Jurnal Pendidikan Vokasi
Vol. 9, No 2, June 2019

9 772476 940005

9 772088 286003

JURNAL PENDIDIKAN VOKASI

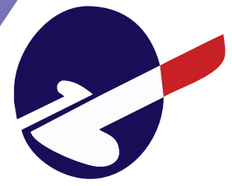
Volume 9, No 2, June 2019

Volume 9, No 2, June 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 2, June 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. 2, June 2019

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (105-118)
Online: http://journal.uny.ac.id/index.php/jpv

DESIGNING AND QUALITY TESTING OF "DIGICHIP" VIRTUAL SIMULATION SOFTWARE OF ANDROID PLATFORM FOR MOBILE-VIRTUAL LEARNING SUPPORTING VOCATIONAL MECHATRONICS ENGINEERING

Titih Rejyasmito Hadi
Universitas Negeri Yogyakarta

Eko Marpanaji
Universitas Negeri Yogyakarta

Abstract

Technology enhancement in any life aspects is undeniably crucial to face the globalization era. A strategic approach to touch any life aspect is gained through education. Supporting this educational long-term goal, this study aims to: (1) produce learning media in the form of a virtual-learning simulation software, which is capable of operation on mobile devices to facilitate mobile, portable, effective, economical, and operationally-safe learning; (2) test the developed software quality in terms of the functional aspects of suitability, maintainability, portability, and usability (ISO/IEC 25010). The subjects of this Research and Development (R&D) study were class XI students of Mechatronics Engineering at SMTI Yogyakarta. The process of designing and testing software uses the V-model type Software Development Life Cycle (SDLC). Unit testing was done through the white-box technique with the base-path test, flowgraph, and independent path. The testing for integration, system, and acceptance used Black-box techniques. The study shows that: (1) V-models were used to design the "DigiChip" virtual simulation software to support virtual learning and mobile learning through the software development stage; (2) The software quality testing based on ISO/IEC 25010 shows that in the functional aspects suitability, all features function properly (very decent), its maintainability is of MI 84 (easy maintenance), it gains 100% portability, or can be operated on all Android OS kernels (very feasible), and its usability is 86.18% (very feasible) with Cronbach's Alpha 0.841 (good). Ninety percent of media experts and 100% of material experts consider that the developed software is very feasible.

Keywords: *simulation, virtual learning, mobile learning, mechatronics*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.23570*

Contact Titih Rejyasmito Hadi titih.rejyasmito@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

The development of science and technology is increasingly complex nowadays. Technology has an essential role in almost all aspects of human life needs. Similarly, the development of the world of digital technology and mobile computer technology has now been developed in the form of handhelds. The development of computer peripheral technology in an increasingly practical form makes various computer features can be enjoyed only on the hand. Technology is truly born to provide something useful and improve the quality of life for humankind. Technology is used as a learning tool and medium in the world of education, which will provide new productivity and skills. Thus, it must be supported by wise behavior in using computer handheld technology in a productive, educative direction, not even in the direction of being counterproductive. The wise behavior in using technology must be a top priority in giving birth to a generation that has a high level of quality in a nation.

Many people view handheld computer devices as the tools which can only be used as a means of entertainment and communication, even though the use of a more educative direction is very necessary to be published. One of them is simulation-based learning media and virtualization technology. Practical, efficient, economical, and safe levels, of course, become more points for simulation and virtual based learning media. It is expected to be very helpful in overcoming students' learning difficulties when faced with problems of limited tools, materials, time (study hours in class/lab/workshop), and learning systems that have to take turns and group.

A mobile device that is a Personal Computer (PC) device is certainly owned by each student personally. Learning activities in a personal and independent manner without having to depend on practical hours, tools, and lab materials provided by the school can be overcome. Students will have more hours of study and can study anytime, anywhere. This research is expected to provide education to the wider community and users of handheld computer devices as a medium that can be used in a more productive direction, in this case, as a medium for learning. Educators and students often use equipment such as; cellphone, smartphone, tablet-PC, which lately has become a device that is so familiar in everyday life. The development of computer technology up to now gave birth to new learning innovations based on this mobile device (Mobile Learning).

Learning activities using mobile devices can be used as an alternative in the problems of the digital engineering learning process, in the form of problems with the availability of equipment and lab materials. The main equipment is, of course, an I/O Digital Logic Board, which is an electronic hardware that functions to process the logic gate chip into an output in the form of a visual display that is usually in the form of an LED indicator light or in the form of segmentation. I/O Equipment Digital Logic Board is the main equipment of digital engineering practicum, which is difficult for each student individually. The availability of lab materials is also a problem in the process of digital engineering learning. The practicum material in the form of a logic gate chip is non-reusable, the arrays when damage occurs is difficult to repair. Damage to a logic gate chip can only be overcome by replacing a new logic gate chip. Because of the nature of the logic gate chip in its use when learning must operate on-off continuously in high intensity. Though when learning is possible, each student spends some practice material in the form of a logic gate chip.

Virtual simulation-based learning media will be more economical, efficient, portable, and safer to operate. Likewise, in this research development, the domain of mobile-based learning was chosen because mobile technology equipment in the form of smartphones and tablet-PCs was students' personal equipment, which the majority of them use and own. The effective value of learning that one student has one media learning will undoubtedly be realized. This development research designs and tests the quality of a learning medium that has the ability as a digital learning media in its original physical form, to be in the form of a virtual simulation. Another concept of innovation in simulation learning media products is the character of products that are off-line, so students are more comfortable to learn because they can use it without having to spend more on costs and depend on the internet connection. This development research, as its main purpose, is to provide innovation in the conversion of learning activities to digital techniques that

require high costs, become completely free of cost, as well as security and other operational conveniences. Research activities carried out to realize an adaptation and competitive nature of the development of the world of technology and vocational education are expected to be realized. Since the presence of the era of global competition requires the vocational education to develop and keep pace with the development in the world of work, therefore, it is important for vocational education to held competencies and remain relevant with demands of the world of business and industry in the era of global competition (Tamrin, Slamet, & Soenarto, 2018, p. 41).

RESEARCH METHOD

This research used the Research and Development (R&D) research method. The software design and testing process used the V-model Software Development Life Cycle (SDLC) method, consisting of (Pressman, 2010, p. 40): (1) Requirement modeling, (2) Architectural design, (3) Component design, (4) Code generation, (5) Unit testing, (6) Integration testing, (7) System testing, and (8) Acceptance testing, as seen in Figure 1.

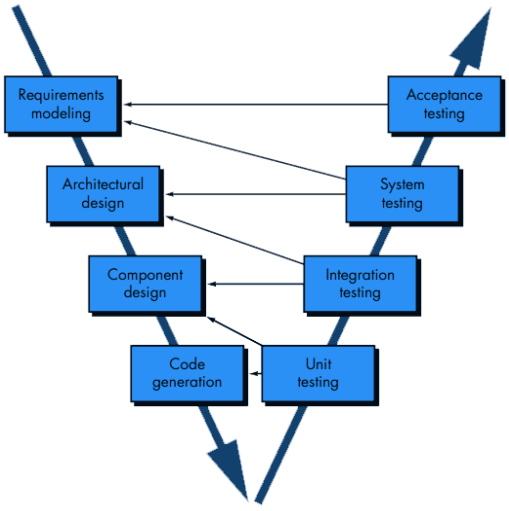


Figure 1. V-model Stage

Software quality testing refers to ISO 25010, in the functional aspects of suitability tested using a list of run tests and test cases. Maintainability aspects were tested through measurements of Maintainability Index (MI), Duplication Source Code, Line of Code (LoC), and Cyclomatic Complexity (CC). Portability aspects were tested through installation activities on various types of hardware configurations and kernel versions of the Android OS. The usability aspect was tested using USE Questionnaire on users and Cronbach's Alpha calculations.

The Requirement modeling phase is carried out through a needs analysis activity in the form of potential user needs found in the school environment. Students are very limited by the problems of the limitations of tools, materials, time (study hours in class/lab), and learning systems that have to take turns or groups. The cost of the learning equipment is too high if students must have to study independently at home. The Architectural stage was done through analysis of media design concepts that are in accordance with digital engineering subject learning. Designing software such as what can overcome the problems faced by students, as well as what hardware can run the software made. Information was collected through observation and interviews.

The Component design stage was done by the process of designing components and systems according to the description of the system requirements analysis that was known in the previous stage. Component design is described in the Unified Modeling Language (UML), flowchart, and user interface (UI). The Code generation stage is an implementation program code design oriented to the system that has been made. The language of the programming code in this study is C#.

Phase Unit testing was done for the smallest part of the software, such as base-path, which consists of Flowgraph, Cyclomatic Complexity (CC), Independent Path to design a Test case. The CC calculations use elements in the form of edges and nodes (Najadat, Alsmadi, & Shboul, 2012, p. 2). Calculation of CC was conducted with the following formula (Equation 1) (McCabe, 1976, p. 308).

$$V(G) = e - n + p \qquad (1)$$

Notes:
V(G) = *Cyclomatic Complexity*
e = number of *edges* on *flowgraph*
n = number of *node* on *flowgraph*
p = connected component

Connected Components (p) has a constant value of the number "2" (Laplante, 2007,

p. 176). Unit testing is the first stage of testing carried out by the engineer or maker on the smallest part of the software made. The unit testing stage uses the white-box testing technique (Watkins & Mills, 2011, p. 52). Integration testing stage was done by testing the smallest part of the software that has been put together. Integration testing is carried out by the concerned engineer using the checklist method, run test, and test case. Integration testing was done to measure the level of functional suitability on ISO 25010 software quality parameters.

Stage System testing was carried out by the engineer concerned when all software components have become a whole unified system. System testing was done to measure the level of maintainability and portability of the software made. Maintainability aspects were tested through the measurements of Maintainability Index (MI), Code Duplication, Line of Code (LoC), Cyclomatic Complexity (CC). The portability aspect uses installation activities on various types of hardware configurations. The results of the duplication code calculation were converted to the rating table to find out the quality of the source code script. Table 1 presents the duplication assessment classification (Heitlager, Kuipers, & Visser, 2007, p. 7).

Table 1. Duplication Source Code Assessment Classification

	Rank	Duplication
++	very small	0-3%
+	small	3-5%
o	moderate	5-10%
-	big	10-20%
--	extremely big	20-100%

The acceptance testing stage was done through media experts, material experts, and users. The material experts are digital engineering subject teachers. The users or respondents are 59 students of Mechatronics Engineering Department of the Vocational High School-Industrial Engineering Vocational High School (or *Sekolah Menengah Kejuruan - Sekolah Menengah Teknik Industri* (SMK-SMTI)) class. The acceptance testing process was done to measure the usability aspects of the software by using a standard USE Questionnaire.

Testing on the functional aspects of suitability was done using a list of test cases that contain all the functions of the features in the "DigiChip" software. The list of test cases refers to the format of Williams (2006, p. 44). Data analysis techniques in testing the functional aspects of suitability by giving a checklist to each test case that is able to function properly. The data of the test results are converted into percentages. The percentage obtained was then converted into definitions of feasibility. The feasibility category refers to the feasibility table proposed by Arikunto (2013, p. 35), as shown in Table 2.

Table 2. Feasibility Classification

Number (in %)	Classification
< 21	Very Not Feasible
21 - 40	Not Feasible
41 - 60	Enough
61 - 80	Feasible
81 – 100	Very Feasible

The maintainability aspect was tested by calculating the value of the Maintainability Index (MI) which consists of three components, namely the Line of Code (LoC), Cyclomatic Complexity (CC), and Duplication Source Code. The LoC measurement phase was done by calculating the source code manually, which is the calculation of the size of the software made. The size of the software created is a factor for diagnostic assessment and analysis requirements in software using the Line of Code (LoC) metric (Koyya, Lee, & Yang, 2013, p. 3). The process of calculating the Duplication Source Code was done using Gendarme 2.11 software. Calculation of the value of Maintainability Index (MI) was processed using software that is used to compile C# language code scripts in the code generation process that has an analyzer feature. The value of MI that has been obtained was translated into the care classification (Microsoft Developer, 2007), as shown in Table 3.

Table 3. MI Value Classification

Maintainability Index (MI)	Classification	Symbol
0 - 9	Difficult Maintain	
10 - 19	Medium Maintain	
20 - 100	Easy Maintain	

Testing the portability aspect consists of the installation, uninstalling, operating on various kernel versions of the Android OS, and

sharing the hardware configuration. The instrument used is a checklist to record test results. The usability aspects were tested using instruments in the form of questionnaires given to the users. Testing in measuring the usability level of software is a beta testing aspect (Chemuturi, 2011, p. 183). The usability test questionnaire used was the USE Questionnaire (Lund, 2001, p. 4). The USE Questionnaire is highly recommended because it contains various aspects including Usefulness, Satisfaction, Ease of Use, and Ease of Learning and has a Likert scale for its level (Tullis & Albert, 2013, p. 142). The assessment technique for usability aspects uses a Likert scale, because it is related to the activities of measuring attitudes, opinions, and perceptions of a person or group about social events or symptoms, by giving five choices of scale responses (Riduwan, 2013, p. 13) (see Table 4).

Table 4. Likert Scale

Alternative Answers		Score
(STS)	Very Disagree	1
(TS)	Disagree	2
(N)	Neutral	3
(S)	Agree	4
(SS)	Very Agree	5

The reliability test of the USE Questionnaire questionnaire was conducted using the Cronbach Alpha analysis method. The criteria for a research instrument are said to be reliable if the reliability coefficient index number is (r11)>0.6 (Arikunto, 2013, p. 319).

Testing the media expert stage was done to find out the quality of the media from the perspective of media experts. The characteristics of media that are good in mobile learning are having characteristics that are in accordance with the device in question (mobile tools), namely mobile devices that have the characteristics of small size and small screen resolution, of course, requires software that is adjustable (Pachler, Bachmair, & Cook, 2010, p. 68). The characteristics of such mobile devices lead to indicators and instrument grids of software media specifications that must be oriented towards adjusting the user interface design and visual appearance, namely in the form of images, symbols, colors, buttons, animations, letters, which correspond to the characteristics of mobile devices which, mostly, are small. After the grid of instruments for evaluating the media expert has been compiled, it was subsequently confirmed in the form of a statement. Testing the aspects of material experts is based on learning material and the characteristics of digital engineering learning devices.

RESULTS AND DISCUSSION

Requirement Modeling

The design activity of digital engineering learning software "DigiChip" begins with the collection of information and data about product detail specifications that represent the user's needs. The process carried out includes: (1) observing the teaching and learning process when using digital engineering hardware devices to determine the level of weakness in the use of hardware media, the level of danger, and risk during the teaching and learning process, (2) conducting interviews with students, laboratory/workshop managers and teachers, about difficulties and weaknesses the use of teaching and learning methods that have been carried out so far, such as the problem of students not being able to study independently at home because of limited equipment which is only available at school, the problem of expensive digital engineering learning devices if students must have it to study independently at home, digital learning activities that must take turns or groups because of the limited digital engineering equipment, (3) discussions about effective and efficient media specifications for the needs of students and teachers in the learning process of digital logic gate techniques.

The results of studying various problems from the information that has been obtained show that, (1) scientifically, the working mechanism of an IC (Integrated Circuit) cannot be understood only by looking at the external physical form, as well as the IC logic gate in digital techniques that have many system variants work. The solution to overcome this problem is the concept of a learning media product which can simulate the working mechanism of the real hardware. The concept of digital engineering learning media products is in the form of software that is packaged in devices that are easily accessible/owned by students, flexible, and portable. (2) The software which is made can be operated on smartphone

devices, not on laptops or PCs because almost all students have a smartphone, even more than one unit, but not all students have a laptop or PC. (3) The software made accommodates the basic needs of digital engineering subjects, such as material about six logic gates base (NOT, AND, OR, NAND, NOR, XOR), providing truth tables as auxiliary material facilitates the logic gate learning process. (4) Students can operate various working mechanisms from six basic logic gate systems, for students to understand the characteristics of the system.

Architectural Design

The design process consists of; (1) User Experience (UX) Design, and (2) User Interface (UI) Design. The UX design process for this "DigiChip" product uses the UML language as a system design model. The system mechanism in this research product is described in the three main diagrams of the modeling language, namely (a) use case diagrams, (b) activity diagrams, and (c) sequence diagrams. The scheme in the use case diagram contains the working mechanism of the "DigiChip" product system. The use case diagram scheme displays the user's mechanism to operate various features designed in the "DigiChip" software for mobile devices. Figure 2 shows the design of a use case diagram from the "DigiChip" software.

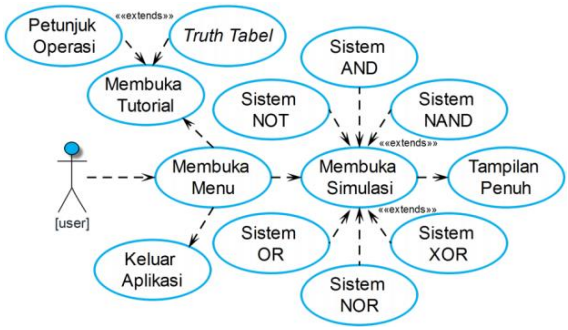


Figure 2. Use Case Diagram

The next process in designing learning media software Digital Techniques "DigiChip" is making activity diagrams, as presented in Figure 3. An activity diagram explains how a software works on instructions or stimuli provided by the user so that there is an interaction between the user with the machine (mobile device) after the expected plan (see Figure 4).

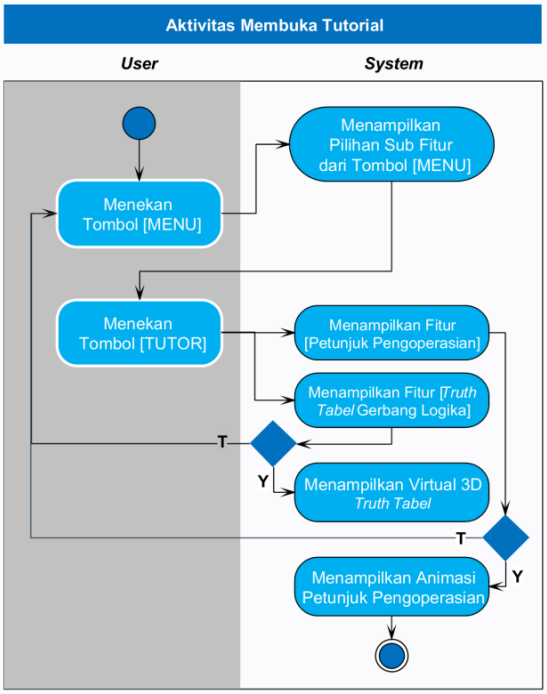


Figure 3. Activity Diagram of Tutorial

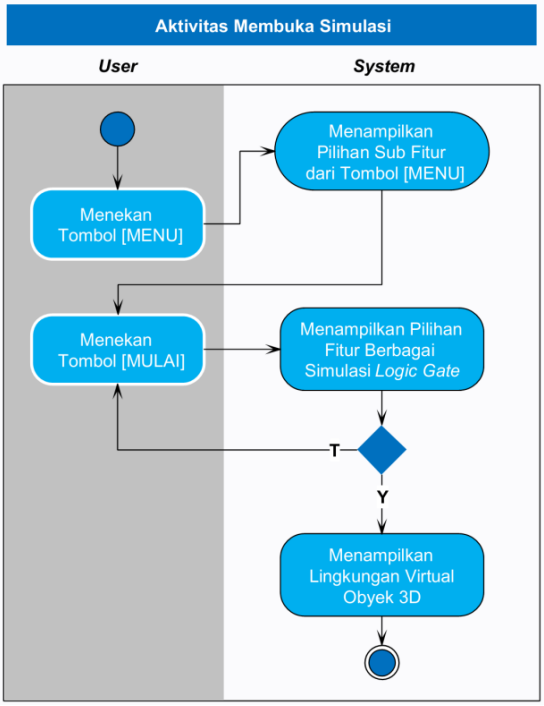


Figure 4. Activity Diagram of Simulation

The next step is designing sequence diagrams (Figure 5), which function as modeling languages that describe user activities in interacting with machines/systems. User interaction activities with the system are described in a timeline.

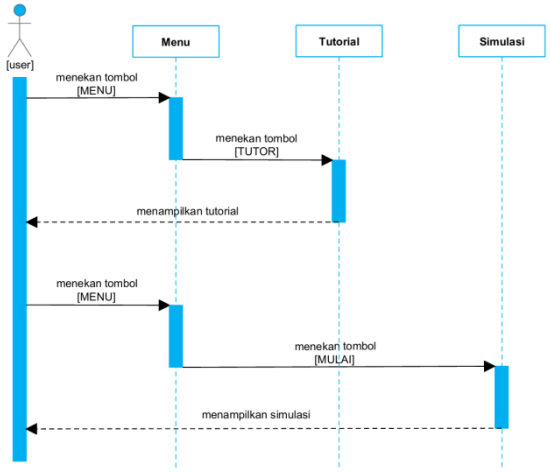


Figure 5. Sequence Diagram

The next stage of the process in architectural design is the design process of the User Interface (UI) to adjust the user's comfort when interacting with the mobile device through the touchscreen. Ergonomics of operational convenience refers to the placement of various positions of UI components on the screen so that it is convenient to operate with one or two hand grips. The placement of various UI component positions in the "DigiChip" software is designed based on other consideration factors, namely the consideration that the majority of users have a culture of right-handed users, not left-handed. The UI in the "DigiChip" software consists of various pages/screens, including (a) splash screen, (b) home screen, (c) simulation screen, and (d) tutorial screen (see Figure 6 & Figure 7).

