should be packaged in various subjects grouped and organized into several programs, including productive, adaptive, and normative programs. According to Jofrishal, et al. (2014), productive programs are basic vocational subjects (engineering) which are the main programs, while normative programs are general basic subjects. The subject groups are supposed to support and complement each other, but in reality, they do not, so there is a gap between them.

One of the skills taught in Vocational High School is "Information and Communication Technology," which consists of several "Skill Programs." One of the Skill Programs under the Information and Communication Technology is "Computer and Informatics Engineering." The Computer and Informatics Engineering program covers several "Competencies," including "Computer and Network Engineering."

The subjects provided by the Computer and Network Engineering program consist of (1) normative programs, (2) adaptive programs, and (3) productive programs. Because the subjects are determined based on the required competencies, they are interrelated. The Ministry of Education and Culture of the Republic of Indonesia (2013) stated that "Each subject is designed to be related to one another and has basic competencies that are bound by the core competencies ."

Vocational High School 7 Takalar is located in Takalar Regency, South Sulawesi. This school provided Computer and Network Engineering Program, which is based on the current curriculum, consists of (1) normative

program, (2) adaptive program, and (3) productive program. However, the author focused on the adaptive subjects associated with students' knowledge of productive subjects.

Based on the preliminary study conducted in the research site, adaptive subjects were not really contributive to productive subjects. Mathematics and Digital Simulation subjects were supposed to support the productive subjects like Basic Programming. However, students who got high scores on adaptive subjects did not always get good scores on productive subjects and vice versa. Adaptive subjects should support the core subjects in the program (E.Mulyasa, 2007). Data about students' achievement obtained before students remedial shows that among 34 students, 24 passed the standard score of Math (75%). In the Digital Simulation subject, 26 students (76%) passed the standard score. Furthermore, in the Basic Programming subject, 59% of students passed the standard score (Source: The teacher of Network and Computer Engineering subject of Vocational School 7 Takalar, 2018).

According to the data, the percentages of students who passed the standard score of adaptive subjects were higher than those who passed the standard score of productive subjects. The standard score applied in the school was 70, both individually and classically. Classically, only Math and Digital Simulation subjects showed completeness above 70%.

Thus, the current study aimed to investigate the correlation between the learning outcomes of Mathematics and Digital Simulation subject and students' knowledge on Basic Programming subject.

METHOD

This correlational study is applied research with ex post facto method. (Sugiyono, 2010) stated that a correlational study aims to measure how strong the correlation between variables is.

The study was conducted in Vocational High School 7 Takalar from April to June 2021.

The research population was all students of the school's Computer and Network Engineering program (210 students). They were from classes X TKJ 1, X TKJ 2, X TKJ 3, XI TKJ 1, XI TKJ 2, XI TKJ 3, XII TKJ 1, XII TKJ 2, and XII TKJ 3. While the samples were determined through the *Proportional Random Sampling* technique selecting 30% students from each class. The total number of samples was 63.

The research variables consisted of two independent variables (X1 and X2) and one dependent variable (Y). The first independent variable was the Mathematics learning result, while the second independent variable was the Digital Simulation learning result. The dependent variable (Y) referred to students' knowledge of the Basic Programming subject.

Data were collected using documentation and test, and they were analyzed through pre-requisite analysis consisting of normality and linearity tests. The data were categorized as normal if the skewness scores were between -1 and 1, meaning that the data was distributed normally (Arikunto, 2010). Hypotheses were tested using simple and multiple regressions.

RESULTS AND DISCUSSION

Results

Research data were analyzed using SPSS analysis to answer the research questions. To test the hypotheses, data were analyzed through simple and multiple regressions. Before testing the hypothesis, pre-requisite analysis was performed consisting of normality and linearity tests. Below are the results of the pre-requisite analysis.

Table 1. Results of Normality Test on Variables

Variables	*Skewness* Scores	Information
Mathematics	-0.091	Normally distributed
Digital Simulation	-0.411	Normally distributed
Basic Programming	-0.608	Normally distributed

Table 1 above shows the results of the normality test performed on data. The skewness score of mathematics=-0.091, Digital Simulation = -0.411, and Basic Programming = -0.608. Those scores are in the intervals -1 and 1, meaning that all have a normal distribution. Furthermore, the results of the linearity test are shown in the table 2.

Table 2. Results of Linearity Test

Variables	Nilai *Linearity* Sig.	Information
Mathematics and Basic Programming	0.000	There was a linear correlation
Digital Simulaion and Basic Programming	0.009	There was a linear correlation

Table 2 above shows that the significance level of the linearity score of 0.000 was (Sig. 0.000) < 0.05 (alpha 5%), meaning that there is a linear correlation between learning results of Mathematics and Basic Programming. While the significance level of linearity score of 0.009 (Sig. 0.009) < 0.05 (alpha 5%) indicates that there is a linear correlation between Digital Simulation and Basic Programming.