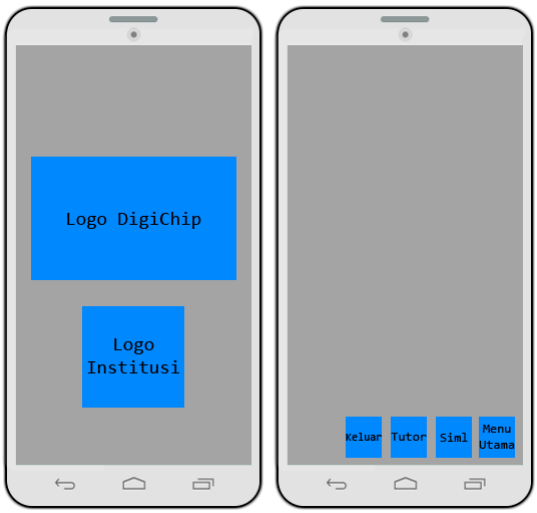


Figure 6. UI Screen – Splash & Home

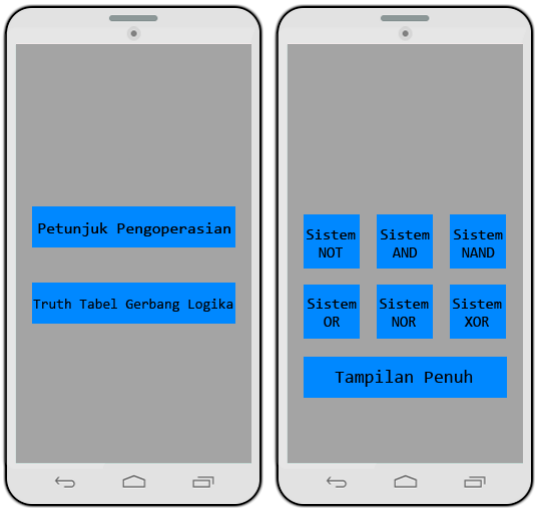


Figure 7. UI Screen – Simulation

Component Design

The next process in designing "DigiChip" software is component design, which is the activity of designing various 2D and 3D components needed to realize "DigiChip" Digital Engineering learning media software (Figure 8). Component design activities involve around four software builders in the form of specialties for 2D object design, 2D object coloring, 2D skin making, 3D shape designers, 3D object coloring, and 3D textures and materials.

Figure 8. Splash-Home Screen

Various components of 3D objects in "DigiChip" software such as ICs, IC sockets, LEDs, LED ports, switches, are designed to have dimensions and scale ratios exactly the same as the actual object components, with

reference to the component datasheet specifications, as seen in Figure 9. Such process is carried to create a three-dimensional world that has a reality that really resembles the real object, so that "DigiChip" software products will not be found in various peculiar shapes, scale ratios, sizes, and other visual oddities in objects/components.

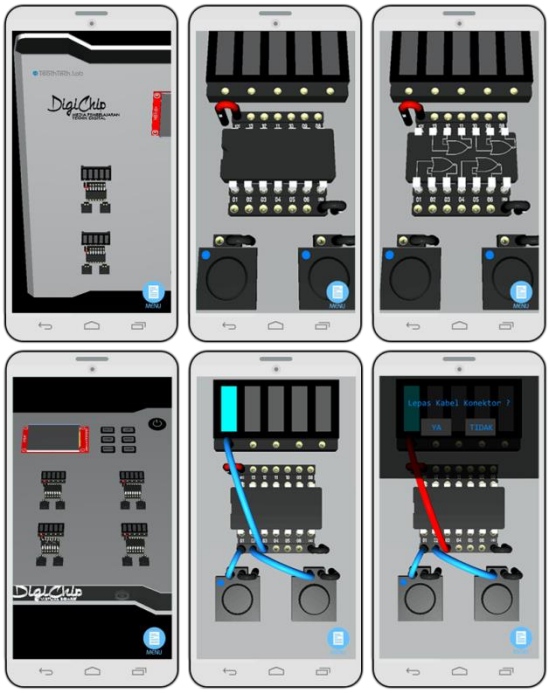


Figure 9. Designing Virtual Dimensions

The menu button on the "DigiChip" software was designed to have a show-hide character, as a consideration of convenience in order to enjoy the overall screen display when running virtual simulations, without being blocked by a series of sub menu buttons from the main menu. The home page on "DigiChip" is designed collaboratively between various 2D menu buttons with Digital Engineering 3D board objects, as a consideration of accessibility convenience and the artistic character of "DigiChip" products.

Code Generation

The stage of code generation in the software design process "DigiChip" is the activity of compiling C# language scripts based on the planned algorithm system. The stages of compiling code scripts for later use as 2D, and 3D object generators are the most time-consuming work in the "DigiChip" software design process. The common phenomenon faced by designers of code scripts (programmers) is not overlooked also in the process of designing software "DigiChip", such as crash-syntax between various scripts, crash-syntax between 2D object scripts, between fellow 3D object scripts, between 2D object scripts with 3D object scripts, between the scripts of all objects with various animate effects, and many more that are not effective are mentioned one by one. The process of designing Digital DigiChip learning media software requires a C# script of around 180 files. Each script has its own specifications and complexity for controlling and controlling objects and visual effects on the "DigiChip" software. The process of making C# scripts with file extensions (.cs) is not different from other coding languages, which has a language structure and systematic object-oriented syntax for embedded targets (Figure 10).

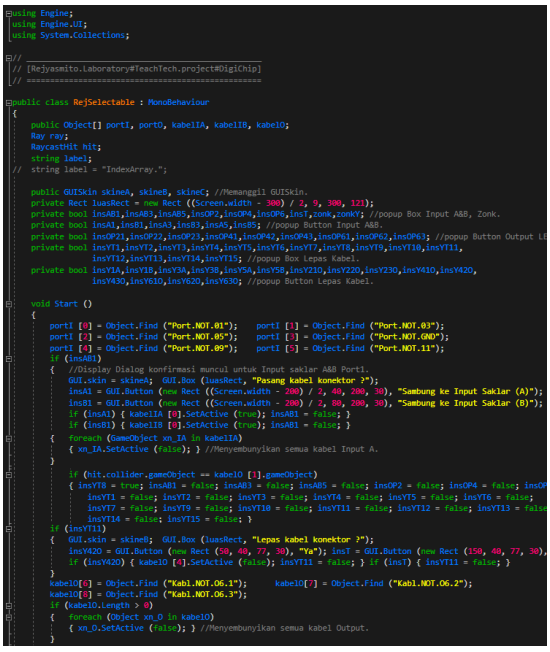


Figure 10. Code Script File

Unit Testing

Unit testing is the earliest testing stage after layout design, content, and the coding algorithm are done in the process of designing "DigiChip" learning media software. The unit testing stage is done using the white-box testing technique. The unit testing process prioritizes targets on source-code and systematic compilation of source-code (syntax). The process of knowing various source-code errors can be done by debugging at the time of compiling

the script (coding). The process for knowing the performance mechanism of the source-code through white-box testing by creating a work-flow base path, and first making a flowgraph. Before making the flowgraph, a flowchart is first made (see Figure 11 and Figure 12). A flowchart is designed as an auxiliary graph of the flowgraph to make it easier for the reader to understand because the flowgraph only contains numeric codes on a base path which the reader must understand for longer (Table 5).

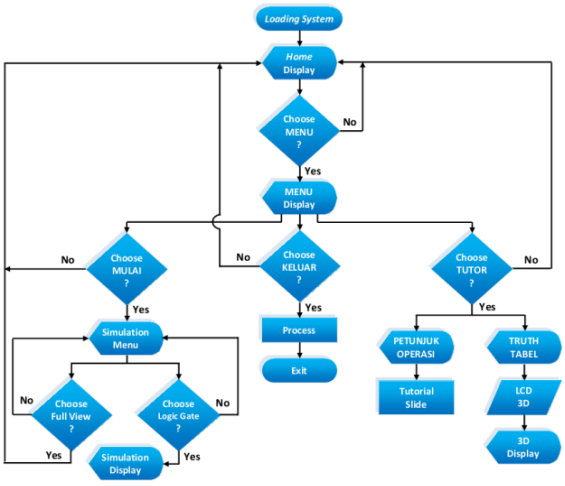


Figure 11. Flowchart

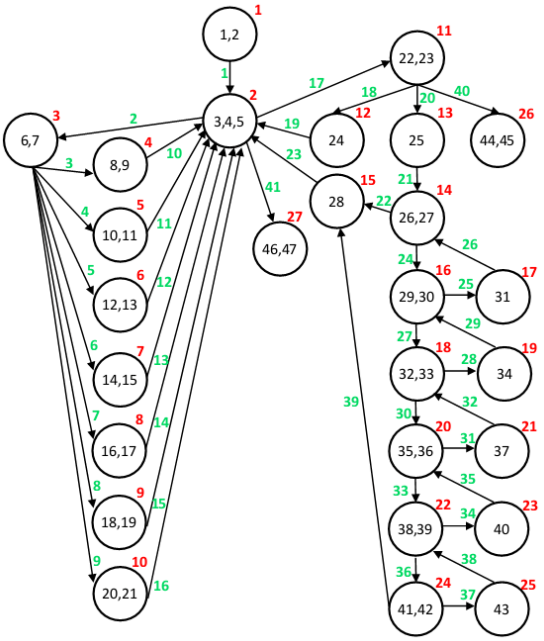


Figure 12. Flowgraph

Table 5. Flowgraph Description

No.	Description	No.	Description
1.	Start	24.	Exit TUTOR
2.	Splash screen loading system	25.	Touch Operating Instructions
3.	Home page	26.	Appearance setting
4.	Touch MENU	27.	Next the appearance setting page
5.	START, TUTOR, EXIT page	28.	Exit the Operating Instructions
6.	Touch START	29.	Displaying Scematic
7.	Simulation options display page	30.	Next Displaying Scematic
8.	Touch system NOT	31.	Prev Displaying Scematic
9.	Logic gate simulation NOT	32.	Plug the connector wire
10.	Touch system AND	33.	Next the Plug connector wire
11.	Logic gate simulation AND	34.	Prev the Plug connector wire
12.	Touch system NAND	35.	Unplug the connector wire
13.	Logic gate simulation NAND	36.	Next the Unplug the connector wire
14.	Touch system OR	37.	Prev the Unplug the connector wire
15.	Logic gate simulation OR	38.	Input button
16.	Touch system NOR	39.	Next the Input button
17.	Logic gate simulation NOR	40.	Prev the Input button
18.	Touch system XOR	41.	LED Output
19.	Logic gate simulation XOR	42.	Next LED Output
20.	Touch fullscreen	43.	Prev LED Output
21.	Exit simulation options	44.	Touch the Truth Table
22.	Touch TUTOR	45.	Truth Table display page
23.	Tutorial options display page	46.	Touch EXIT

The next process in unit testing is first to calculate Cyclomatic Complexity (CC). Calculations are denoted by V(G) = e – n + 2. Notation "e" is the number of edges (system speed), and "n" is the number of nodes (system features). The value of CC is used for the next process, which is determining the independent path. The "DigiChip" software that has been created has 41 edges and 27 nodes. Then CC or V(G) is as shown in Equation 2:

$e = 41 ; n = 27$
$V(G) = e – n + 2$
$V(G) = 41 – 27 + 2 = 16$ (2)

The next process is to determine the independent path, which is a representation of the speed of the system when governed by the user from the beginning to the end — the total number of lines as calculated in the CC calculation, which is 16 (Table 6).

Unit testing consists of 47 execution features available in the "DigiChip" learning media software. Feature items that operate well are recorded in the feature test list with a check list. Data that has been obtained from the unit testing stages are analyzed based on the feasibility percentage formula (Equation 3).

$$Feasibility\ percentage\ (\%) = \frac{Total\ score\ obtained}{Total\ highest\ score} \times 100 \quad (3)$$

The calculation results obtained are then converted to the feasibility category. 100% unit testing is included in "Very Worthy" category.

Integration Testing

The next test that must be done to improve the results of the software design that has been made is integration testing, which is to run the system/program algorithm by referring to the list of test cases made. Integration testing is done using the black-box method. The integration testing process is carried out when all elements in the previous stage, such as architectural design, user interface, and code script, have been integrated. The integration testing stage is conducted to find out whether the "DigiChip" algorithm and systematics of software made are in accordance with the planning stage without any errors. The results of integration testing are used as a reference in determining the functional suitability aspects of the ISO/IEC 25010 software quality standard, which focuses on the suitability of a single function to be able to perform certain tasks.

Integration testing is in the form of testing the operation of various features through a list of 16 test cases using the black-box method. Calculation analysis obtained is presented in Equation 4.

$$Operational\ test\ case\ (\%) = \frac{Total\ score\ obtained}{Total\ highest\ score} \times 100\%$$
$$= \frac{16}{16} \times 100\%$$
$$= 100\% \quad (4)$$

The calculation results obtained are then converted to the feasibility category table. The percentage of 100% integration testing is in the "Very Worthy" category. Other meanings can be interpreted that 100% nominal explains that all the features of the "DigiChip" learning software that have been made run well.

Table 6. Flowgraph Description

No.	Independent Path
1.	1,2→3,4,5→6,7→8,9
2.	1,2→3,4,5→6,7→10,11
3.	1,2→3,4,5→6,7→12,13
4.	1,2→3,4,5→6,7→14,15
5.	1,2→3,4,5→6,7→16,17
6.	1,2→3,4,5→6,7→18,19
7.	1,2→3,4,5→6,7→20,21
8.	1,2→3,4,5→22,23→24
9.	1,2→3,4,5→22,23→25→26,27→28
10.	1,2→3,4,5→22,23→25→26,27→29,30→31
11.	1,2→3,4,5→22,23→25→26,27→32,33→34
12.	1,2→3,4,5→22,23→25→26,27→35,36→37
13.	1,2→3,4,5→22,23→25→26,27→38,39→40
14.	1,2→3,4,5→22,23→25→26,27→41,42→43
15.	1,2→3,4,5→22,23→44,45
16.	1,2→3,4,5→46,47

System Testing

The next stage is system testing, which is the stage of software testing that are made when between parts have been incorporated into a single unified system. System testing is testing the overall performance of software products created. This process is carried out by the engineer/programmer concerned. The system testing process uses black-box technique, by calculating (1) the Line of Code (LoC) source code, (2) Duplication Source-code, and (3) The insulation test. Calculation of Line of Code (LoC) is an accumulation process of the amount of source code used in making "Digi-Chip" learning media software. Calculation of source code is done manually by accessing one by one script file embedded in the object, in the graphics engine software used (see Figure 13). The results of calculating the total number of source code used are 10,541 lines of source code or LoC (Line of Code). All source code in script files is written in C# (Csharp).

The next testing process is the calculation of the number of duplication source code in all script files containing 10,541 lines of source code. The process of calculating and analyzing duplication source code to be more precise and without errors was done using a software analyzer system which is in one type and brand with the system used in the process of designing source code; it is to minimize the occurrence of analyzed errors and weak accuracy due to differences in system formats. The results of the duplication source code analysis show there are two lines of source code from 10,541 lines of source code created. The 2-line duplication source code is in a script file called RejTouchEv.cs, which is a C# language file extension.

System testing was done to determine the maintainability and portability aspects of the ISO 25010 standard. The maintainability aspect is expressed by calculating the Maintainability Index (MI) value on all source code files used in making "DigiChip" learning media. MI values were calculated using software used to compile C# language code scripts in the process of creating "DigiChip" learning media, which has an analyzer feature. The results of the MI values calculation are shown in Table 7.

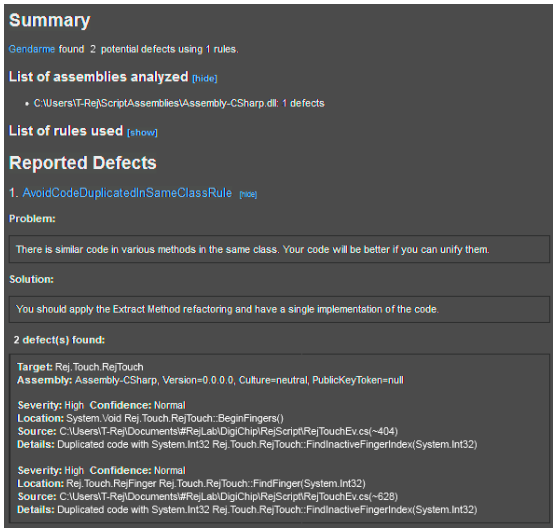


Figure 13. Duplication Source Code Analysis

Table 7. Maintainability Index (MI) Total

Solution 'DigiChip MI' (1 project)	Maintainability Index
Assembly-Csharp (Debug)	84

The known MI value is 84 with a green symbol; if translated referring to Table 3, it means that the entire code script in the "Digi-Chip" software has "easy maintenance" category. In theory, all future code scripts will be easy to develop and modify to the desired innovation stage.

The next testing process is to test the installation of various types of mobile device hardware configurations. The installation test process is basically more about the operational analysis of software that has been made in various kernel variants or the Android operating system (OS) version (see Table 8).

Table 8. Portability Testing

No.	OS Version	Type	Install	Running	Result Score	Max. Score
1	4.2 Jelly Bean	Samsung Galaxy G-Neo	1	1	2	2
2	4.4 Kit kat	Lenovo A536	1	1	2	2
3	5.0 Lolipop	Asus ZenFone 2 Laser	1	1	2	2
4	6.0 Marshmallow	Asus ZenFone 3	1	1	2	2
5	7.0 Nougat	Xiaomi Redmi Note 4 Pro	1	1	2	2
6	8.0 Oreo	Vivo Y71	1	1	2	2
		Total Score			12	12

Screen ratio parameters are not a priority because the "DigiChip" software created was designed with the ability to auto-extend at various screen ratios. The characteristics of the "DigiChip" software is a realtime 3D simulation software, which requires the specifications of mobile devices that have adequate graphics capabilities. The software products have the character of driving graphics hardware performance continuously as long as the application is "on", and it will stop when it is "off". Such software characters require dif-ferent hardware performance compared to other software products that have static performance characteristics. Thus, the testing at the installation test stage focuses on the graphic capabilities of mobile devices to run the "DigiChip" Digital Engineering learning media software.

The method used in testing the portability aspect is the running test technique owned by an emulator device, such as an AVD (Android Virtual Device). The type of configuration of the smartphone device and the kernel and Android OS variants was tested based on user-sourced data. The results of the test on various configurations of mobile devices have not found any errors in the install process or during the operation of "DigiChip" software continuously. Testing on a variety of mobile devices that have CPU (central processing unit) and GPU (graphics processing unit) hardware configurations is the least even if there is no system bottleneck or errors during the running.

Portability aspects testing was done using the installation process on various smartphone device configurations. The installation test is carried out on six Android OS variants. Based on the portability test results shown in Table 8, it can be calculated with the formula presented in Equation 5.

$$\begin{aligned} Portability\ Testing\ (\%) &= \frac{Total\ score\ obtained}{Total\ highest\ score} \times 100\% \\ &= \frac{12}{12} \times 100\% \\ &= 100\% \end{aligned} \quad (5)$$

The calculation results that have been obtained were then converted to the feasibility category. The 100% portability testing was included in the "Very Worthy" category.

Acceptance Testing

The acceptance testing process involves the assessment of experts, in this case, material experts and media experts. The next process is the assessment of the respondents as the end-user of the DigiChip Digital Engineering learning media software product. Acceptance testing instruments are prioritized by expert judgment. The assessment carried out by material experts is an aspect to determine the quality of the "DigiChip" software product from the parameters of conformity to the content of the material with teaching materials designed from the school. The assessment of media experts is an aspect of the assessment of learning media from the quality of software products that have been made, more specifically about the point of view of a software to be worthy of being called a learning tool or media in the learning process. The results of testing on media experts obtained a value of 63. Then calculated as the percentage of eligibility (Equation 6).

$$\begin{aligned} Eligibility\ Percentage\ (\%) &= \frac{Total\ score\ obtained}{Total\ highest\ score} \times 100\% \\ &= \frac{63}{70} \times 100\% \\ &= 90\% \end{aligned} \quad (6)$$

The calculation results of the eligibility percentage from the media expert test were then translated based on the feasibility table, and the results are included in the category of "Very Eligible". Furthermore, the test results on material experts obtain a value of 19. Thus, it is calculated as the percentage of eligibility as follows (Equation 7):

$$\begin{aligned} Eligibility\ Percentage\ (\%) &= \frac{Total\ score\ obtained}{Total\ highest\ score} \times 100\% \\ &= \frac{19}{19} \times 100\% \\ &= 100\% \end{aligned} \quad (7)$$

The calculation results of the eligibility percentage from the material expert test, if interpreted based on the feasibility table, were then categorized in "Very Worthy". Meanwhile, the calculation of the feasibility percentage of usability testing aspects is as follows (Equation 8).

$$\begin{aligned} Feasibility\ Percentage\ (\%) &= \frac{Total\ score\ obtained}{Total\ highest\ score} \times 100\% \\ &= \frac{7119}{8260} \times 100\% \\ &= 86.18\% \end{aligned} \quad (8)$$

The calculation results of the feasibility test percentage on 59 users are then interpreted according to the feasibility table, which is cate-

gorized into "Very Worthy". The reliability parameter analysis on the aspects of usability testing was performed using Cronbach Alpha (α) alpha counting software. The results obtained are presented in Table 9.

Table 9. Alpha Cronbach Calculation

Case Processing Summary

		N	%
Cases	Valid	59	100.0
	Excluded[a]	0	.0
	Total	59	100.0

[a]. Listwise deletion based on all variables in the procedure

Reliability Statistics

Cronbach's Alpha	N of Items
.841	28

Cronbach's Alpha 0.841 is then interpreted through the description table (George & Mallery, 2016, p. 240) shown in Table 10. The results of alpha calculations that have been obtained (0.841) can be interpreted as "good".

Table 10. Alpha Value Description IBM SPSS

α > .9 – excellent
α > .8 – good
α > .7 – acceptable
α > .6 – questionable
α > .5 – poor
α < .5 – unacceptable

CONCLUSION

The results of a series of research, design, and testing of "DigiChip" learning media products are as follows: (1) "DigiChip" software as a learning tool for Digital Engineering Subjects in science Mechatronics is developed through the SDLC type V-model. V-model procedures and stages include Requirement Modeling, Architectural Design, Component Design, Code Generation, Unit Testing, Integration Testing, System Testing, and Acceptance Testing. The next stage of testing in the software that has been made is to use the SQA procedure using the ISO/IEC 25010 software testing standard. (2) "DigiChip" software testing parameters using ISO/IEC 25010 consists of Functional Suitability, Maintainability, Portability, and Usability aspects. The results of a series of testing processes conclude that in the functional suitability aspect shows the percentage of 100% feasibility of all features operating properly, with the classification of the feasibility table "Very Worthy". The test results on maintainability aspects show the value of the Maintainability Index (MI) of 84, which means in the category "Easy Care". The portability test results show that the percentage of 100% "DigiChip" learning software can operate on various variants of the Android OS, including the "Very Worthy" category. The usability test results show 86.18% in the "Very Worthy" category, with a reliability value of 0.841 included in the "Good" category. The stages of testing aspects of media experts show that 90% belong to the "Very Worthy" category. Testing aspects of material experts show that 100% are included in the "Very Worthy" category.

REFERENCES

Arikunto, S. (2013). *Prosedur penelitian: Suatu pendekatan praktik*. Jakarta: Rineka Cipta.

Chemuturi, M. (2011). *Mastering software quality assurance: Best practices, tools and techniques for software developers*. Plantation, FL: J. Ross.

George, D., & Mallery, P. (2016). *IBM SPSS statistics 23 step by step: A simple guide and reference* (14th ed.). Oxon: Routledge.

Heitlager, I., Kuipers, T., & Visser, J. (2007). A practical model for measuring maintainability. In *6th International Conference on the Quality of Information and Communications Technology*. Lisbon, Portugal: IEEE Explore. https://doi.org/10.1109/QUATIC.2007.8

Koyya, P., Lee, Y., & Yang, J. (2013). Feedback for programming assignments using software-metrics and reference code. *International Scholarly Research Notices (ISRN) Software Engineering, 2013*, 1–8. https://doi.org/10.1155/2013/805963

Laplante, P. A. (2007). *What every engineer should know about software engineering* (1st ed.). Boca Raton, FL: CRC Press.

Lund, A. M. (2001). Measuring usability with the USE Questionnaire. Retrieved May

12, 2016, from https://www.researchgate.net/publication/230786746/

McCabe, T. J. (1976). A complexity measure. *IEEE Transactions on Software Engineering*, *SE-2*(4), 308–320. https://doi.org/10.1109/TSE.1976.233837

Microsoft Developer. (2007). Maintainability index range and meaning – Code analysis team blog. Retrieved May 9, 2017, from https://blogs.msdn.microsoft.com/codeanalysis/2007/11/20/maintainability-index-range-and-meaning/

Najadat, H., Alsmadi, I., & Shboul, Y. (2012). Predicting software projects cost estimation based on mining historical data. *International Scholarly Research Notices (ISRN) Software Engineering*, *2012*, 1–8. https://doi.org/10.5402/2012/823437

Pachler, N., Bachmair, B., & Cook, J. (2010). *Mobile learning: Structures, agency, practices*. (G. R. Kress, Ed.). London: Springer.

Pressman, R. S. (2010). *Software engineering: A practitioner's approach* (7th ed.). New York, NY: McGraw-Hill.

Riduwan. (2013). *Skala pengukuran variabel: Variabel penelitian*. Bandung: Alfabeta.

Tamrin, A. G., Slamet, S., & Soenarto, S. (2018). The link and match of the demand and supply for productive vocational school teachers with regard to spectrum of vocational skills in the perspective of education decentralization. *Jurnal Pendidikan Vokasi*, *8*(1), 40–52. https://doi.org/10.21831/jpv.v8i1.15135

Tullis, T., & Albert, B. (2013). *Measuring the user experience: Collecting, analyzing, and presenting usability metrics* (2nd ed.). Waltham, MA: Elsevier.

Watkins, J., & Mills, S. (2011). *Testing IT: An off-the-shelf software testing process* (2nd ed.). Cambridge: Cambridge University Press. https://doi.org/10.1017/CBO9780511997310

Williams, L. (2006). Testing overview and black-box testing techniques. Retrieved May 12, 2016, from http://agile.csc.ncsu.edu/SEMaterials/BlackBox.pdf.

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (119-131)
Online: http://journal.uny.ac.id/index.php/jpv

VOCATIONAL SCHOOL TEACHERS' READINESS IN IMPLEMENTING CURRICULUM 2013 REVISED EDITION IN CILACAP REGENCY

Hanief Iqbal Saputra
Universitas Negeri Yogyakarta

Nuchron
Universitas Negeri Yogyakarta

Abstract

The purpose of this research is to reveal factors that influence vocational school teachers' readiness to implement curriculum 2013 revised edition in Cilacap regency. The factors are (1) principals' leadership toward the teachers' readiness, (2) the impact of teachers' professionalism toward teachers' readiness, (3) the impact of the teachers' training. This research is ex-post facto research. The method of data collection used in this research is the mix method. The data were collected using questionnaire and interview and then analyzed by applying statistics descriptive counts mean of the percentage. This study employed multiple linear regression to confirm the hypotheses. The result of the research shows that: (1) principals' leadership affects teachers' readiness in the amount of 8.4%, (2) teachers' professionalism impacts the teachers' readiness in the amount of 17.7%, (3) teachers' training impacts teachers' readiness in the amount of 24.1%, and (4) principals' leadership, professionalism, and teachers' training simultaneously, affect teachers' readiness, and it is proven by Fcalculate in the amount of 5,403 and significant value (p = 0.001 < 0.05). It means that the whole result of the three free-variables affects the teachers' readiness significantly in implementing curriculum 2013 revised edition at vocational school in Cilacap.

Keywords: *teachers' readiness, curriculum implementation, Cilacap regency*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.24551*

Contact Hanief Iqbal Saputra haniefiqbals.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

Releasing Curriculum 2013, especially the revised edition, is one of the government's effort to build-up citizen's competitive character. The government has expanded it comprehensively, full of integrity, and dynamically to make them get ready facing educational era in the 21st century. Education and schools quality depends on the alumnus quality. A school can create top-grade students only by conducting qualified teaching-learning process. Then, qualified teaching-learning process must be supported by good facilities too. The data of *Lembaga Penjaminan Mutu Pendidikan* (Institute for Educational Quality Assurance or IEQA), in Central Java (2016), based on National Education Standards (NES) for Vocational School in Cilacap regency, show that vocational school in Cilacap is in the category of "going to be the third level" (see Figure 1). Thus, it can be concluded that the education quality of the vocational school in Cilacap regency has not attained NES yet.

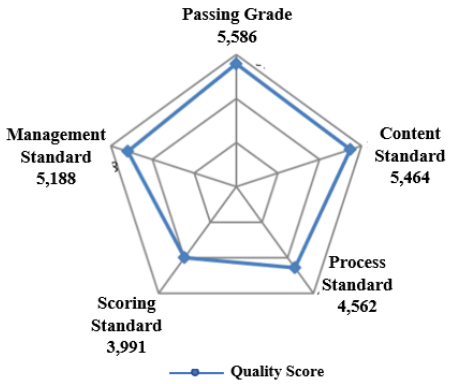


Figure 1. NES Achievement Map of Vocational School in Cilacap Regency in 2016

(Source: Document of *Lembaga Penjaminan Mutu Pendidikan* or Institute for Educational Quality Assurance (2016) of Central Java)

The finest achievement is when the passing grade is in the amount of 5.586, and the inferior is in the amount of 3.991. Related to this statement, the achievement of vocational schools in Cilacap still become one of the schools' problem since they have not passed National Education Standards.

Curriculum materials and knowledge on curricular purposes and structures are valuable tools that teachers often draw upon to organize instruction and facilitate students' learning. Careful analysis of teachers' curriculum implementation and the decision making that undergirds their curriculum use is critical for fully understanding enactment (Penuel, Phillips, & Harris, 2014). Curriculum fidelity describes the extent to which a curriculum is implemented faithfully as planned. Curriculum fidelity issues may arise when teachers implement the curriculum inconsistently due to differences in philosophy, barriers in the setting, or other local concerns (Zhu, Ennis, & Chen, 2011).

Principal, teachers, and stakeholder have a responsibility to improve the education quality in the school. Improving education quality is not done easily; it needs dynamic activities with many defiances. Education fluctuates so that a change and improvement is an important thing that should be done. Education, as a program of study for teachers and prospective teachers, should be based upon the problems growing out of school management and the relationships between the school and the various aspects of the community and society at large (Lynch, 1937).

(Wahjosumidjo, 2011, p. 46) said that the quality of a leader is often assumed as the main factor of the success or failure of an organization. A leader is in charge to design and imply the organization strategy. Leaders responsible for innovation need to be competent in making innovation happen (Vlok, 2012). For example, being a successful leader requires knowing what is expected and doing it. However, organizational leadership matters more. Leadership occurs when the organization builds a cadre of future leaders who can shape an organization's culture and create patterns of success (Ulrich & Smallwood, 2012). Moreover, expanded leadership roles may further develop experienced professionals while simultaneously supporting teacher knowledge during a period of embedding educational reform (Taylor, Yates, Meyer, & Kinsella, 2011). A strategically focused school is one that is educationally effective in the short-term but also has a clear framework and processes to translate core moral purpose and vision into an excellent educational provision that is challenging and sustainable in the medium to long-term. It has the leadership that enables short-term objectives to be met while concurrently building capability and capacity for the long-term (Davies, 2004, p. 11).

Day, Fleenor, Atwater, Sturm, and McKee (2014) claimed that the development of effective leaders and leadership behavior is a prominent concern in organizations of all types. Further, International Labour Organization (2012, p. 41) explained that leadership is a sensitive issue for human resource dispute. The roles of a leader are: (1) defining the organization aims, (2) managing the learning process, (3) upgrading the human resource (students and teachers), and (4) developing the organization. In addition, Davies and Brundrett (2010) claimed that a key shift in the mindset of leaders, who take on strategic roles, is that they move away from the detailed operational view and develop a holistic and broad organizational perspective. School principals' work, like that of teachers, has intensified and become more complex in recent times as ideologically driven external interventions by government in the curriculum and management of schools have increased (Day, 2000).

In addition, Alanazi, Khalaf, and Rasli (2013) explain that Effective Leadership can affect subordinate satisfaction, motivation, and performance. Another opinion comes from Hsiao, Chen, and Yang (2008) who say that the curriculum leadership tasks for principals can be categorized into shaping school vision, constructing organizational operation, providing and integrating resources, facilitating coordination and communication, leading curriculum design, cultivating curriculum specialization among staff, building organizational culture, solving implementation problems, conducting supervision, and promoting curriculum evaluation. Based on the Duignan (2004, p. 11) scheme, the background of the principal's leadership is constructed by five significant dimensions. They are education, personality, relation, intellectual, and organization ability.

It is in line with the statement of Ariff, Mansor, and Yusof (2017) saying that "Professionalism practice is closely related to the quality of practices, moral and ethical. Professional practices include behaviors that are compliant to the requirements of professional ethics, reflection on teaching duties, and determination to constantly learn and grow". As the implementation of curriculum 2013, teachers are obligated to create and organize an effective learning process. For example, the pedagogical transformation of a teacher can be facilitated through teacher professional development that focuses on reflective practice through their interactions with other practitioners, aimed at improving their professional practices (Sari, 2012). Schools, in close collaboration with university teacher training institutions, were encouraged to set up in-school professional development programs to support beginning teachers in their professional development during their first three years of teaching (Coenders & Verhoef, 2019). They also have to choose appropriate learning approach to determine the learning procedure and plan the competence effectively then, decide the achievement criteria (Mulyasa, 2017, p. 99).

It is supported by the statement of Tanang and Abu (2014), claiming that teacher professional development needs supporting on policy, moral, infrastructure, and financial that can lead teachers to be professional. A vocational teacher who can adapt to professional students can transfer knowledge and skills. Curriculum materials provide teachers with student activities to help students accomplish particular aims (Krajcik, McNeill, & Reiser, 2008) and knowledge about curricular purposes and structures provides a framework within which teachers can select and adapt materials in ways that are consistent with designers' intentions (Davis & Varma, 2008). For example, in the curriculum implementation, the factors are intertwined, either facilitating or challenging curriculum implementation. Previous studies in classroom education and physical education examined the issue of curriculum implementation often from a single factor perspective (Snyder, Bolin, & Zumwalt, 1992).

The importance of improving schools, increasing teacher quality, and improving the quality of student learning has led to a concentrated concern with the professional development of teachers as one crucial way of achieving these goals (Opfer & Pedder, 2011). Vocational teachers are productive Program teachers (Mappalotteng, 2014). In their research, Sintawati, Joebagio, and Agung (2017) declares that the position of teachers as professionals is urgently important in the realization of the vision and mission of learning especially in the educational aspect where the teachers can fulfill their duties.

Likewise, Bayrakcı (2009) explains that the key points about the in-service training of teachers appear as providing professional staff, collaborative partnerships between teachers,

provision for feedback, and a systematic in-service training model. Also, Nielsen (2010) suggests new approaches to cope with future challenges, including: (1) the need to develop VET (Vocational Education and Training) didactics, (2) enabling the teaching professional to become professionals and stakeholders in VET reform by facilitating policy learning platforms, and (3) creation of communities of practice among VET teachers to nurture innovation and creativity. In her writing, Oliva (2004) states that curriculum is the plan or program for all experiences which the learner encounters under the direction of the school.

Other than that, Fullan and Pomfret (1977) earlier assert that all innovative curricula require some organizational change in order to be implemented, although often these changes are left implicit in the design. Moreover, these organizational characteristics are likely to be the most difficult of the innovation's components to implement. Obviously, curriculum innovation involves more than organizational change, in the same way, that organizational change entails more than alterations in structural arrangements and role relationships. Still, the organizational characteristics of innovations appear to be the most difficult to implement, and, of the organizational components, role relationships often present the most difficulties.

Zais (1976, p. 7) defines that curriculum is a racecourse of subject matters to be mastered. Curriculum can be defined as learning substance or all effort done by the school. The spectrum between those both side commented that curriculum as the interaction planner for students and teachers to achieve the education purpose (Miller & Seller, 1985, p. 3). Similar to a study conducted by Sundayana (2015), the implementation of curriculum is considered as one of the most prominent phases after developing the 2013 primary and secondary curriculum in Indonesia, and it is greatly influenced especially by teachers' readiness and competence. Besides, Suyanto (2017) points out that specific training on the new curriculum implementation is still needed. As the Association of American Vocation, Thompson (1973, p. 111) defines vocational education as education designed to develop skill, abilities, understanding, attitudes, work habits, and appreciations needed by workers to enter and make progress in employment on a useful and productive basis. Then, Pavlova (2009) in Sudira (2016, p. 7) explains that traditionally, direct preparation for work was the primary goal of vocational education.

RESEARCH METHOD

This research is ex-post-facto research with transparent descriptive statistics analysis approach. The procedure of this study was done by collecting the questionnaire; then, it was analyzed to get the mean percentage of the readiness of vocational teachers. In addition, an interview was also used to get qualitative data as secondary data. This research was done in seven vocational schools (*Sekolah Menengah Kejuruan* or SMK) in Cilacap Regency. They are: (1) SMK Negeri 1 Wanareja, (2) SMK Negeri Karangpucung, (3) SMK Negeri 1 Kawunganten, (4) SMK Negeri 1 Cilacap, (5) SMK Negeri 2 Cilacap, (6) SMK Negeri 1 Nusawungu, (7) SMK Negeri 1 Binangun.

RESULTS AND DISCUSSION

Results

The result of descriptive analysis for principal's category, teachers' professionalism, and teacher training through vocational teachers' readiness in implementing curriculum 2013 revised edition in Cilacap Regency is presented in Table 1, Table 2, Table 3 and Table 4.

Table 1. Category of principal's leadership

No	Category	Interval Score	Frequency	Relative (%)
1	Very Good	≥ 244.45	15	7.1%
2	Good	230.15-244.45	43	20.5%
3	Fair	215.85-230.15	96	45.7%
4	Poor	201.55-215.85	42	20.0%
5	Very Poor	0-201.55	14	6.7%
Total			**210**	**100**

Table 2. Category of Teachers' Profesionalism

No	Category	Interval Score	Frequency	Relative (%)
1	Very Good	≥ 143.45	15	7.1%
2	Good	137.15-143.45	53	25.2%
3	Fair	130.85-137.15	83	38.6%
4	Poor	124.55-130.85	47	22.4%
5	Very Poor	0-124.55	14	6.7%
Total			**210**	**100**

Table 3. Category of Teachers' Training

No	Category	Interval Score	Frequency	Relative (%)
1	Very Good	≥ 90.45	12	5.7%
2	Good	84.15-90.45	60	28.6%
3	Fair	77.85-84.15	77	36.7%
4	Poor	71.55-77.85	43	20.5%
5	Very Poor	0-71.55	18	8.6%
Total			**210**	**100**

Table 4. Caterory of Teachers' Readiness

No	Category	Interval Score	Frequency	Relative (%)
1	Very Good	≥ 126	17	8.1%
2	Good	118-126	46	21.9%
3	Fair	110-118	79	37.6%
4	Poor	102-110	57	27.1%
5	Very Poor	0-102	11	5.2%
Total			**210**	**100**

The result of the study was obtained by conducting the analysis requirement test with several steps done: normality test, linearity test, multicollinearity test, homoscedasticity test, and hypothesis test. Analysis requirement test can be seen in Table 5, Table 6, Table 7, and Table 8.

Table 5. Normality Test

Variable	Sig.
Principal's Leadership	0.059
Teachers' Profesionalism	0.054
Teachers' Training	0.059
Teachers' Readiness	0.053

Table 5 shows that the score of principal's leadership is p = 0.059, variable of teachers' professionalism is p = 0.054, variable of teachers' training is p = 0.059 and variable of teachers' readiness in implementing curriculum 2013 revised edition is p = 0.053. Based on the result, it can be defined that those data are normal because the score of probability exceeds the significance standard 5% (p > 0.05).

Table 6. Linearity Test

Variable	Sig. Deviation from Linearity
Principal's Leadership & Teachers' Readiness	0.257
Teachers' Profesionalism & Teachers' Readiness	0.066
Teachers' Training & Teachers' Readiness	0.106

The result of Sig. Deviation from Linearity computation to the principal's leadership data toward the teachers' readiness in implementing curriculum 2013 revised edition is 0.257 with significance standard 0.05. Then, teachers' professionalism data toward teachers' readiness in implementing curriculum 2013 revised edition is 0.066 with significance standard 0.05. Then, teachers' training toward teachers' readiness in implementing curriculum 2013 revised edition is 0.106 with significance standard 0.05. Since the result of Sig. Deviation from Linearity computation are 0.257, 0.066 and 0.106 exceed the significance standard 5% (p > 0.05). Thus, the importance

of the principal's leadership to teachers' readiness, professionalism, readiness, and training are asserted that it is linear.