After all pre-requisite analyses had fulfilled the criteria, we tested the hypotheses test through simple and multiple regressions. However, prior to that, we analyzed the students' learning results on Mathematics, Digital Simulation, and Basic Programming. Below are the data.

Table 3. Description of Students' Learning Results on Mathematics

No	Intervals	Criteria	Frequencies	Percentages
1.	91 -100	Very good	0	0
2.	75 - 90	Good	46	73%
3.	60 - 74	Fair	17	27%
4.	54 - 59	Low	0	0
5.	< 54	Very Low	0	0
			63	100%

Based on table 3, students' Mathematics learning results were in the Good category as, among 63 students selected as samples, 46 of them (73%) got scores between 75 and 90 which were categorized Good, and 17 students (27%) got the scores in the Fair category. Based on the data, the Mathematics learning results of students of the Computer and Network Engineering Program in Vocational High School 7 Takalar were good.

Table 4. Description of Students' Learning Results on Digital Simulation Subject

No	Intervals	Criteria	Frequencies	Percentages
1.	91 -100	Very good	0	0
2.	75 - 90	Good	50	73%
3.	60 - 74	Fair	13	27%
4.	54 - 59	Low	0	0
5.	< 54	Very Low	0	0
			63	100%

Based on Table 4, students' understanding of Digital Simulation was in the Good category as among 63 students involved as samples, 50 of them (79%) were in the Good category, and 13 students (21%) were in the Fair category. Based on the findings, students' learning results of Digital Simulation subject in the Vocational High School 7 Takalar, especially in the Computer and Network Program was in the Good category.

Table 5. Description of Students' Learning Results on Basic Programming Subject

No	Intervals	Criteria	Frequencies	Percentages
1.	91 -100	Very good	3	0
2.	75 - 90	Good	43	73%
3.	60 - 74	Fair	17	27%
4.	54 - 59	Low	0	0
5.	< 54	Very Low	0	0
			63	100%

Based on Table 5, students' learning results in Basic Programming subject were in the Good category as among 63 students selected as samples, 3 of them (5%) got the scores in the Very Good category, 43 students (68%) were in the Good category, and 17 students (27%) got the scores in the Fair category. Based on the data, students' learning results on Digital Simulation on Computer and Network Engineering Program in Vocational High School 7 Takalar were good.

Results of Test on Hypothesis

Table 6. Results of Simple Regression Test on Correlation Between Learning Outcomes of Mathematics and Basic Programming Subjects.

Hypothesis	R	R Square	Sig.	Information
There is a correlation between the students' learning outcomes of Mathematics and Basic Programming subjects in Vocational High School 7 Takalar	.418	.175	.001	Ho was rejected Ha was accepted

Based on table 6 above, the R score = 0,418 and the significance value (Sig.) was 0,001 which was smaller than the level of α 5% (0,001 < 0,05). It shows that hypothesis 0 was rejected, and the alternative hypothesis was accepted. Thus, based on the inferential statistic analysis, it can be concluded that there is a correlation between the students' learning results on Mathematics and Basic Programming in Vocational High School 7 Takalar. While Mathematics contributed 17.5% on Basic Programming subject, as shown in Table 6, the R square value was 0,175.

Table 7. Results of Simple Regression Test on Correlation Between Learning Outcomes of Digital Simulation and Basic Programming Subjects

Hypothesis	R	R Square	Sig.	Ket
There is a correlation between the students' learning outcomes of Digital Simulation and Basic Programming subjects in Vocational High School 7 Takalar	.357	.128	.004	Ho was rejected Ha was accepted

Based on table 7 above, the value of R= 0.357 with the significance level (Sig.) of 0.004. The significance score was smaller than α level 5% (0,004 < 0,05). It indicates that the null hypothesis was rejected while the alternative hypothesis was accepted. Thus, based on the inferential statistic analysis, there was a correlation between the students' learning

results on Digital Simulation and Basic Programming in Vocational High School 7 Takalar. Digital Simulation subject contributed 12.5% on Basic Programming subject as Table 7 shows that R square value was 0,128.

Table 8. Results of Multiple Regression Test on Correlation Between Learning Outcomes of Mathematics and Basic Programming Subjects

Hypothesis	R	R Square	Sig.	Information
There is a correlation between the students' learning outcomes of Mathematics and Digital Simulation Subject and Basic Programming subject in Vocational High School 7 Takalar	.486	.236	.000	Ho was rejected Ha was accepted

Based on table 8 above, the value of R= 0.486 with the significance level (Sig.) of 0.000. The significance score was smaller than α level 5% (0,000 < 0,05). It indicates that the null hypothesis was rejected while the alternative hypothesis was accepted. Thus, based on the inferential statistic analysis, there was a correlation between the students' learning results on Mathematics and Digital Simulation Subjects and Basic Programming Subject in Vocational High School 7 Takalar. Mathematics and Digital Simulation subjects contributed 23.6% on Basic Programming subject as Table 8 shows that R square value was 0,236.