Table 7. Multicollinearity Test

Variable	TOL	VIF
Principal's Leadership	0.986	1.014
Teachers' Profesionalism	0.982	1.018
Teachers' Training	0.993	1.007

Table 7 shows that tolerance score in all variable is less than 10% and VIF score in all variable are under 10. It indicates that the principal's leadership, teachers' professionalism, and teachers' training are disengaged from Multicollinearity tendency.

Table 8. Homoscedasticity Test

Variable	p
Principal's Leadership	0.460
Teachers' Profesionalism	0.575
Teachers' Training	0.812

Based on Table 8, the significance score in the variable of the principal's leadership is 0.460 ($p > 0.05$); thus, homoscedasticity transpires. Significance score in the variable of teachers' professionalism is 0.575 ($p > 0.05$), so homoscedasticity transpires. The significance score in the variable of teachers' training is 0.812 ($p > 0.05$), so homoscedasticity transpires.

The research result of vocational teachers' readiness in implementing curriculum 2013 revised edition in Cilacap Regency can be seen in Table 9, Table 10, and Table 11.

Table 9. t Test Result

Variable	β	t	Sig.
(Constant)	52.660	3.199	0.002
Principal's Leadership	0.084	2.034	0.043
Teachers' Profesionalism	0.177	2.005	0.046
Teachers' Training	0.241	2.709	0.007

Table 10. t Test Result in Multiple Linear Regression Analysis

Variable	β
(Constant)	52.660
Principal's Leadership	0.084
Teachers' Profesionalism	0.177
Teachers' Training	0.241

Table 11. F Test Result in Multiple Linear Regression Analysis

Model	F	Sig.
Regression	5.403	0.001

Discussion

The success of teachers' readiness in implementing curriculum 2013 revised edition in vocational school is affected by various factors such as principal's leadership, teachers' professionalism, and teachers' training. A leader must be success-oriented, and he has to recognize the target well to achieve it (Priansa & Somad, 2014, p. 185). Principals should stimulate assistant principals and teacher leaders to take part in leading the school, lead the school in a collegial way with other members of the leadership team, and empower teachers to participate in school decision making (Devos, Tuytens, & Hulpia, 2014). Further, Coleman and Morales (2018) declare that leadership is the process through which one or more people influence other group members in a way that motivates them to contribute to the achievement of group goals.

Wahjosumidjo (2010, p. 40) mentions that a leader has duties to (1) arouse trust and team loyalty, (2) communicate his idea to others, (3) influence the others, and (4) be charismatic. Leadership is an essential factor that affects the working performance to achieve the purpose. The principal's leadership has a vital role in improving school quality. A leader has to motivate his team because it makes the team focus on the target. It is strengthened by a study conducted by Jacobson and Bezzina (2008) that principals who lead effective schools work tenaciously to create safe and orderly learning environments, set clear instructional objectives, expect high performance from teachers and students through increased time on task, and develop positive home-school relations. In schools, what is expected from the school principals is to realize the change and mutation depending on the improvements. Leadership is a process that manages people affecting organizational aims (Polatcan & Titrek, 2014).

Successful leadership is not top-down; instead, a strong organization sees everyone (at all levels) working in conjunction to fulfill the mission of the organization (Mallon, 2017). Effective leadership guides nations in times of

peril, promotes effective team and group performance, makes organizations successful, and, in the form of parenting, nurtures the next generation (Miller, 2008, p. 152). Duke (1987, p. 23) defines that a school leader's effectiveness is based on how well students achieve. Principals clearly articulate views on education and helped their schools set appropriate directions. All principals are instructional leaders who influence teaching and learning and are committed to making a difference (Garza Jr, Drysdale, Gurr, Jacobson, & Merchant, 2014).

Ng and Szeto (2016) claim that the newly appointed principals are expected to be equipped with the administrative skills of human resources management such as empowering middle leaders and handing underperforming staff; the practical technique of financial management; the skills of dealing with legal matters regarding school management and the capacities of curriculum and instructional leadership. In addition, they attributed networking with peers and working with mentors as invaluable experience and support for their early years' principalship.

In his research, Katuuk (2014) wrote that the implementation of curriculum 2013 is successful if there is a proper management. There are several management aspects which significantly help the curriculum implementation: planning the implementation, deciding the primary and secondary resource, defining learning process, monitoring and evaluating the activities. The components of the school are the teacher, principal, facility, culture, and environment. Those components have a responsibility toward the recent curriculum. The curriculum and its associated materials are the materia medica of pedagogy, the pharmacopeia from which the teacher draws those tools of teaching that present or exemplify particular content and remediate or evaluate the adequacy of student accomplishments (Shulman, 1986, p. 10). Reform-based curriculum materials have been suggested as a mechanism to make inquiry-based instruction more prevalent in secondary science classrooms, specifically when accompanied by comprehensive professional development (Loucks-Horsley, Hewson, Love, & Stiles, 1998; Powell & Anderson, 2002).

Professionalism should be possessed by every teacher in performing their tasks professionally. Besides every teacher should improve her/his competence by his/her own efforts, the school principal should develop the teacher's professionalism (Wulandari, 2009). The characteristic of a professional teacher is competent in theoretical and practical pedagogy. The professional teacher has to master his subject and be able to deliver it to the students. A professional teacher is someone who is capable of teaching the students about his subject (Barizi, 2009, p. 138); a teacher who apprehends the subject and has to know how to teach it to the student effectively, efficiently, and properly (Alma, 2012, p. 127). Sumali (2016), in his study, proves that the school-based management influence on the teachers' professionalism. It means that professionalism improvement of teachers is essentially the improvement of the quality of education within the scope of narrow and wide, which can be done by increasing the school-based management. For example, Gürsoy (2013) claims that the teaching practice has great importance both for teacher trainers and student teachers (ST). According to the research conducted by American Association of Colleges for Teacher Education in 1991, both the teacher trainers and cooperating teachers found teaching practice significant for the development of the pedagogical skills.

In addition, Majid, Jelas, and Rahman (2010) state that teaching professionalism has always been given the limelight due to the development in the knowledge that requires educators to be mentally, emotionally, and physically prepared. The quality of teachers plays an important role in producing good quality of teaching. In producing professional teachers, effective measures must be identified to raise the standard of the teaching profession. In short, the kind of education needed today requires teachers to be high-level knowledge workers who constantly advance their own professional knowledge as well as that of their profession. Teachers need to become agents of innovation, not least, because innovation is critically important for generating new sources of growth through improved efficiency and productivity (Schleicher, 2012, p. 36). Other than that, the professionalism of teachers is based on three levels of expertise: mastering academic knowledge, mastering the teaching of this knowledge, and mastering the role played by teachers in schools (Nze & Ginestié, 2012).

Quality of the school is determined by the teachers' quality, Great School = Great teacher. Beginning teachers need to grow in the school culture and system, further develop their professional identity (Pillen, Den Brok, & Beijaard, 2013), and build routines for classroom management and pedagogy. The key to education improvement is by improving the teachers' quality. It is only a qualified teacher who is able to implement the curriculum 2013 revised edition. Training is one of the learning processes to improve the teachers' ability in teaching, to have a skill, to create a concept, and to obey the rule. Even when designers provide teachers with varied tools for supporting instruction, teachers may need to pose questions about curriculum tools, seek out resources, ask for help from colleagues and solicit feedback on their practice as they go about learning about curriculum (Sinha et al., 2010).

In addition to experience, teachers exercising more advanced types of behavior have better student outcomes (Kyriakides, Creemers, & Antoniou, 2009). Moreover, the other teacher training, teaching experience, and teacher content and teaching styles were significant motives behind classroom-level curriculum developments. Other factors include curriculum policy in terms of curriculum content, pedagogical and assessment orientations, teacher curriculum development opportunities, and teacher's soft skills (Shawer, 2017). In his research, Liaw (2009) states that the greatest benefit of teacher preparation programs is field-related training where preservice teachers contextualize the learned knowledge and theories with tasks and students during training.

Information Resources Management Association (2018, p. 213) defines that every study focusing on a good strategy observed in teacher training highlights the importance of teaching practice and school placement (also known as school residency program). A teacher needs coaching and upgrading intensely in order to increase his/her dedication. This training is given appropriate with their competence needs (Suherman & Saondi, 2010, p. 79). Training is used to handle teacher's low competence. The training program should be appropriate for the teacher's need. It means that the training is programmed to upgrade the teacher's weaknesses competence. The training result is optimal if it is designed to fulfill the teacher's need, method, and time. The training program is useful to the potential teacher but still lack of knowledge and skill (Arifin & Barnawi, 2014, p. 80). In addition, the training program has a significant role in school effectiveness. In addition, Serdenciuc (2013) states that teacher training process plays an important role in the whole context on education reform, and that is why, today, we are facing a growing interest from the part of the national policy makers regarding the improvement of teacher training programs.

Fullan and Park (1981, p. 97) assert that an effective implementation plan is based on an understanding of the developmental aspects of change, sets clear expectations and manageable objectives, incorporates realistic timelines, allocation of resources and monitoring and feedback procedures, and incorporates the professional development of consultants, principals and resource teachers as well as classroom teachers. In other words, change is a process, not an event like a workshop, and it requires the understanding of all "stakeholders". To avoid the potential obstacles in implementing curriculum 2013, the planner and policy-maker should discuss to solve the problem and reach an agreement about curriculum development and implementation to create competence students. Then, policy-maker identifies the problem solving occurred in implementing curriculum by the teacher, curriculum worker, and other sides involved (Miller & Seller, 1985, p. 277).

Roehrig, Kruse, and Kern (2007) claimed that the teachers' beliefs strongly influenced the implementation of the curriculum about teaching and learning and the presence of a supportive network at their school sites. The meanings that a teacher attaches to the new curriculum reforms act as his or her map on the curriculum implementation journey, and these usually determine the success of the education reforms (Bantwini, 2010).

Related to this research, principal's leadership, teachers' professionalism, and teachers' training have positive impact significantly toward teachers' readiness in implementing curriculum 2013 revised edition. Each aspect values (1) 8.4%, (2) 17.7%, and (3) 24.1%. They affect the curriculum implementation Fcalculate in the amount of 5,403 and significant value ($p = 0.001 < 0.05$). In addition, it is also supported by an interview with several

vocational teachers in Cilacap regency. The result shows that teachers' readiness in implementing curriculum 2013 revised edition needs (1) a leader or principal to direct the organization or employee, (2) socialization about recent education policy, (3) a workshop to the vocational school teachers in Cilacap Regency.

CONCLUSION

The result of the research shows that: (1) principals' leadership affects teachers' readiness in the amount of 8.4%, (2) teachers' professionalism impacts the teachers' readiness in the amount of 17.7%, (3) teachers' training impacts teachers' readiness in the amount of 24.1%, and (4) principals' leadership, professionalism, and teachers' training, simultaneously, affect teachers' readiness, and it is proven by Fcalculate in the amount of 5.403 and significant value ($p = 0.001 < 0.05$). It means that the whole result of the three free-variables affects the teachers' readiness significantly in implementing curriculum 2013 revised edition at vocational school in Cilacap.

REFERENCES

Alanazi, T. R., Khalaf, B., & Rasli, A. (2013). Overview of path-goal leadership theory. *Jurnal Teknologi*, *64*(2), 49–53. Retrieved from https://jurnalteknologi.utm.my/index.php/jurnalteknologi/article/view/2235/1779

Alma, B. (2012). *Guru profesional: Menguasai metode dan keterampilan mengajar*. Jakarta: Alfabeta.

Ariff, N., Mansor, M., & Yusof, H. (2017). Preparing pre-service teacher in professionalism practice. *International Journal of Academic Research in Business and Social Sciences*, *7*(2), 749–756. https://doi.org/10.6007/IJARBSS/v7-i2/2683

Arifin, M., & Barnawi, B. (2014). *Kinerja guru profesional*. Yogyakarta: Ar-Ruzz Media.

Bantwini, B. D. (2010). How teachers perceive the new curriculum reform: Lessons from a school district in the Eastern Cape province, South Africa. *International Journal of Educational Development*, *30*(1), 83–90. Retrieved from http://hdl.handle.net/20.500.11910/4639

Barizi, A. (2009). *Menjadi guru unggul*. Yogyakarta: Ar Ruzz Media.

Bayrakcı, M. (2009). In-service teacher training in Japan and Turkey: A comparative analysis of institutions and practices. *Australian Journal of Teacher Education*, *34*(1), 10–22. https://doi.org/10.14221/ajte.2009v34n1.2

Coenders, F., & Verhoef, N. (2019). Lesson study: Professional development (PD) for beginning and experienced teachers. *Professional Development in Education*, *45*(2), 217–230. https://doi.org/10.1080/19415257.2018.1430050

Coleman, J. M., & Morales, H. (2018). Leadership. In A. Mugford & J. G. Cremades (Eds.), *Sport, Exercise, and Performance Psychology* (pp. 382–406). New York, NY: Routledge. https://doi.org/10.4324/9780429438851-25

Davies, B. (2004). Success and sustainability: Developing the strategically focused school. *School Leadership & Management*, *24*(1), 11–27. https://doi.org/10.1080/1363243042000172796

Davies, B., & Brundrett, M. (2010). *Developing successful leadership*. Heidelberg: Springer.

Davis, E. A., & Varma, K. (2008). Supporting teachers in productive adaptation. In Y. Kali, M. C. Linn, & J. E. Roseman (Eds.), *Designing coherent science education* (pp. 94–122). New York, NY: Teachers College Press.

Day, C. (2000). Effective leadership and reflective practice. *Reflective Practice*, *1*(1), 113–127. https://doi.org/10.1080/713693134

Day, D. V., Fleenor, J. W., Atwater, L. E., Sturm, R. E., & McKee, R. A. (2014). Advances in leader and leadership development: A review of 25 years of research and theory. *The Leadership Quarterly*, *25*(1), 63–82. https://doi.org/10.1016/J.LEAQUA.2013.11.004

Devos, G., Tuytens, M., & Hulpia, H. (2014). Teachers' organizational commitment:

Examining the mediating effects of distributed leadership. *American Journal of Education*, *120*(2), 205–231. https://doi.org/10.1086/674370

Duignan, P. (2004). Forming capable leaders: From competence to capabilities. *New Zealand Journal of Education Leadership*, *19*(2), 5–13.

Duke, D. (1987). *School leadership and instructional improvement*. New York: NY: Random House.

Fullan, M. G., & Park, P. (1981). *Curriculum implementation: A resource booklet*. Toronto: Ontario Ministry of Education.

Fullan, M., & Pomfret, A. (1977). Research on curriculum and instruction implementation. *Review of Educational Research*, *47*(2), 335–397. https://doi.org/10.2307/1170134

Garza Jr, E., Drysdale, L., Gurr, D., Jacobson, S., & Merchant, B. (2014). Leadership for school success: Lessons from effective principals. *International Journal of Educational Management*, *28*(7), 798–811. https://doi.org/10.1108/IJEM-08-2013-0125

Gürsoy, E. (2013). Improving practicum for a better teacher training. *Procedia - Social and Behavioral Sciences*, *93*, 420–425. https://doi.org/10.1016/J.SBSPRO.2013.09.214

Hsiao, H.-C., Chen, M.-N., & Yang, H.-S. (2008). Leadership of vocational high school principals in curriculum reform: A case study in Taiwan. *International Journal of Educational Development*, *28*(6), 669–686. https://doi.org/10.1016/J.IJEDUDEV.2007.12.002

Information Resources Management Association. (2018). *Teacher training and professional development: Concepts, methodologies, tools, and applications*. Hershey, PA: IGI Global.

International Labour Organization. (2012). *Handbook of good human resource practices in the teaching profession* (8th ed.). Boston, MA: Pearson.

Jacobson, S., & Bezzina, C. (2008). The effects of leadership on student academic/affective achievement. In G. Crow, J. Lumby, & P. Pashiardis (Eds.), *The international handbook on the preparation and development of school leaders* (pp. 80–102). Thousand Oaks, CA: Sage Publications.

Katuuk, D. A. (2014). Manajemen implementasi kurikulum: Strategi penguatan implementasi Kurikulum 2013. *Jurnal Cakrawala Pendidikan*, *1*(1), 13–26. https://doi.org/10.21831/cp.v1i1.1858

Krajcik, J., McNeill, K. L., & Reiser, B. J. (2008). Learning-goals-driven design model: Developing curriculum materials that align with national standards and incorporate project-based pedagogy. *Science Education*, *92*(1), 1–32. https://doi.org/10.1002/sce.20240

Kyriakides, L., Creemers, B. P. M., & Antoniou, P. (2009). Teacher behaviour and student outcomes: Suggestions for research on teacher training and professional development. *Teaching and Teacher Education*, *25*(1), 12–23. https://doi.org/10.1016/j.tate.2008.06.001

Lembaga Penjaminan Mutu Pendidikan (Institute for Educational Quality Assurance). (2016). Laporan peta mutu pendidikan Kabupaten Cilacap Provinsi Jawa Tengah berbasis SNP tahun 2016 (IEQA).

Liaw, E.-C. (2009). Teacher efficacy of preservice teachers in Taiwan: The influence of classroom teaching and group discussions. *Teaching and Teacher Education*, *25*(1), 176–180. https://doi.org/10.1016/J.TATE.2008.08.005

Loucks-Horsley, S., Hewson, P. W., Love, N., & Stiles, K. (1998). *Designing professional development for teachers of science and mathematics*. Madison, WI: National Institute for Science Education.

Lynch, J. A. (1937). Teacher training. *Peabody Journal of Education*, *15*(3), 113–118. Retrieved from https://www.jstor.org/stable/1488320

Majid, N. A., Jelas, Z. M., & Rahman, S. (2010). Communication skills and work motivation amongst expert teachers. *Procedia - Social and Behavioral*

Sciences, *7*, 565–567. https://doi.org/10.1016/J.SBSPRO.2010.10.075

Mallon, M. (2017). Leadership development. *Public Services Quarterly*, *13*(2), 90–97. https://doi.org/10.1080/15228959.2017.1302391

Mappalotteng, A. M. (2014). Improving vocational teacher professionalism through lesson study. *IOSR Journal of Research & Method in Education (IOSR-JRME)*, *4*(6), 11–14. Retrieved from http://www.iosrjournals.org/iosr-jrme/papers/Vol-4 Issue-6/Version-1/C04611114.pdf

Miller, J. P., & Seller, W. (1985). *Curriculum perspectives and practice*. New York, NY: Longman.

Miller, R. (2008). Leadership: Theory and practice. In S. F. Davis & W. Buskist (Eds.), *21st century psychology: A reference handbook* (vol. 2, pp. II-152-II–163). Thousand Oaks, CA: Sage Publications. https://doi.org/10.4135/9781412956321.n68

Mulyasa, E. (2017). *Pengembangan dan implementasi Kurikulum 2013* (10th ed.). Bandung: Rosdakarya.

Ng, S., & Szeto, S. E. (2016). Preparing school leaders. *Educational Management Administration & Leadership*, *44*(4), 540–557. https://doi.org/10.1177/1741143214564766

Nielsen, S. (2010). Vocational education and training teacher training. *International Encyclopedia of Education*, 503–512. https://doi.org/10.1016/B978-0-08-044894-7.00808-3

Nze, J. S. B., & Ginestié, J. (2012). Technical and vocational teaching and training in Gabon: How future teachers build their vocational identity? *International Journal of Technology and Design Education*, *22*(3), 399–416. https://doi.org/10.1007/s10798-010-9143-3

Oliva, P. F. (2004). *Developing the curriculum. Scott, Foresman and Company*. Glenview, IL: Scott, Foresman and Company.

Opfer, V. D., & Pedder, D. (2011). Conceptualizing teacher professional learning. *Review of Educational Research*, *81*(3), 376–407. https://doi.org/10.3102/0034654311413609

Penuel, W. R., Phillips, R. S., & Harris, C. J. (2014). Analysing teachers' curriculum implementation from integrity and actor-oriented perspectives. *Journal of Curriculum Studies*, *46*(6), 751–777. https://doi.org/10.1080/00220272.2014.921841

Pillen, M. T., Den Brok, P. J., & Beijaard, D. (2013). Profiles and change in beginning teachers' professional identity tensions. *Teaching and Teacher Education*, *34*, 86–97. https://doi.org/10.1016/J.TATE.2013.04.003

Polatcan, M., & Titrek, O. (2014). The relationship between leadership behaviors of school principals and their organizational cynicism attitudes. *Procedia - Social and Behavioral Sciences*, *141*, 1291–1303. https://doi.org/10.1016/J.SBSPRO.2014.05.222

Powell, J. C., & Anderson, R. D. (2002). Changing teachers' practice: Curriculum materials and science education reform in the USA. *Studies in Science Education*, *37*(1), 107–135. https://doi.org/10.1080/03057260208560179

Priansa, D. J., & Somad, R. (2014). *Manajemen supervisi & kepemimpinan kepala sekolah*. Bandung: Alfabeta.

Roehrig, G. H., Kruse, R. A., & Kern, A. (2007). Teacher and school characteristics and their influence on curriculum implementation. *Journal of Research in Science Teaching*, *44*(7), 883–907. https://doi.org/10.1002/tea.20180

Sari, E. R. (2012). Online learning community: A case study of teacher professional development in Indonesia. *Intercultural Education*, *23*(1), 63–72. https://doi.org/10.1080/14675986.2012.664755

Schleicher, A. (Ed.). (2012). *Preparing teachers and developing school leaders for the 21st century: Lessons from around the world*. Paris: OECD. https://doi.org/10.1787/9789264174559-en

Serdenciuc, N. L. (2013). Competency-based

education – Implications on teachers' training. *Procedia - Social and Behavioral Sciences*, *76*, 754–758. https://doi.org/10.1016/J.SBSPRO.2013.04.200

Shawer, S. F. (2017). Teacher-driven curriculum development at the classroom level: Implications for curriculum, pedagogy and teacher training. *Teaching and Teacher Education*, *63*, 296–313. https://doi.org/10.1016/J.TATE.2016.12.017

Shulman, L. S. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher*, *15*(2), 4–14. https://doi.org/10.3102/0013189X015002004

Sinha, S., Gray, S., Hmelo-Silver, C. E., Jordan, R., Honwad, S., Eberbach, C., … Goel, A. (2010). Appropriating conceptual representations: A case of transfer in a middle school science teacher. In K. Gomez, L. Lyons, & J. Radinsky (Eds.), *Proceedings of the 9th International Conference of the Learning Sciences* (pp. 834–841). Chicago, IL: International Society of the Learning Sciences.

Sintawati, F. R. D. A. I., Joebagio, H., & Agung, L. (2017). The effectiveness of SAT (Self-Assessment Teacher) application to improve teachers' professionalism. In *Proceeding of International Conference on Art, Language, and Culture* (pp. 136–152). Surakarta: Pascasarjana Universitas Sebelas Maret. Retrieved from https://jurnal.uns.ac.id/icalc/article/view/16078

Snyder, J., Bolin, F., & Zumwalt, K. (1992). Curriculum implementation. In P. W. Jackson (Ed.), *Handbook of research on curriculum: A project of the American Educational Research Association* (pp. 402–35). New York, NY: Simon & Schuster Macmillan.

Sudira, P. (2016). *TVET abad XXI - Filosofi, teori, konsep, dan strategi pembelajaran vokasional*. Yogyakarta: UNY Press.

Suherman, A., & Saondi, O. (2010). *Etika profesi keguruan*. Bandung: PT. Refika Aditama.

Sumali, S. (2016). The effect of school based management to teacher professionalism of senior high school in Central Lampung. *GUIDENA: Jurnal Ilmu Pendidikan, Psikologi, Bimbingan Dan Konseling*, *6*(2), 195–199.

Sundayana, W. (2015). Readiness and competence of senior high school English teachers to implement Curriculum 2013. *Indonesian Journal of Applied Linguistics*, *5*(1), 29–36. https://doi.org/10.17509/ijal.v5i1.828

Suyanto, S. (2017). A reflection on the implementation of a new curriculum in Indonesia: A crucial problem on school readiness. In *AIP Conference Proceedings* (Vol. 1868, p. 100008). AIP Publishing LLC. https://doi.org/10.1063/1.4995218

Tanang, H., & Abu, B. (2014). Teacher professionalism and professional development practices in South Sulawesi, Indonesia. *Journal of Curriculum and Teaching*, *3*(2), 25–42. https://doi.org/10.5430/jct.v3n2p25

Taylor, M., Yates, A., Meyer, L. H., & Kinsella, P. (2011). Teacher professional leadership in support of teacher professional development. *Teaching and Teacher Education*, *27*(1), 85–94. https://doi.org/10.1016/J.TATE.2010.07.005

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

Ulrich, D., & Smallwood, N. (2012). What is leadership? In W. Mobley, Y. Wang, & M. Li (Eds.), *Advances in global leadership* (vol. 7, pp. 9–36). Bingley: Emerald Group Publishing Limited. https://doi.org/10.1108/S1535-1203(2012)0000007005

Vlok, A. (2012). A leadership competency profile for innovation leaders in a science-based research and innovation organization in South Africa. *Procedia - Social and Behavioral Sciences*, *41*, 209–226. https://doi.org/10.1016/J.SBSPRO.2012.04.025

Wahjosumidjo. (2010). *Kepemimpinan kepala*

sekolah: Tinjauan teoritik dan permasalahnnya. Jakarta: PT. Raja Grafindo Persada.

Wahjosumidjo. (2011). *Manajemen motivasi kerja*. Jakarta: PT. Bumi Aksara.

Wulandari, A. R. (2009). Meningkatkan profesionalitas guru. *Perspektif Ilmu Pendidikan*, *20*(XI), 75–82. https://doi.org/10.21009/PIP.202.8

Zais, R. S. (1976). *Curriculum, principles and foundations*. New York, NY: Harper & Row.

Zhu, X., Ennis, C. D., & Chen, A. (2011). Implementation challenges for a constructivist physical education curriculum. *Physical Education & Sport Pedagogy*, *16*(1), 83–99. https://doi.org/10.1080/17408981003712802

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (132-140)
Online: http://journal.uny.ac.id/index.php/jpv

FACTORS AFFECTING THE EMPLOYABILITY SKILLS OF VOCATIONAL STUDENTS MAJORING MECHANICAL ENGINEERING

Muhammad Noor Fitriyanto
Universitas Negeri Yogyakarta

Pardjono
Universitas Negeri Yogyakarta

Abstract

This study aims to find out the significance of the direct effect of industrial work practices on work learning readiness, vocational competency, and employability skills, the direct effect of work learning readiness on employability skills, and the direct effect of vocational competency on employability skills. The significance of the effect founds was expected to enhance the knowledge and consideration for developing employability skills vocational high school (VHS) students especially at industrial work practice, work readiness, vocational competency at vocational high school. The research used a quantitative approach with ex-post facto type. The data were analyzed quantitatively to test the formulated hypothesis. The research was conducted at State and Private Vocational High School in Yogyakarta Special Region. The population of the study was grade XII students majoring mechanical engineering. The research samples were 444 students who were selected using proportionate stratified random sampling. The data collection techniques were questionnaires distribution and documentation. The content validity was established using expert judgment. The construct validity was established using analysis factor by Kaiser Meyer Olkin Measure of Sampling Adequacy (KMO MSA) with a value of 0.691. The reliability of the research was judged using Cronbach's alpha with value for work readiness of 0.921 and employability skills of 0.864. The data analysis technique used path analysis. The result of the study shows that employability skills can be improved through effective implementation of industrial work practice, good training work learning readiness, and vocational competency-based technical skills and non-technical skills.

Keywords: *industrial work practices, vocational competence, work learning readiness, employability skills*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.24420*

Contact Muhammad Noor Fitriyanto muhammadnoorfitriyanto.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

In the 21st century today, there have been many changes in technological progress and the increasing number of job seekers who are mostly young people. These changes lead to increasingly fierce competition in terms of preparing labor or human resources. Vocational High School (VHS) is one of the educational channels in Indonesia to prepare students to get jobs through mastering skills relevant to the world of work.

Many factors cause vocational school graduates still do not get a job after graduating. The focused factor is in terms of soft skills owned by vocational students, which is also known as employability skills. Factors that influence the employability skills of vocational students include communication, information management, counting, problem-solving ability, positive thinking, responsibility, ability to adapt, continuous learning, and working safely. Based on those aspects, vocational school is organized through industrial work practices carried out for several months, the implementation of the Vocational Competency Test at the end of the semester in accordance with their field of expertise, and work readiness of students when they graduate from vocational education. These three things are influential factors for vocational students in getting the opportunity to work in the industry later.

Industrial work practices in vocational schools have a strategic role in preparing high-quality mid-level skilled workforce following the community/industry needs. Although many research results show the success of an internship, seen from the aspects of the process and results, there are still many gaps. According to Directorate of Technical and Vocational Education (2008), the gap between the graduates quality and industrial needs is still high. Industrial participation in the implementation of vocational education is still weak. Students who are in industrial practice in various fields do not receive adequate guidance from the industry. The dual system education model (dual system) is a system that is effective enough to educate and prepare someone to deepen and master complex skills that are impossible or never done in school (Pardjono, 2011).

The existence of differences in the level of readiness and level of progress of VHS (*Sekolah Menengah Kejuruan* or SMK) is also one of the causes of the not optimal level of work readiness of vocational graduates, in the sense that the level of graduate work readiness is uneven. The high and low level of work readiness possessed by students is determined by themselves (Krisnamurti, 2017, p. 67). Other factors that exist outside the student's self are only supporting factors. Although they are only supporting factors, however, they must also be considered. Students, as prospective workers who are declared ready to work, usually have experienced/gone through various processes, both theoretically and practically. Many factors or variables can affect work readiness, both from within students and from outside students.

Student competency testing is carried out following the competence of his expertise and carried out before the national examination. Directorate of Technical and Vocational Education (2018, p. 2) states that the purpose of conducting competency tests is to be an indicator of achievement of graduate competency standards, while for stakeholders, competency tests are used as information on the competencies of prospective workers. Students are said to have passed the competency test if they have implemented the competency test of expertise, including practical competency tests and theory competency tests. The overall verification of the implementation of the competency test is intended so that the implementation of the competency test runs well, and the results of competency tests can be fully recognized by the industrial world.

In addition to the hard-skill competencies described above, vocational students are also required to have skills that make them ready to be employed. The skills learned by students during their education at vocational school are grouped into two, namely technical skills and non-technical skills. Technical skills commonly referred to as hard skill are skills in completing certain occupations. Non-technical skills, or commonly called soft skills in the vocational realm, are known as employability skills. Employability skills are several skills that can be used in daily life in the workplace and can be transferred to various fields of work and professions, which include elements of teamwork, communication skills, problem-solving skills, adaptability, ability to manage oneself (The Conference Board of Canada, 2000).

The assessment indicators on technical aspects and employability skills are indicators received by the industry. Indicators on the technical skills aspect can be identified through the knowledge and skills of the work field. Employability skills aspects can be identified through indicators of managerial ability and personality/personality. Thus, all the indicators on technical and employability skills already represent the competence level of qualification in the Indonesian Qualification Framework (IQF) (Febriana, Premono, & Iriani, 2017).

The industry is expected to provide the right guidance to students who take part in industrial work practice by giving the list of tasks in the implementation of industrial work practice. The school should improve the students' work readiness by providing training before conducting industrial work practice (Putri & Sutarto, 2018).

The results of students' industrial work practice are good; it can improve students' work learning readiness because industrial work practices have a direct effect on the students' work learning readiness. It means that improving the students' work readiness can be achieved by improving the quality of vocational students. The results of good industrial work practices of students can also improve students' vocational competence because industrial work practices have a direct effect on students' vocational competencies. It means that improving the vocational competence of students in the field of mechanical engineering can be achieved through the improvement of the quality of the good vocational student. The results of good student industrial work practices are also able to improve students' employability skills because industrial work practices have a direct effect on students' employability skills. It means that improving students' employability skills in the field of mechanical engineering can be achieved by improving the quality of vocational students.

Students' good work learning readiness can improve their employability skills because students' work learning readiness directly influences their employability skills. It means that improving students' employability skills in the field of mechanical engineering can be achieved by increasing students' work readiness to the maximum level.

Good vocational competence can improve students' employability skills because students' vocational competencies directly influence students' employability skills. It means that improving students' employability skills in the field of mechanical engineering can be achieved by improving the quality of vocational competencies (Jackson, 2013).

Vocational education is education for vocation or education for occupations. Vocational education for the world of work in question is that through vocational education, someone is trained to have the capacity and capability to be able to carry out a task or position. Capacity is obtained through productive training to produce special skills according to the needs of business and industral world. Capability means that someone is able to work hard (Sudira, 2016).

The implications obtained from industrial work practices or apprenticeship which indirectly affect employability skills through work learning readiness is that apprenticeship can improve employability skills if it is supported by increasing students' work learning readiness to the fullest. It means that improving students' employability skills can be achieved by implementing a good internship and supported by increasing students' work learning readiness to the fullest. Industrial work practice impacts indirectly on employability skills through students' vocational competencies. In this case, apprenticeship is able to improve employability skills if it is supported by the implementation of quality vocational competency tests. It means that the implementation of good internship supported by the implementation of a good vocational competency test will improve students' employability skills.

Based on those statements, these three factors are considered to be able to influence the achievement of students' work abilities - or also known as employability skills in the vocational domain - later. For this reason, it is important to look for and see the factors that influence students' employability skills, starting from industrial work practice factors, work readiness factors, and skill competency factors.

RESEARCH METHOD

This research is ex-post facto research with This study employs a quantitative approach, with an ex-post facto type. The nature of this analytical research is to prove an existing theory. The research was conducted in

the State Vocational Schools and Private Vocational Schools in Special Region of Yogyakarta in the major of Mechanical Engineering. The population of this study was 1060 students. The sampling technique was done using the Multi-Stage sampling technique. Cluster random sampling technique was used to attain the number of clusters from each vocational school. The minimum sample of this study was 444 students. The data were collected using the techniques of documentation and questionnaires. Industrial work practice variables and vocational competencies were taken from the final value of the school's industrial work practices and the final value of the school's skills competency test for the variable of work readiness study and employability skills measured using a questionnaire. The validity test used in this study is the factor analysis technique using the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO MSA). The data analysis technique used in this study is covariance-based Structural Equation Modeling (SEM).

RESULTS AND DISCUSSION

The results of this study produce a description of the data using the Structural Equation Modeling model and obtain a path analysis based on the previous theory, and path diagram obtained as presented in Figure 1.

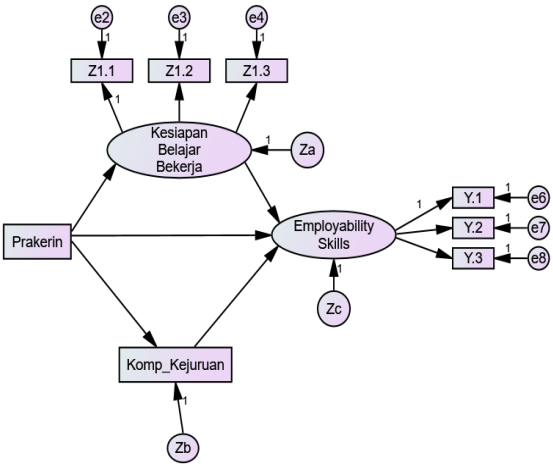


Figure 1. Path Diagram

SEM analysis can only be done if the model identification results show that the model belongs to the over-identified category. This identification is done by looking at the df value of the model made (Ghozali, 2017).

Table 1. Result of Degrees of Freedom

Number	df (degrees of freedom)
Number of distinc sample moment	36
Number of distinc parameter to be astimated	19
Degrees of freedom	36-19 = 17

Table 1 is the output that shows the model df value of 17. It identifies that the model belongs to the over-identified category because it has a positive df value. Therefore, data analysis can proceed to the next stage.

The next testing phase is the model feasibility test consisting of two stages of testing, namely testing the measurement model and the structural model. To test the measurement model, testing the Goodness of Fit (GoF) was conducted to find out how fit the model was with the research data obtained. Figure 2 is the path diagram generated after performing the stages of fulfilling the SEM assumption test.

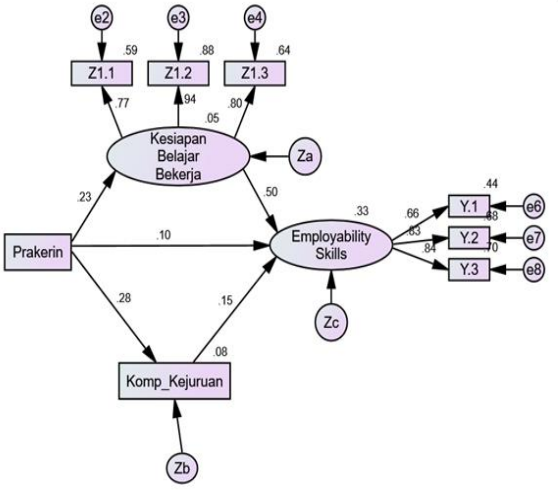


Figure 2. Output Diagram

Based on the output path diagram, a summary of the GoF test results is made as presented in Table 2.

Table 2. Result Goodness of Fit Model

Goodness of Fit	Cut Value	Model Score	Notes
Chi-square	Small	103.637	
DF	>2.0	6.096	Good Fit
p (probability)	>0.05	0.000	Good Fit
RMSE	>0.08	0.107	Good Fit
GFI	>0.09	0.947	Good Fit
TLI	>0.09	0.904	Good Fit

The GoF test results are summarized in Table 3 with information on work learning readiness (KBK), Industrial Work Practice (P), Expertise Competence (UKK), and also employability skills (ES), work learning readiness indicator consists of Z1 (mental and attitude), Z2 (a skill), and Z3 (an insight into the world of work). The employability skills indicators consist of Y1 (fundamental skills at the operator level), Y2 (expert level management personnel), and Y3 (teamwork skills at the supervisor level). The modified model is fit with existing data so that hypothesis testing can be done. Hypothesis testing was done by looking at the value of C.R. (critical ratio) in Table 3.

Hypothesis testing was conducted by comparing the value of C.R. in Table 3. The critical value is identical to the calculated t value, which is 1.65 at the 5% significance level. If the value of C.R. is greater than the critical value with a significance level of $p < 0.05$, then it means that the proposed hypothesis is accepted. However, if the value of C.R. has not been able to reach its critical value at a significance level of $p > 0.05$, then it can be inferred that the proposed hypothesis is rejected.

The following is a discussion of each factor analysis test or hypothesis test based on the test results summarized in Table 3:

In Table 3, the value of C.R. amounting to 4.690 means that this value exceeds the critical value, which is 1.65. These results indicate that the factors of industrial work practice have a significant influence on work learning readiness with a coefficient of 0.156. C.R value. Therefore, the hypothesis is accepted. The fieldwork practice has a significant impact on the readiness of vocational school students majoring mechanical engineering in Yogyakarta Special Region; it is contrary to the research conducted by Firdaus (2012) entitled Production unit, engineering and family support in vocational students' work readiness, showing that work training experience has a significant effect on students' work readiness by 50.1%. It proves that, currently, students have a good and right experience in industrial work, so these students will have good work readiness, supported by the experience possessed by these students, in this case, the students of the mechanical engineering program.

Then, the value of C.R. amounting to 6.196 means that this value exceeds the critical value, which is 1.65. These results indicate that industrial work practice factors have a significant effect on vocational competencies with a coefficient of 0.218. It is in line with a research conducted by Putriatama, Patmanthara, and Sugandi (2016) entitled Contribution of industrial worker experience, world work insights, and vocational competence competence of computer engineering and jaringa expertise. The results of the study show that there is a positive and significant influence between an internship, insight into the world of work, and competency on work readiness. It is in line with Huda, Thoharuddin, and Sore (2019) in his research entitled The effects of industrial work practices, vocational competencies, and parents' socio-economic conditions on work interest and work readiness of computer and networking expertise in Sintang City, showing that industrial work practices have a significant effect on work readiness with an effect of 0.009.

Table 3. Regression Weights

Path Analyzed	Estimation	S.E	C.R	P
KBK - P	0.156	.003	4.690	.000
UKK – P	0.218	.035	6.196	.000
ES – KBK	0.309	.039	7.953	.000
ES – UKK	0.083	0.28	2.989	.003
ES – P	0.042	.020	2.125	.034
Z1.1 – KBK	1.000			
Z1.2 – KBK	0.993	.052	19.194	.000
Z1.3 – KBK	0.326	.019	17.505	.000
Y.1 – ES	1.000			
Y.2 – ES	1.296	.090	14.359	.000
Y.3 - ES	0.892	.064	13.985	.000

Then, the value of C.R. amounting to 2.125 means that this value exceeds the critical value, which is 1.65. These results indicate that the internship factor has a significant effect on employability skills with a coefficient of 0.042. It is in line with research conducted by Susanti, Waras, and Dardiri (2015) who state that vocational students say that the suitability of industrial work practices contributes to student employability skills 28.35. Students who have implemented the apprenticeship well, namely in terms of time or length of internship, appropriateness of internship, and discipline in the implementation of daily apprenticeship will affect their ability to work or student employability skills because these students are trained in obtaining skills relevant to the business world and the world of work that students do not get while at school.

Next, the value of C.R. amounting to 7.953 means that this value exceeds the critical value, which is 1.65. These results indicate that the work learning readiness factor has a significant influence on employability skills with a coefficient of 0.309 C.R value. Thus, it can be said that good work readiness in a student has a big influence on his employability skills because the indicators of work learning readiness and employability skills are quite similar. In work readiness, the indicators include mental and attitudes, skills, and knowledge. In employability skill, if seen in more detail, the indicators also include components in analyzing, communicating, negotiating, and planning skills. All sub-indicators or subcomponents are included in the vocational students' employability skills category in developing their job skills.