Discussion

Research findings show that students learning results on adaptive subjects (Mathematics and Digital Simulation) in Computer and Network Engineering Program in Vocational High School 7 Takalar were in the Good category. It indicates that the scores completed the minimum standard score set by the school, which is 70 (individually). However, the scores were obtained after students took remedial exams. The current findings are similar with Atmoko (2015) that in Vocational High School 1 Magelang, the students' learning outcomes of Mathematics and Physics subjects in the Electrical Power Installation Engineering program were also in the Good category.

The current study found that students' knowledge on Basic Programming subject in Vocational High School 7 Takalar was in the Good and Very Good categories as 73% students were in the categories and only 27% students in Fair category. It indicates that the learning process in Vocational High School 7 Takalar, especially in the Computer and Network Engineering Program was effective because the set minimum standard score had been achieved both individually and classically. It is similar to the study by Danawuri (2015), which found that 83.7 % of students got Good and Very Good scores in Basic Programming in Software engineering in Vocational High School 7 Singosari.

Since the study found that the correlation between Mathematics and Basic Programming subjects got the R-value of 0.418, it was not strong (medium). However, it suggested that Mathematics still should be provided in the Vocational High School curriculum especially in Computer and Network Engineering program. Also, as the correlation between the Digital Simulation subject and Basic Programming subject showed the R-value of 0,357, it was also not really strong (medium). Yet, the curriculum of Vocational High School, especially Computer and Network Engineering Program, should provide the Digital Simulation subject.

Mathematics and Digital Simulation subjects together showed a correlation with Basic Programming subject with R = 0.486. It indicated a medium correlation and suggested the need to retain those subjects in the curriculum of Computer and Network Engineering Program in the Vocational High School.

A similar study was conducted by Rinasa Agistya (2014), which found that the correlation between Mathematics subject and the vocational subject had the R-value of 0.391. It means that the correlation was low. Furthermore, Prasetyo (2012) study shows a positive and significant correlation between students' achievement on

adaptive subjects and their understanding of the academic character with the R-value of 0.26.

As the Mathematics and Digital Simulation subjects contributed to Basic Programming subject at 23.6%, students' understanding of Basic Programming is determined by their achievement in Mathematics and Digital Simulation at 23.6%. Other factors determine the rest. These two subjects are regarded as quite strongly influential because the other 76.4% should consist of a number of internal and external variables (factors) affecting students' mastery of a subject.

Based on the findings of current and earlier relevant studies, the correlation between adaptive and productive subjects in Vocational High School is not strong. However, the adaptive subjects still positively contribute to the success of productive subjects. Thus, it can be concluded that adaptive subjects are still important in the Vocational High School curriculum, especially for Basic Programming subject in the Network and Computer Engineering program.

CONCLUSION AND SUGGESTION

Based on the data and analysis, we concluded that: (1) The Mathematics learning outcome of Computer and Network Engineering students in Vocational High School 7 Takalar was in the Good category as among 63 students selected as research samples, 43 of them (73 %) got scores between 75 and 90 (Good); (2) The Digital Simulation learning outcome of Computer and Network Engineering students in Vocational High School 7 Takalar was in the Good category as among 63 students selected as research samples, 50 of them (79 %) got scores between 75 and 90 (Good); (3) The Basic Programming learning outcome of Computer and Network Engineering students in Vocational High School 7 Takalar was in the Good category as among 63 students selected as research samples, 43 of them (68 %) got scores between 75 and 90 (Good), and 3 students (5%) got scores in the range between 91 and 100 (Very Good); (4) There was a positive correlation between the learning outcomes of Mathematics and Basic Programming subjects of Computer and Network Engineering students in Vocational High School 7 Takalar with the R score of 0.418 and Sig. value of 0.001 < 0.05 and the contribution was at 17.5%; (5) There was a positive correlation between the learning outcomes of Digital Simulation and Basic Programming subjects of Computer and Network Engineering students in Vocational High School 7 Takalar with the R score of 0.357 and Sig. value of 0.004 < 0.05 and the contribution was at 12.8%; (6) There was a positive correlation between the learning outcomes of Mathematics and Digital Simulation subjects and Basic Programming subjects of Computer and Network Engineering students in Vocational High School 7 Takalar with the R score of 0.486 and Sig. value of 0.00 < 0.05 and the contribution was at 23.6%.

Based on the conclusions above, we suggest: (1) the curriculum makers of Computer and Network Engineering program in Vocational High School to retain the Mathematics, Physics, and Digital Simulation subjects because they contribute to productive subjects, especially Basic Programming, (2) teachers of Mathematics and Digital Simulation in Vocational High School especially in Computer and Network Engineering Program, to prioritize productive subjects to optimize the contribution of Mathematics and Digital Simulation on productive subjects; (3) the next researchers to investigate the correlation between or contribution of adaptive subject and/ on productive subjects in Vocational High School using the test as the instrument to get data from each variable.

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