The next is 2.989. This value exceeds the critical value of 1.65. It shows that vocational competency factors have a significant influence on employability skills with a coefficient value of 0.083. Thus, it can be said that with the implementation of competency skills tests that are competent, especially in the field of mechanical engineering expertise in vocational high schools, it has a large influence on employability skills for students because vocational competence in vocational schools aims to produce graduates who have proven and competent skills in accordance with their fields of expertise. Vocational competency test is carried out at the end of class XII before students graduate with written exam questions and practices made by teachers and experts in their fields, in this case, in the mechanical engineering field. Employability skills will be formed by testing students through competencies that students must achieve in procedural and effective ways of working so that if students have passed the skills competency test, the vocational student's employability skills will increase, especially in the aspect of problem-solving. It is in line with the research conducted by Putriatama et al. (2016) that there is a significant influence between internship experience, work insight, and vocational competencies for work readiness through employability skills.

Furthermore, the value of t calculated for industrial work practice factors affects employability skills through vocational competence of 2.649. Industrial work practice has a significant effect if the value of t count> t table (1.965). The internship factor has a significant influence on employability skills through vocational competence with a coefficient value of 0.043. Employability skills will increase if the implementation of industrial work practice carried out by students at the time of class XI is carried out well and automatically increases work learning readiness due to the experience possessed by students after completion of industrial work practices. Therefore, employability skills become good when the application of industrial work practice by students is well followed by good work learning readiness. It is in line with the research conducted by Putriatama et al. (2016) stating that there is a significant effect of internship experience, vocational competence on readiness employment through employability skills of 54%, and the remaining 46% is influenced by other factors outside the model.

Finally, industrial work practice factors affect employability skills through vocational competence in the amount of 4.036. Industrial work practice has a significant effect if the value of t count> t table (1.965). The industrial work practice factor has a significant influence on employability skills through vocational competencies with a coefficient of 0.117. A vocational competency is a number of competencies tested at the end of the study period found in a group of subjects in vocational high schools. It means that by completing the industrial work practices in class XI and skills competency tests in class XII, students' work-

ing ability or employability skills will increase. Two variables or two factors, apprenticeship and vocational competence, are the basic requirements that students must fulfill to graduate and achieve overall school activities aimed at improving job skills or employability skills.

So far, there have not been found the results of research on the indirect effect of industrial work practices on employability skills through readiness to work. However, the influence of work readiness on employability skills can be traced from several studies related to the achievement of technical and non-technical skills. The application of technical and non-technical skills in the learning environment of vocational schools generally provides an outstanding influence on character development. It also influences the development of students' employability skills.

There are limitations to the research, namely the measurement of industrial work practices uses the value of apprenticeship from the school or secondary data, causing the score given by the school to have a minimum score of B or good. This condition does not show the real condition because the students' abilities, if measured, are various, from low to very high.

The existence of several schools in the implementation of skills competency tests carried out in different periods, and different test packages cause the measurement parameters used are not the same because the provincial education office adjusts the completeness of the equipment facilities owned by the vocational high schools. Therefore, in this case, it cannot control the quality of the same test for the entire population.

CONCLUSION

Based on the results of the research previously discussed, some conclusions are drawn as follows. (1) There is a direct influence on the apprenticeship to the preparation of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio value of 4.690 and a coefficient of 0.233. (2) There is a direct influence of apprenticeship on vocational competence of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio of 6.196 and a coefficient of 0.282. (3) There is a direct influence of apprenticeship on the employability skills of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio of 2.125 and a coefficient of 0.101. (4) There is a direct effect of work readiness on the employability skills of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio of 7.953 and a coefficient of 0.501. (5) There is a direct effect of vocational competence on the employability skills of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio of 2.989 and a coefficient of 0.154. (6) There is an indirect influence of apprenticeship on employability skills through work readiness of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio of 2.649 and a coefficient of 0.117. (7) There is an indirect influence of apprenticeship on employability skills through the vocational competence of vocational students majoring mechanical engineering in Yogyakarta Special Region with a Critical Ratio of 4.036 and a coefficient of 0.043.

Thus, it can be concluded that the work readiness factor has the highest coefficient value compared to other factors. The coefficient value that is owned is 7.953. Job readiness factor is the strongest predictor that affects employability skills.

Based on the conclusions made, suggestions are proposed as follows: (1) Students' employability skills can be improved by training students in guidance on Industrial Work Practices through communication technology such as e-mail, WhatsApp, Google Drive, etc. in a systematic and structured manner. It will shape their communication skills. (2) Information management owned by students can be trained by familiarizing class discussions about the insights of the business and industry through the direction of the vocational school teacher managing special job fair or through the vocational development center owned by the school so that the information students get is always updated. (3) Employability skills can be improved by familiarizing students with calculating using the mechanical engineering parameter formula both during teaching and learning activities in the classroom and during the final practice exam or expertise competency test. (4) The teacher does not help students who are examining even though students

are in a state of full pressure/underpressure, with the aim that mentally trained students are able to solve the problem well. (5) Employability skills will be formed by encouraging students to conduct SOP workshops with high commitment and discipline, such as giving penalties if students do not use safety shoes when they are in the workshop. (6) Vocational high schools can improve students' work-readiness with periodic and controlled career guidance, which can be achieved through homerooms, vocational development centers owned by schools, or invite industry parties to schools regularly and periodically. Finally, there is a need for further research to uncover other factors that have a significant influence on students' vocational skills, particularly on their employability skills, such as the learning environment, workplace insights, students' interests and talents, students' learning outcomes, and family economy.

REFERENCES

Directorate of Technical and Vocational Education. (2008). *Pelaksanaan prakerin*. Jakarta: Directorate of Technical and Vocational Education, Department of National Education.

Directorate of Technical and Vocational Education. (2018). *Pedoman penyelenggaraan UN kompetensi keahlian SMK tahun pelajaran 2018/2019*. Jakarta: Directorate of Technical and Vocational Education.

Febriana, R., Premono, A., & Iriani, T. (2017). Industrial assessment to technical and employability skills students based on KKNI (in Jakarta Region). *Jurnal Pendidikan Vokasi*, *7*(3), 340–348. https://doi.org/10.21831/jpv.v7i3.16599

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

Ghozali, I. (2017). *Konsep aplikasi dengan program AMOS 21*. Semarang: Badan Penerbit Universitas Diponegoro.

Huda, F. A., Thoharuddin, M., & Sore, A. D. (2019). Pengaruh kondisi sosial ekonomi orang tua terhadap kesiapan kerja siswa SMK keahlian teknik komputer dan jaringan se-kota Sintang. *VOX EDUKASI: Jurnal Ilmiah Ilmu Pendidikan*, *10*(1), 66–77. https://doi.org/10.31932/ve.v10i1.326

Jackson, D. (2013). The contribution of work-integrated learning to undergraduate employability skill outcomes. *Asia-Pacific Journal of Cooperative Education*, *14*(2), 99–115.

Krisnamurti, T. F. (2017). Faktor-faktor yang mempengaruhi kesiapan kerja siswa SMK. *Jurnal Pendidikan Dan Ekonomi*, *6*(1), 65–76. Retrieved from http://journal.student.uny.ac.id/ojs/index.php/ekonomi/article/view/6075

Pardjono, P. (2011). *Peran industri dalam pengembangan SMK*. *Paper presented at Workshop on the Role of Industry in the Development of Vocational High School on 19 February 2011*. Bantul, Yogyakarta.

Putri, D. Y., & Sutarto, S. (2018). The effect of industrial work practice, guidance intensity of industrial side, and vocational competence on working readiness of grade XII students of banking program, Vocational High School Perbankan, Pekanbaru. *Jurnal Pendidikan Vokasi*, *8*(2), 132–142. https://doi.org/10.21831/jpv.v8i2.18908

Putriatama, E., Patmanthara, S., & Sugandi, R. . (2016). Kontribusi pengalaman prakerin, wawasan dunia kerja dan kompetensi kejuruan melalui employability skill serta dampaknya terhadap kesiapan kerja lulusan SMK kompetensi keahlian teknik komputer dan jaringan di Probolinggo. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *1*(8), 1544–1554. https://doi.org/10.17977/JP.V1I8.6643

Sudira, P. (2016). *TVET abad XXI - Filosofi, teori, konsep, dan strategi pembelajaran vokasional*. Yogyakarta: UNY Press.

Susanti, A. I., Waras, W., & Dardiri, A. (2015). Kontribusi persepsi siswa tentang kualitas guru, kesesuaian, dan hasil prakerin terhadap employability skills siswa SMK. *Teknologi Dan Kejuruan:*

Jurnal Teknologi, Kejuruan Dan Pengajarannya, *38*(2), 121–132. https://doi.org/10.17977/TK.V38I2.4953

The Conference Board of Canada. (2000). Employability skills 2000. Retrieved from http://www.conferenceboard.ca/education/eps2000.pdf

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (141-150)
Online: http://journal.uny.ac.id/index.php/jpv

THE IMPACT OF INDEPENDENT LEARNING ON STUDENTS' ACCOUNTING LEARNING OUTCOMES AT VOCATIONAL HIGH SCHOOL

Ery Novita Sari
Universitas Negeri Yogyakarta

Zamroni
Universitas Negeri Yogyakarta

Abstract

The independence of student learning in recent years was discussed in several articles. Through the development of an independent attitude in learning, students can diagnose learning difficulties and find the right solution to solve them. This study was aimed at finding out how the influence of learning independence on students' accounting learning outcomes. The type of research used is ex-post facto quantitative research. The population of the research is all students of class XI of Public Middle School in the city of Yogyakarta, with a total of 156 students. The instruments used were questionnaires and multiple-choice questions (MCQs). Validity and reliability of the questionnaire were measured using Confirmatory Factor Analysis (CFA) through the Lisrel 8.80 application, while the validity and reliability of MCQs were measured using Rasch approach through the Quest application. Several questionnaires in the form of questionnaires and documentation were used on the testing instrument. The number of instruments for learning independence was 19 statements. The closed statement form used a Likert scale consisting of five alternative answers. The number of MCQs is 18 questions. There were 18 valid statements found after going through the calculation of validation, reliability, difficulty level of the question, and distinguishing power. Simple regression was used for the data analysis technique. The results of the study show that the learning independence variable has a significant and positive influence. It can be seen from the learning independence variable, which has a value of 2.187 and a significance value smaller than 0.05 (0.030 <0.05).

Keywords: *independent learning, accounting, learning outcomes*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.24776*

Contact Ery Novita Sari
erynovitasari.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

Learning outcomes are the achievement of students' success obtained at school. Vocational High School (*Sekolah Menengah Kejuruan* or SMK) is one form of secondary education. Based on the Government Regulation No. 17 of 2010, article 76 paragraph 2, education in vocational high schools aims to improve the skills of students in facing all challenges of the world of work by becoming skilled and professional workers along with the progress of science and technology.

It is in line with curriculum 2013 that has been implemented for several years. In the revised curriculum 2013, students are expected to be able to be independent and know what has been learned, what is being learned, and what must be learned. In curriculum 2013, special attention was placed on structuring mindset and governance, deepening the material and expanding the material, strengthening the process, and adjusting the burden borne by students. It is hoped that with the implementation of the curriculum 2013, schools can produce competent and independent human resources.

To achieve good learning outcomes, instilling students' independent nature in learning is needed. O'Rourke and Carson (2010, p. 83) inform that "Learner autonomy is that learning has to start from the learner's existing knowledge." The effect of learning independence is important to measure the maximum achievement of learning outcomes, because, with the independence in learning, students will have broad insights and initiatives to carry out the learning process in school. According to Schunk (2012, p. 122), learning independence is the ability of students to exercise self-control and self-observation and to evaluate their cognitive processes personally. Independence will encourage students to achieve and be creative. Arista and Kuswanto (2018, p. 3) add that "learning independence is defined as a form of awareness that arises from within themselves who want to receive information, manage it, and connect one part of information with another." Through developing independent attitudes in learning, students can diagnose learning difficulties and find the right solution to solve the difficulties. It will certainly become a positive influence on students themselves in terms of mastering the concept of learning.

Based on the results of observations and interviews with accounting subject teachers in class XI of Financial Accounting in Vocational High Schools in the city of Yogyakarta, the independence of student learning is still not optimal. It can be seen from the score of the mid-semester examination obtained by students in financial accounting subjects in material receivables can be said to be less good. It is said to be not good because it shows the majority of 65% on average students get grades ranging from 60 to 75 with minimum completeness criteria (*Kriteria Ketuntasan Minimum* or KKM) 75 as the lower limit of competencies that must be passed. Meanwhile, students who score 75 to 100 can be categorized very little, which is equal to 35%.

In general, students who are not independent in accounting learning can be seen when students still lack confidence in their ability to do the tests. Independence of learning can also be seen from the daily learning habits of students, such as the way students plan and do learning. Thus, students' high learning independence is essential for improving accounting learning outcomes because it will affect the creation of self-enthusiasm for learning. Students who lack learning independence are characterized by not doing assignments and paying less attention to the teacher when learning takes place, such as daydreaming and chatting with friends. Therefore, students have not applied a routine, effective, and regular learning strategy.

According to van der Stel and Veenman (2014, p. 117), students must act as active students with their own learning responsibilities. Students must also be able to plan their learning activities and implement them in a systematic and orderly way to monitor and evaluate student learning itself. Students are also still less independent in learning, so their learning achievements are below the minimum standards (Clark & Lyons, 2011, p. 293). From the above statement, it can be assumed that independence in learning is something that requires special attention in learning.

Kyndt, Gijbels, Grosemans, and Donche (2016, p. 3) state that learning also refers to an activity that is structured in terms of time-space, goals, and support. High-level learning outcomes require students to improve, recognize, and understand concepts (Van der Kleij, Feskens, & Eggen, 2015, p. 5). Further, it is

followed by the statement of Fatkhurrokhman, Leksono, Ramdan, and Rahman (2018, p. 166) that learning is an activity carried out by teachers to change students to be better.

Based on the statements as mentioned earlier, it can be concluded that learning is an effort that is consciously carried out by students to change, from being unknowledgeable into knowledgeable, from not performing the right attitude to performing the right attitude, and from being unskilled to being skilled in doing things. Henderson and Trede (2017, p. 73) believe that results are an essential component of the collaborative governance framework as a feedback mechanism to ensure the proper functioning of structures and processes. According to Kyndt et al. (2016, p. 4), there is a great value in the glitter of visible learning outcomes. Moreover, Page, Meehan-Andrews, Weerakkody, Hughes, and Rathner (2017, p. 46) state that learning outcomes are reflected in the proportion of student mastery. Then, according to the Engineering Accreditation Council (2007, p. 24), the results are statements that explain what students must know, understand, and do after the completion of the study period.

According to Sjukur (2013, p. 372), learning outcomes are a final assessment of the process and introduction that has been done repeatedly and will be stored for a long time or will not even disappear forever, because the learning outcomes participate in forming the individual person always to want to achieve better results. Thus, they will change their way of thinking and produce better work behavior. From this opinion, it can be concluded that learning outcomes are improvements in the form of achievements and behavioral changes obtained by students after participating in teaching and learning activities in schools.

Accounting learning results are the results obtained by students after taking accounting subjects in school, the results of which can be in the form of student changes as indicated by the level of ability of students who experience changes and achievements that have increased. With changes or improvements in learning outcomes in accounting subjects, learning outcomes have been achieved as expected.

Self-reliance, according to Medlin and Butler (2018, p. 68), refers to teaching itself and also states that independent means learning the best things themselves. Independence in learning is something that requires special attention in learning. According to Boeree (2013, p. 260), independence is not dependency. Independence is also the impact of learning (Birnbaum & Schmidt, 2015, p. 7).

The term independence of learning is related to several other terms: (1) self-regulated learning, (2) self-regulated thinking, (3) self-directed learning, (4) self-efficacy, and (5) self-esteem. The definition of the five terms above is not exactly the same but has several similarities in characteristics (Prayekti, Budiman, & Budi, 2016, p. 144). Arista and Kuswanto (2018, p. 3) explains that independence of learning can be interpreted as a form of awareness that arises from within themselves who want to receive information, manage it, and connect one part of information with another. Then, Mulyono (2017, p. 690) adds that "learning independence is a person's perception or view of himself, which is formed through experience and interaction with the environment and is influenced by people who are considered important." Mukhlis, Japar, Maksum, and Adiansha (2018, p. 1033) state that learning independence is an attitude and behavior in a person to carry out independent learning activities based on his own motivations and is the result of his own experience and training without depending on others to master certain material, so that it can be used to solve the problem at hand.

By increasing student learning independence, the better the independence of learning will have an impact on the ability and learning outcomes, and vice versa. Prayekti et al. (2016, p. 146) also state that someone who has an independent attitude must be able to actualize optimally, not relying on others. Therefore, changes in someone is the result of his daily experience and independent practice to not depend on others. It is in line with Fatihah (2016, p. 200) who believes that learning independence is a person's ability to carry out learning activities with full confidence and responsibility for their actions. Then, according to Aini and Taman (2012, p. 54), learning independence is a learning activity that is carried out by students of their own volition and have high self-confidence in completing their tasks.

Independence of learning, according to Aliyyah, Puteri, and Kurniawati (2017, p. 126),

is an active learning activity that is built with the knowledge or competence that is owned, both in determining the time of the study, place of learning, learning, and evaluation of learning done by the students themselves. Then, Setyowati (2018, p. 25) adds that learning independence can make students have initiative in learning, search for learning methods, carry out learning processes, practice effectiveness in learning, have independence in making decisions, working on tasks, consequences after doing assignments, repeating lessons, recalling lessons, remembering lessons, record important things, ask friends for help, and have the responsibility for doing tasks.

In-depth, there are several characteristics of learning independence that is proposed by Prayekti et al. (2016, p. 147), namely: (1) being able to think critically, creatively and innovatively; (2) being not easily affected by the opinions of others; (3) not running from or avoiding problems; (4) solving problems with deep thinking; (5) solving problems by him/ herself without asking someone for help; (6) not feeling inferior at anytime, even when he/ she has to be different from others; (7) trying to work with perseverance and discipline; (8) responsible for his own actions.

Fatihah (2016, p. 200) insists that the characteristics of learning independence are indicated by the ability to solve problems faced with behavior. With changes in behavior, children have an increase in thinking, learning to be independent without relying on help from others and not relying on learning only from the teacher, because the teacher is not the only source of knowledge, and can use shared resources and media to learn. Learning independence can be seen in students' daily learning habits, such as how to plan and do learning (Syahputra, 2017, p. 383).

The development of independence in students makes students able to do everything according to their abilities optimally and do not rely on others. Students who have high learning independence will try to complete all the exercises or assignments given by the teacher with their own abilities. If students get into trouble, then they will ask questions or discuss the trouble with friends, teachers, or other parties who are more competent in overcoming these difficulties (Fatihah, 2016, p. 200).

RESEARCH METHOD

This research is an ex post facto study with a quantitative approach. This research was conducted at State Vocational Schools in Yogyakarta City, with a population of 156 students. The variables used in this study are learning independence and student accounting learning outcomes. Two measuring instruments, namely tests and non-tests, were used in data collection. The test instrument employs multiple-choice questions, while the non-test instruments are in the form of questionnaires and documentation. The number of instruments for learning independence questionnaire is 19 statements. The form of the statement is closed statements using a Likert scale consisting of five alternative answers. Meanwhile, the number of multiple-choice questions are 26 questions.

Before the instrument was used as a data retrieval tool, first, the data were tested for validity and reliability. The Quest application using the Rasch approach was used to test the validity of the test. Determination criteria are valid if INFIT MNSQ is in the range of 0.77 <MNSQ <1.30. Thus, out of 26 questions that were tested, all of them are entirely declared valid, followed by reliability testing, which obtains values of 0.97 in high criteria. It can be seen in Figure 1.

Next, the non-test instrument validity was tested using Confirmatory Factor Analysis (CFA) using the Lisrel 8.80 application. Of the 19 questions tested, nine valid statements were obtained. It can be seen in the chart shown in Figure 2.

From the reliability test statement, a value of 0.713 is obtained. This number is obtained from calculations in the application of SPSS Version 20.

Data from the processed questionnaire was followed by an analysis of each variable to answer the research question. Previously, the analysis prerequisite test was conducted, consisting of a normality test, linearity test, and multicollinearity test. Then, it was followed by a simple-regression hypothesis test.

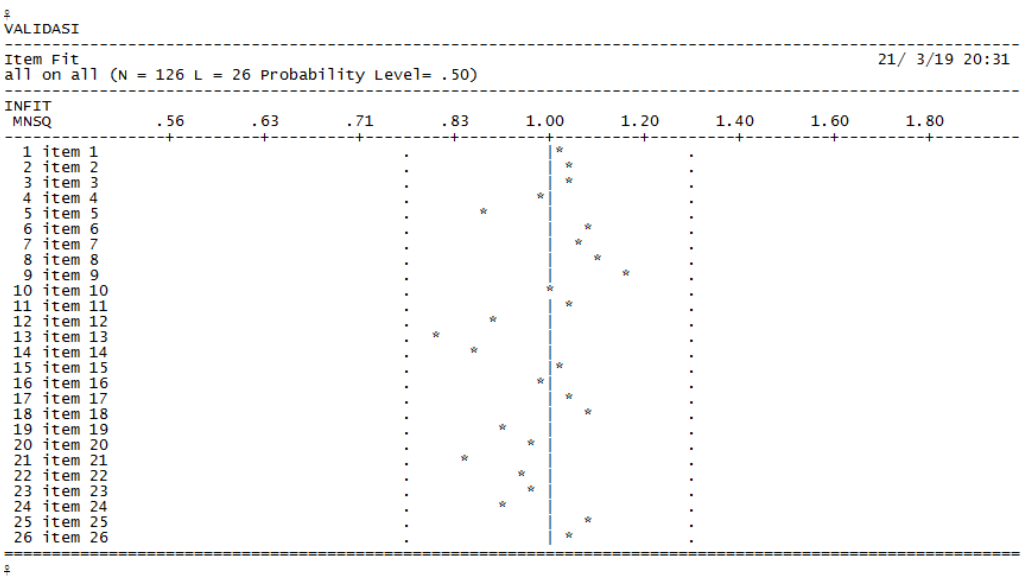


Figure 1. The Validity Results of Test Instruments

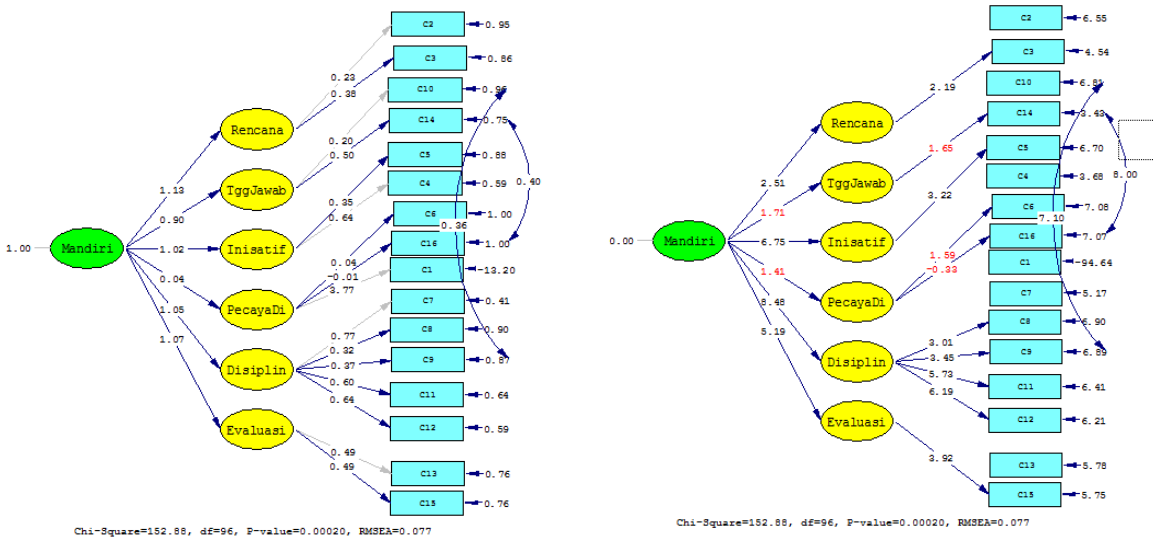


Figure 2. The Validity Results of Non-Test Instruments

RESULTS AND DISCUSSION

The data of 159 respondents in this study are generally described in Table 1. It can be seen that the 159 respondents were dominated by female students as many as 154 students or 96.9% and male students as many as five students or 3.1%.

Table 1. Gender

Gender	Number	(%)
Male	5	3.1
Female	154	96.9
Total	**159**	**100**

Source: Data processed in 2019

Table 2. Age

Age	Number	(%)
16	68	42.8
17	90	56.6
18	1	0.6
Total	**159**	**100**

Source: Data processed in 2019

Based on Table 2, it is known that research respondents consisted of 17-year-old students as many as 90 students or 56.6%, 16-year-old students as many as 68 students or 42.8%, and 18-year-old students as many as one person or equal to 0.6%. Meanwhile, Table

3 shows that there are 93 respondents from Yogyakarta City or 58.5%, 30 students or 18.9% from Sleman Regency, and 36 students or 22.6 % are from Bantul Regency.

Table 3. Residential Districts

Sub-district	Number	(%)
Yogyakarta City	93	58.5
Sleman	30	18.9
Bantul	36	22.6
Total	**159**	**100**

Source: Data processed in 2019

Table 4. Student Father's Latest Education

Educational level	Number	(%)
Not completed primary school	-	-
Elementary school	29	18.2
Junior high school	32	20.1
Senior high school	83	52.2
College	15	9.4
Total	**159**	**100**

Source: Data processed in 2019

Table 4 shows that the last education level of the students' fathers was dominated by high school/equivalent graduates, namely 83 people or 52.2%, followed by 32 junior high school graduates or 20.1%, 29 elementary school graduates or 18.2 %, while college graduates are only 15 people or 9.4%. In Table 5, it was found that high school/equivalent graduates dominated the last education of students' mothers, namely 68 people or 42.8%, followed by 37 junior high school graduates or 23.3%, 32 elementary school graduates or 20.1%, while college graduates are only 21 people or 13.2%, and one person does not graduate at elementary school level, or 0.6%.

Table 5. Student Mother's Latest Education

Educational level	Number	(%)
Not completed primary school	1	0.6
Elementary school	32	20.1
Junior high school	37	23.3
Senior high school	68	42.8
College	21	13.2
Total	**159**	**100**

Source: Data processed in 2019

Data on learning independence variables were taken from a questionnaire consisting of nine statement items. Based on the results of the research data, the highest variable X score is 44, the lowest score is 25, the mean is 34.21, and the standard deviation obtained is 3.969. Thus, the categorization of learning independence variables is presented in Table 6.

Table 6. Variable Categorization of Independence Learning

Category	Score Interval	f	(%)
High	X≥38.17	22	13.8
Medium	38.17≤X<30.24	113	71.1
Low	X < 30.24	24	15.1
Total		**159**	**100**

Source: Data processed in 2019

Based on Table 6, it can be seen that the result of assessment on the respondents in terms of the learning independence variables are in the moderate category for 113 students or equal to 71.1%, 22 students or equal to 13.8% are in the high category, and 24 students are in a low category or equal to 15.1%.

Prerequisite Test for Analysis

The prerequisite test analysis is carried out before testing the hypothesis. If the test for each variable meets the analysis prerequisites, then the test can proceed. In this prerequisite, the test includes a normality test, linearity test, and multicollinearity test. The normality test is seen from the significance of the two-tailed test from the Kolmogorov-Smirnov test, at a significance level of 0.05.

Table 7. Result of Normality Test

One-Sample Kolmogrov-Smirnov Test		
		Unstand. Residual
N		159
Normal Parameters[a]	Mean	0.000
	Std. Deviation	9.562
Most Extreme Differences	Absolute	0.105
	Positive	0.070
	Negative	-0.105
Kolmogrov-Smirnov Z		1.324
Asymp. Sig. (2-tailed)		0.60

a. Test distribution is Normal
b. Calculated from data
Source: Data processed in 2019

From Table 7, it can be seen that based on the One-Sample Kolmogrov-Smirnov Test table on Asym. Sig. (2-tailed), a number of

0.60 is obtained. It means that the value of Asym. Sig. (2-tailed) is greater than the significant value of 0.05. Therefore, the data are declared normal, and it can proceed to further data processing.

After the normality test, the next prerequisite test is the linearity test. Two variables are said to have a linear relationship if the linearity coefficient seen in the Linear Deviation form is Sig (P)> 0.05.

Based on Table 8, the Deviation from Linearity value is 0.459. This value is greater than the significant value of 0.05. Thus, the data is declared linear.

The classic assumption of multicollinearity is the correlation between independent variables in the regression model. The rule for the Multicollinearity test is that the Tolerance value is <0.1, and the VIF value is> 10.

Based on Table 9, the Tolerance value is 1, and the VIF is 1. The Tolerance value is greater than 0.1, and the VIF value is smaller than 10. It means that the data passed the multicollinearity test.

Hypothesis Testing

Based on the results of a simple linear regression test in Table 10, it is found that the learning independence variable had a t-count value of 2.187 and a significance value smaller than 0.05 (0.030 <0.05). It indicates that learning independence had a positive and significant effect on students' accounting learning outcomes.

Table 11 shows that the results of the Adjusted R Square test in this study obtained a number of 0.23. It means that the influence of learning independence on student learning outcomes is 23%, while other variables influence the remaining 77%.

Table 8. Result of Linearity Test of Learning Independence with Learning Outcomes

ANOVA Table

			F	Sig.
(Y)*(X3)	Between Groups	(Combined)	1.203	.264
		Linearity	4.786	.030
		Deviation from Liniarity	1.004	.459

Source: Data processed in 2019

Table 9.Result of Multicolliniearity Test

Coefficients[a]

		Tolerance	**VIF**
1	(Constant)		
	Learning Independence	1.000	1.000

Source: Data processed in 2019

Table 10. Results of Simple Linear Regression Analysis

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	79.792	6.623		12.048	.000
	Learning Independence (X)	.421	.192	.172	2.187	.030

a. Dependent Variable: Learning Outcomes (Y)

Source: Data processed in 2019

Table 11. Determination Coefficient Test Results (R^2)

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.172[a]	.030	.023	9.593

a. Predictors: (Constant), Learning Independence (X)

b. Dependent Variable: Learning Outcomes (Y)

The results of this study are supported by Mulyono, Asmawi, and Nuriah (2018) who state that there is an interaction effect between learning and independent learning models on students' mathematics learning outcomes; after controlling students' initial abilities, the students' mathematics learning outcomes using learning models with learning independence is higher than the result of students' learning using a facilitator model. It is seen from the analysis of the t-test, which is greater than t table, which is equal to 4.90> 2.39. Moreover, the average value obtained when students' learning independence is high is 73.18, when compared to student facilities which are only 55.97. Therefore, it can be concluded that students who have a high level of learning independence will automatically have a good influence on their learning outcomes.

A research conducted by Kharismawan, Haryani, and Nuswowati (2018) found that the level of students' learning independence increases with learning Problem-Based Learning. The instrument used in this study was a questionnaire with a Likert scale. Then, the results of the analysis of the questionnaire found that students' learning independence increased. The characteristics used in this study are as follows: (1) students are able to think critically, creatively and innovatively; (2) students are not easily influenced by the opinions of others; (3) students do not run or avoid problems; (4) students solve problems with deep thinking; (5) when facing a problem, students solve it by themselves without asking for help from others; (6) students do not feel inferior when they must become different from others; (7) students strive to work diligently and discipline; (8) students are responsible for their own actions.

Further, Syahroni, Dewi, and Kasmui (2016) conducted a quasi-experimental study with a control group design that was not equivalent to learning independence characteristics, including students could determine their approach to learning optimally and efficiently, are responsible for decisions that had been taken, and are able to work with other people to expand their knowledge. Based on the results of a sudden observation of student independence, it shows that the average score of independent learning was 85.47 for an experimental class, while the control class scored 69.94.

A research conducted by Saefullah, Siahaan, and Sari (2017) examines the relationship between learning independence attitudes and student learning achievement. The results of the study show that there is a positive and significant correlation between attitudes of learning independence and learning achievement. There are six indicators used in this study, namely the independence of others, having self-confidence, being disciplined, having a sense of responsibility, being based on their own initiative, and exercising self-control. Based on the results of the calculation of the correlation coefficient r = 0.64, where r table 5% is found 0.355, so that the r count> r table (0.64> 0.355), there is a positive relationship between the attitudes of learning independence and learning achievement. The contribution of students' independence attitude is 40.96%. Then, Hasibuan, Saragih, and Amry (2018) find that students' learning independence increases after learning to use learning tools based on realistic mathematical approaches that have been developed. It is concluded based on the students' response given in experiment II, which has a high category, that is equal to 92.87%.

Students' learning independence to being able to understand the material, and working on the questions given by the teacher are some of the characteristics of students' positive learning independence. In addition, students who have positive learning independence also have the responsibility to complete all tasks assigned to them. Therefore, positive learning independence is very important for every student to have so that students' learning outcomes are said to be good.

CONCLUSION

Students' learning independence has a positive and significant effect on student accounting learning outcomes. It means that the higher the students' learning independence, the higher the accounting learning outcomes of students.

ACKNOWLEDGMENT

The researchers sincerely thank the colleagues who have provided encouragement and very constructive input to the authors so this article can be completed well and on time.

REFERENCES

Aini, P. N., & Taman, A. (2012). Pengaruh kemandirian belajar dan lingkungan belajar siswa terhadap prestasi belajar akuntansi siswa kelas XI IPS SMA Negeri 1 Sewon Bantul tahun ajaran 2010/2011. *Jurnal Pendidikan Akuntansi Indonesia*, *10*(1), 48–65. https://doi.org/10.21831/jpai.v10i1.921

Aliyyah, R. R., Puteri, F. A., & Kurniawati, A. (2017). Pengaruh kemandirian belajar terhadap hasil belajar IPA. *Jurnal Sosial Humaniora*, *8*(2), 126–143. https://doi.org/10.30997/jsh.v8i2.886

Arista, F. S., & Kuswanto, H. (2018). Virtual physics laboratory application based on the Android Smartphone to improve learning independence and conceptual understanding. *International Journal of Instruction*, *11*(1), 1–16. https://doi.org/10.12973/iji.2018.1111a

Birnbaum, M. H., & Schmidt, U. (2015). The impact of learning by thought on violations of independence and coalescing. *Decision Analysis*, *12*(3), 144–152. https://doi.org/10.1287/deca.2015.0316

Boeree, C. G. (2013). *Personality theories: Melacak kepribadian anda bersama psikolog dunia*. Yogyakarta: PrismaSophie. Retrieved from https://www.goodreads.com/book/show/7655165-personality-theories

Clark, R. C., & Lyons, C. C. (2011). *Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials*. Hoboken, NJ: John Wiley & Sons.

Engineering Accreditation Council. (2007). *Engineering programme accreditation manual*. Kuala Lumpur: Board of Engineers Malaysia.

Fatihah, M. Al. (2016). Hubungan antara kemandirian belajar dengan prestasi belajar PAI siswa kelas III SDN Panularan Surakarta. *At-Tarbawi: Jurnal Kajian Kependidikan Islam*, *1*(2), 197–208. https://doi.org/10.22515/attarbawi.v1i2.200

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

Government Regulation No. 17 of 2010 on Educational Management and Implementation (2010). Republic of Indonesia.

Hasibuan, A. M., Saragih, S., & Amry, Z. (2018). Development of learning materials based on realistic mathematics education to improve problem solving ability and student learning independence. *International Electronic Journal of Mathematics Education*, *14*(1), 243–252. https://doi.org/10.29333/iejme/4000

Henderson, A., & Trede, F. (2017). Strengthening attainment of student learning outcomes during work-integrated learning: A collaborative governance framework across academia, industry and students. *Asia-Pacific Journal of Cooperative Education*, *18*(1), 73–80.

Kharismawan, B., Haryani, S., & Nuswowati, M. (2018). Application of a pbl-based modules to increase critical thinking skills and independence learning. *Journal of Innovative Science Education*, *7*(1), 78–86. https://doi.org/10.15294/JISE.V7I1.23220

Kyndt, E., Gijbels, D., Grosemans, I., & Donche, V. (2016). Teachers' everyday professional development: Mapping informal learning activities, antecedents, and learning outcomes. *Review of Educational Research*, *86*(4), 1111–1150. https://doi.org/10.3102/0034654315627864

Medlin, R. G., & Butler, J. L. (2018). Thinking skills, academic intrinsic motivation, academic self-concept, and academic independence in homeschooled children. *Journal of Unschooling and Alternative Learning*, *12*(24), 62–90. Retrieved from https://jual.nipissingu.ca/wp-content/uploads/sites/25/2018/10/v12243.pdf

Mukhlis, S., Japar, M., Maksum, A., & Adiansha, A. A. (2018). Improving discipline and learning independence of PKn through reinforcement. *American Journal of Educational Research*, *6*(7), 1033–1039. https://doi.org/10.12691/education-6-7-22

Mulyono, D. (2017). The influence of learning model and learning independence on mathematics learning outcomes by controlling students' early ability. *International Electronic Journal of Mathematics Education*, *12*(3), 689–708. Retrieved from https://www.iejme.com/download/the-influence-of-learning-model-and-learning-independence-on-mathematics-learning-outcomes-by.pdf

Mulyono, D., Asmawi, M., & Nuriah, T. (2018). The effect of reciprocal teaching, student facilitator and explaining and learning independence on mathematical learning results by controlling the initial ability of students. *International Electronic Journal of Mathematics Education*, *13*(3), 199–205. https://doi.org/10.12973/iejme/38 38

O'Rourke, B., & Carson, L. (Eds.). (2010). *Language learner autonomy: Policy, curriculum, classroom*. Oxford: Peter Language.

Page, J., Meehan-Andrews, T., Weerakkody, N., Hughes, D. L., & Rathner, J. A. (2017). Student perceptions and learning outcomes of blended learning in a massive first-year core physiology for allied health subjects. *Advances in Physiology Education*, *41*(1), 44–55. https://doi.org/10.1152/advan.00005.2016

Prayekti, P., Budiman, M. H., & Budi, U. L. (2016). Pengaruh kemandirian belajar terhadap hasil belajar mahasiswa bidik misi masa registrasi 2016.1. In *Prosiding Temu Ilmiah Nasional Guru (Ting) VIII* (pp. 143–154). Universitas Terbuka Convention Center.

Saefullah, A., Siahaan, P., & Sari, I. M. (2017). The correlation of learning independence attitudes and student's learning achievement on physics learning based-portfolio. *Jurnal Penelitian Dan Pembelajaran IPA*, *3*(1), 74–83. https://doi.org/10.30870/JPPI.V3I1.1741

Schunk, D. H. (2012). *Learning theories: An educational perspective* (6th ed.). Boston, MA: Pearson.

Setyowati, C. S. P. (2018). *Penerapan pendekatan paradigma pedagogi reflektif (PPR) pada materi laju reaksi terhadap kemandirian belajar dan prestasi belajar siswa*. Thesis, Universitas Negeri Yogyakarta.

Sjukur, S. B. (2013). Pengaruh blended learning terhadap motivasi belajar dan hasil belajar siswa di tingkat SMK. *Jurnal Pendidikan Vokasi*, *2*(3), 368–378. https://doi.org/10.21831/jpv.v2i3.1043

Syahputra, D. (2017). *Pengaruh kemandirian belajar dan bimbingan belajar terhadap kemampuan memahami jurnal penyesuaian pada siswa SMA Melati Perbaungan*. *AT-TAWASSUTH: Jurnal Ekonomi Islam* (Vol. 2). Retrieved from http://jurnal.uinsu.ac.id/index.php/tawassuth/article/view/1227

Syahroni, M. W., Dewi, N. R., & Kasmui, K. (2016). The effect of using digimon (science digital module) with scientific approach at the visualizationof students independence and learning results. *Jurnal Pendidikan IPA Indonesia*, *5*(1), 116–122. https://doi.org/10.15294/jpii.v5i1.5800

Van der Kleij, F. M., Feskens, R. C. W., & Eggen, T. J. H. M. (2015). Effects of feedback in a computer-based learning environment on students' learning outcomes. *Review of Educational Research*, *85*(4), 475–511. https://doi.org/10.3102/0034654314564881

van der Stel, M., & Veenman, M. V. J. (2014). Metacognitive skills and intellectual ability of young adolescents: A longitudinal study from a developmental perspective. *European Journal of Psychology of Education*, *29*(1), 117–137. https://doi.org/10.1007/s10212-013 -0190-5

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (151-160)
Online: http://journal.uny.ac.id/index.php/jpv

IMPROVING THE MILLING MACHINE COMPETENCY LEARNING OUTCOMES THROUGH INDUSTRIAL PROJECT-BASED LEARNING FOR VOCATIONAL SCHOOL STUDENTS

Heri Yudiono
Universitas Negeri Semarang

Wirawan Sumbodo
Universitas Negeri Semarang

Salim
Sekolah Menengah Kejuruan Negeri 1 Semarang

Rizki Setiadi
Universitas Negeri Semarang

Abstract

This research is motivated by the implementation of conventional learning. Besides, student learning motivation is still low due to student activities that are less centered on making workpieces that are suitable for work in the industry. Learning outcomes show that only 55.88% of students reach Minimum Completeness Criteria (Kriteria Ketuntasan minimum or KKM). The design and learning of productive machining competencies that are in accordance with the needs of the industry influence students' experience and learning outcomes. This study aims to analyze the results of industrial project-based learning (InPro-BL) milling machine competency learning outcomes in SMK Negeri 1 Semarang. The method used in this study is Class Action Research (CAR) through four stages: (1) planning, (2) implementation of actions, (3) observation and evaluation, (4) reflection. The samples were 34 students of class XII of Mechanical Engineering. The data were collected using product assessment instruments to measure dimensional accuracy, timeliness, level of disability, level of smoothness, and work attitude. This study was descriptive quantitative, and qualitative. The results of the study show that InPro-BL is effective in improving the learning outcomes of milling machine competencies. In Cycle I, there is an increase in learning outcomes, from 19 students who completed the KKM to 25 students or 73.52%. In Cycle II, there are 88.23% of students passed the KKM. These results can be improved by paying attention to the management of learning time through the block system, teacher's understanding of industrial-project-based learning, and industry guest teachers mentoring every learning process.

Keywords: *learning outcomes, student experience, milling machine engineering, industrial projects*

Permalink: *http://dx.doi.org/*10.21831/jpv.v9i2.23686

Contact Heri Yudiono heri_yudiono@mail.unnes.ac.id
Department of Mechanical Engineering, Universitas Negeri Semarang
Jl. Taman Siswa Sekaran, Gunungpati Semarang, 50229 Jawa Tengah, Indonesia

INTRODUCTION

Vocational schools, as a subsystem of vocational education, are expected to be able to shape innovative, creative, competitive, and sustainable characters requiring sociocultural and structural support. Vocational education has its own peculiarities in choosing substantive learning must always keep abreast of technology, community needs, individual needs, and job requirements (Yudiono, 2017). Global transformation towards a knowledge-based economy encourages increased demand for quality human development as a resource, international, and national competition (Cheng, 2005). Vocational education requires a conceptual framework that is proven in meeting objectives effectively, efficiently, and meaningfully. The pattern of the conceptual framework cultivates vocational values in vocational schools in each region that are different from each other because each region in Indonesia has unique sociocultural characteristics, different regional potentials, different local advantages, political and economic policies different.

Vocational school is a part of Indonesia's national education, which plays a strategic role in producing a competent national workforce that is globally competitive and promotes sustainable development. Vocational education must be pro-work, pro-activity, pro-growth, pro-distribution, and pro-prosperity. Vocational education significantly influences sustainable development. Therefore, learning content must meet the labor requirements (Yudiono, Soesanto, & Haryono, 2018).

The transformation in the planned world of education must, of course, meet the principles of the principle of link and match, which is at the core of the successful implementation of vocational education. The application of this concept does not only massively trigger the transformation of educational facilities and infrastructure but also demands changes to the teacher as the main actor who carried out learning in school. The fact that happened in Indonesia as one of the developing countries is that it must face several obstacles to realize ideal vocational education based on the concept of link and match such as lack of qualified teachers, difficult to meet high operational costs, lack of equipment for practice, lack of curriculum clarity and maintenance problems and repair equipment (Bukit, 2014).

The success of learning in school will be realized from the success of students learning. Learning is a form of behavioral changes in a person expressed in new ways of behaving thanks to experience and practice (Hamalik, 1983). Student learning success also depends on student motivation. There are two types of motivation, intrinsic and extrinsic, which are based on the different reasons or goals that underlie an action. Intrinsic motivation refers to doing something because it is inherently interesting or fun, whereas extrinsic motivation refers to doing something because it leads to results that are fun but external and can be separated. Self-determined motivation is found to be associated with more interest, effort, positive emotions, satisfaction, and commitment by students (Ryan & Deci, 2000).

SMK N 1 Semarang is one of the Vocational Schools in Semarang which has a Mechanical Engineering Skills Program. The standard of competence expected from graduates is to be able to do conventional machining work with a milling machine. In achieving these competency standards, students must be able to operate the milling machine in making products needed by the industry. The achievement of competency standards is done by using learning methods that are in accordance with the needs of the industry. One of the industrial partners owned by SMK N 1 Semarang is CV Surya Cipta Inti Pratama which produces spurs gears and bevel gears. Implementation of the existing industrial-based partnership management model of Vocational High Schools (VHS) on Mechanical Engineering expertise has only 62.5% ready to work graduates which belongs to low category (Sumbodo, Pardjono, Samsudi, & Rahadjo, 2018).

The results of preliminary studies show that there are still many problems that arise in machining learning that have an impact on the development of student competencies as expected by industry partners. These problems relate to learning models that suit the needs of students and industry, the development of teacher competencies based on industry competency, the time of student practice learning, and the feasibility of practicum support equipment that is in accordance with the industry partners. In addition, the lack of a more comprehensive partnership between the school and the industry in aligning the curriculum, teacher apprenticeship, and sharing resources.

Competency development will be efficient if the environment in which students are trained is a replica of the environment where they will later work (Prosser & Allen, 1959). The development of graduate competencies also emphasizes practical knowledge and direct ability; some of them have the problem-solving experience, so teachers in vocational high schools have problems teaching students problem-solving (Chiang & Lee, 2016). In order for vocational graduates to work under the industrial needs, then in the learning process, there is a need for learning as done by industry. The concept of production-based learning is a new paradigm, both academic and industrial learning. This learning aims to provide students with technical activities and practices directly under industrial conditions (Rentzos, Doukas, Mavrikios, Mourtzis, & Chryssolouris, 2014). A very effective production-based learning model was developed in the learning of students in increasing creativity and innovation (Ganefri, 2013).

Competence is described as the capacity to carry out specific activities that will always require several combinations of knowledge skill/disposition/values which when it is analyzed, it almost always seems like a combination of generic or key competence (Gonczi, 2004). The theory of developing competencies emphasizes that students must not only acquire but also integrate knowledge, skills, and attitudes to achieve vocational competence (Kaslow et al., 2007). Based on the existing curriculum, the core competencies needed in the milling machine are shown in Table 1.

Table 1. Competencies Needed in Milling Machine.

Subject	Competency
Milling Machine Techniques	4.15 Designing bevel gear 4.16 Determine the manufacture of bevel gear 4.17 Designing the manufacture using a rotary table. 4.18 Determine the making of circular groove using rotary table

In order for VHS graduates to be employed, they must have those competencies needed by the industry. VHS graduates are potentials human resources who will work in the industrial world. VHS graduates are human-resource inputs for partner industries that must have mutually beneficial relationships with partner industries through increasing practical training activities such as the utilization of every resource owned by VHS and industries to increase students' competency to match the industry needs. Various activities are needed, including the use of shared equipment, expert exchanges and placement of students and teachers in the industry to make them experience the work culture in the partner industry (Raihan, 2014).

However, student activities in participating in learning still tend to be less. The value of low students has a dependence on other students who are high achievers and have high grades in working on problems and projects. In addition, there is also a lack of positive collaboration between students in an effort to master the material taught by the teacher.

The condition of learning also shows the low awareness of high achieving students towards friends who need help in understanding the subject matter. Based on observations, the researchers saw that class XII students were not independent in participating in learning because there was no desire to ask teachers or friends when there was a subject matter that was not understood. Thus, the learning outcomes of the milling machine techniques were also not satisfactory.

For this reason, improving student learning outcomes requires the application of a learning model that is in accordance with the learning experience expected by students. The success or failure of education depends on the teaching and learning process determined in choosing and applying the appropriate learning model (Suswanto et al., 2017). The effort that can be done to improve student learning outcomes is by industrial project-based learning. The benefits of collaborative project learning force students to work together to solve complex problems and technological developments and encourage students to think critically (Mitchell, Petter, & Harris, 2017).

One of the well-known learning models is project-based learning. Project-based learning is a learning approach that considers the project as part of the infrastructure — projects in the form of thought, imaging, and function. Based on thinking, imaging, and function, it is to train the creativity of individuals who are responsible for their own learning outcomes (Yalçin, Turgut, & Büyükkasap, 2009). The

factory learning process can be designed with a focus on relevant competencies to develop competencies (Müller-Frommeyer, Aymans, Bargmann, Kauffeld, & Herrmann, 2017).

Project-based learning model is quite useful in designing effective learning so that there is enough potential to meet the demands of learning (Sastrika, Sadia, & Muderawan, 2013). Project-Based Learning (PBL) is an innovative approach to learning that teachers many important strategies for success in the 21st century (Bell, 2010). Project-based learning has the advantage of making learning stand out among other pedagogies, including involving students, improving cooperative learning skills, improving academic performance, developing higher-order thinking skills, and building positive relationships between students and teachers (See, Rashid, & Bakar, 2015; Thomas, Mergendoller, & Michaleson, 2000). Project-based learning as science-based learning has several fundamental features, which in the current learning process can go through several stages starting from the stage of asking, appreciating, analyzing, associating and concluding (Short, Lundsgaard, & Krajcik, 2008).

Project-based learning generally has the steps of Planning (planning), Creating (implementation), and Processing. Project-based learning can help students in group learning, develop skills and the projects that are done are capable of providing a personal experience to students and can emphasize student-centered learning activities (Wena, 2008). Based on the statements above, the researchers conclude that industrial project-based learning is learning planned by teachers and industry, implemented into study groups so that they have almost the same environment as in the industry so that students can improve their skills.

However, the learning process is still conventional. It causes student learning motivation is still low. The data showed that in the pre-cycle, only 55.88% or 19 students passed the Minimum Completeness Criteria (*Kriteria Ketuntasan Minimal* or KKM). For this reason, it is necessary to improve student learning outcomes. Based on the previous description, the researchers were motivated to conduct research to improve the results of motivation and learning outcomes of students in industrial project-based class XII in Milling Machine Engineering Subjects at SMK N 1 Semarang.

RESEARCH METHOD

This research was conducted at SMK N 1 Semarang (Semarang 1 Vocational School). The subjects of this study were 34 students of class XII of Mechanical Engineering. The classroom action research (CAR) method was chosen to improve the learning system, consisting of two cycles. The study was conducted from July to October 2018. This study was planned for two cycles, and reflection and evaluation were carried out in each cycle. The implementation of each cycle is shown in Table 2. In carrying out the class actions research, each cycle includes stages which consist of: (1) planning, (2) implementation of actions, (3) observations, and (4) reflection.

In the planning stage, an industrial project-based learning strategy is formulated, namely compiling a Learning Implementation Plan. The implementation stage is to apply Industrial Project Based Learning (InPro-BL) in the classroom. This part is the most impor-

Table 2. Industrial Project Based Learning Implementation

No	Cycle I		Cycle II	
	Action	**Outcome**	**Action**	**Outcome**
1	The teacher submits the purpose of learning and what motivates learning	-	Plan corrective actions based on problems and learning outcomes in the cycle	Cycle II learning planning
2	Students are divided into 6 groups of 5-6 students	Study groups	Application of industrial projects	-
3	Application of industrial projects	product	Evaluation of cycle II learning outcomes	Student learning outcomes of cycle II
4	Evaluation of cycle I learning outcomes	Student learning outcomes cycle 1	Overall reflection on learning	Improving student learning outcomes
5	Cycle I reflection			

tant stage because it is an improvement activity in the learning process. In observation stage, the research team observes student activities during the learning process, both about attitudes and behavior during learning. Reflection stage is an activity of analyzing and synthesizing from the results of observations during the learning process takes place, and at this stage, an evaluation is also carried out to determine the progress of student learning outcomes both individually and in groups. Then, the learning outcomes obtained by students will be compared with the learning completeness criteria which have been made.

The instrument used in this study is a sheet of assessment of the practical ability to make bevel gear. Data collection techniques used were observation, practice tests, and interview tests. The data analysis technique used was descriptive quantitative and qualitative.

The indicator of success in CAR is being able to reach criteria of good, or minimum if 85% of students achieve the KKM in the learning process. The criteria for the effectiveness of project-based learning are shown in Table 3.

Table 3.Category of Industrial Project-Based Learning Effectiveness

Category	Score
Very effective	75 – 100
Effective	50 – 74
Less Effective	25 – 49
Not Effective	0 – 24

RESULTS AND DISCUSSION

In Cycle I, the actions carried out at the planning stage are: (a) Planning the time of learning implementation, held on August 6 - October 1, 2018; (b) Preparing the location for the practice of Milling Machine Engineering, namely in the machining workshop of SMK N 1 Semarang; (c) Preparing material, media, and tools used for learning. The material taught is the basic competency in determining work requirements and focusing by using all machine tools on the competency standard to do work with a milling machine; (d) Preparing a set of learning implementation plans for the Milling Machine Engineering subject.

At this stage, some activities are carried out as planned. The implementation phase in the industrial project-based learning includes: (1) Preliminary stage, including (a) The teacher opens the lesson with opening activities; (b) The teacher conveys the learning objectives to be implemented; (c) The teacher conveys the outline of the subject matter to students. (2) Learning stage, including (a) Students arrange the work steps with the theme of the project to be carried out. The preparation of work steps focuses on the preparation of tools and materials to be used; (b) Students discuss with the teacher about the work steps prepared for the project work; (c) Students follow an evaluation. In this stage, students carry out project activities in accordance with the design made, results and assessment for reports, product assessment, and assessment. (3) Closing stage, in which the teacher invites students to conclude the learning outcomes together.

The implementation of Cycle I in learning using InPro-BL models on milling machine competencies shows that the increase of percentage in Minimum Completion Criteria at 55.88% increases 31.57% after Cycle I with a KKM of 73.52%. The milling machining competency learning outcomes of Pre-cycle and Cycle I are shown in Table 4.

Table 4.Student Learning Outcomes of Pre-Cycle and Cycle I

No	Learning Score	Pre-Cycle	Cycle I
1	Highest Score	85	92
2	Lowest Score	45	47
3	Average score	73.32	81.23
4	Learning Completion (%)	**55.88**	**73.52**

There is an increase in pre-cycle student learning outcomes, and after Cycle I. Comparison of the average value of student learning outcomes before and after the first cycle can be seen in Figure 1.

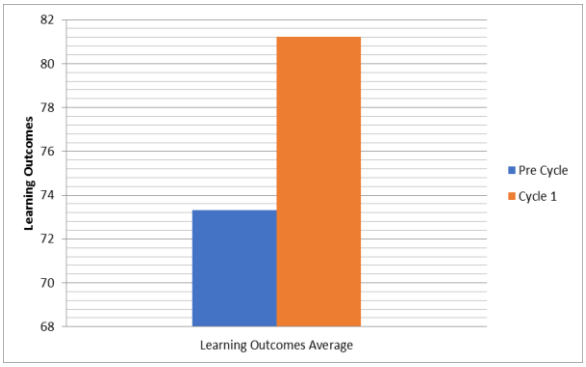


Figure 1. Student Learning Outcomes in Pre-Cycle and Cycle I

There is an increase in student learning outcomes after Cycle I. Students' average score increases from 73.32 to 81.23. The percentage of classical learning completeness increases from 55.88% to 73.52%. The number of students who experience an increase in grades is as many as 25 students. Learning outcomes have increased but have not achieved the class success of 85%. Furthermore, the grouping of completeness values is based on the Reference Value Approach. The grouping of achievement of competencies can be seen in Table 5.

Table 5. Comparison of Students Achievement Outcomes in the Pre-Cycle and After Cycle I

No	Learning Score	Pre-Cycle 1 (%)	Cycle I (%)
1	Very Good	00.00	29.41
2	Good	47.05	44.14
3	Less Good	29.41	14.70
4	Not Good	20.58	11.76

Table 5 shows that 47.05% of students have competencies classified as good from the total students, the rest 29.41% are less good, and 20.58% is very poor. After Cycle I, there was an increase in student learning outcomes, namely students with very good competencies to be 29.41%, 44.14% is good, 14.70% is sufficient, and 11.76% is very less good competence, and reduce the less or very less.

The actions taken at the observation stage are recording the students' behavior and response to the learning carried out. Researchers observe the course of learning, along with peer teachers and industry observers. Field notes are used to record the subjects' behavior patterns in one cycle, from meeting 1 to meeting 2. The observers' task is to observe the course of the teaching and learning process as a whole. The observation sheet is used to record the behavior of each student in the group.

From the observations of the students, the following findings are obtained: (a) There are still many students who are quiet and less active and lacking in communication, although there are also students who are very active in communicating and asking about jobs to be done; (b) Still lacking in confidence in the work; (c) Steps to work and use of tools in some students is still inappropriate; (d) implementations of occupational health and safety is not good.

These results indicate that in the implementation of Cycle I, the majority of students have learning behaviors that are classified as less active and lacking in confidence. Students are still very dependent on the teacher in carrying out the work. Therefore, it is necessary to carry out the next cycle in order to determine the increase in student responses to learning activities. After observing the actions of learning in the classroom, a reflection on all activities that have been carried out in Cycle I was obtained.

Based on the results of reflection in the first cycle, the planning prepared for the second cycle was carried out by taking into account the following matters: (a) Teachers and industry guest must always encourage students to be active in carrying out the work; (b) The teacher also emphasizes that students are more courageous in carrying out work or expressing opinions and asking questions about the work steps, and the teacher must not laugh or be angry in giving the feedback, even the teacher must be proud of the students' courage; (c) To improve collaboration between students, on the next meeting, students are given time and opportunities to communicate with each other in a longer time; (d) The teacher reminds students that in carrying out work, students may use modules, handbooks, and other learning resources related to the learning material provided from the industry.

The learning implementation in Cycle II is to correct the shortcomings or problems that are faced in Cycle I. In Cycle II, meeting learning activities are still carried out with an industry project-based learning model. The steps taken at this meeting are still the same as the steps taken in Cycle I. However, this meeting was conducted with different material. The teacher reminds students to make the best use of time because the material being studied is quite a lot, and students may discuss with their friends.

The implementation of Cycle II in learning using industrial project-based learning (InPro-BL) models on milling machining competencies shows an increase in the percentage of KKM in the first cycle of 73.52% experiencing an increase of 20.01% after the second cycle, with a minimum completeness criteria of 88.23 %. The learning outcomes for Cycle I and Cycle II of machining competence are shown in Table 6.

Table 6.Student Learning Outcomes in Cycle I and Cycle II

No	Learning Score	Cycle I	Cycle II
1	Highest Score	92	95
2	Lowest Score	47	70
3	Average	81.23	86.32
4	Learning Completion (%)	**73.52**	**88.23**

There is an increase in student learning outcomes in Cycle I and Cycle II. Comparison of the average value of student learning outcomes before and after the first cycle can be seen in Figure 2.

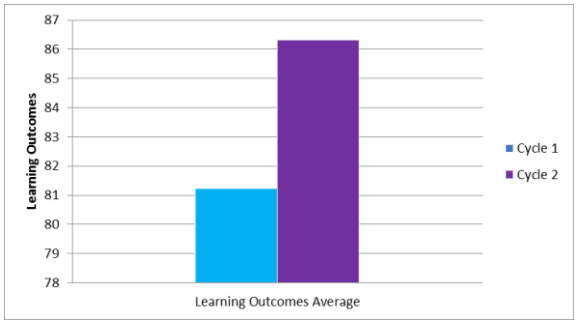


Figure 2. Student Learning Outcomes in Cycle I and Cycle II

The improvement of student learning outcomes after Cycle I is as follows. Students' average value increases from 81.23 to 86.32. The percentage of classical learning completeness increases from 73.52% to 88.23%. In the second cycle, the number of students with a return value increases by as many as 30 students. From these results, it can be seen that learning outcomes have increased and have succeeded in achieving the class success of 85%. Furthermore, the disclosure of the results of the second cycle is based on Benchmark Reference Value. The grouping of competency achievements can be seen in Table 7.

Table 7. Comparison of Student Competency Achievements Cycle I and Cycle II

No	Learning Outcome	Cycle I	Cycle II
1	Very good	29.41	35.29
2	Good	44.14	50.00
3	Bad	14.70	11.76
4	Very Bad	11.76	00.00

In the first cycle, student learning outcomes have not met the established indicators, so it needs to be continued with the second cycle so that the predetermined indicators can be fulfilled. In the second cycle, there are no significant obstacles. Improvement of learning outcomes in Cycle II is caused by students who are familiar with the learning model applied by the teacher. The courage of students is growing so that their activeness also increases. It is indicated by the number of students who take advantage of the opportunity to answer questions, as well as express their opinions regarding the execution of material given by the teacher in the second cycle. Industrial project-based learning makes students trained to carry out work independently and respect the workings of others and become more active in the learning process. The description above shows that the use of a project-based learning model on learning milling machines of class XII students of SMK N 1 Semarang can improve student learning outcomes at least 85% of students obtain a value = 75.

Based on the data of the test results on the cycle above, completeness has not been achieved. Learning completeness obtained in the second cycle was 88.23% with an average value of 86.32. The lowest value is 70, and the highest value is 95. It shows a change in a better direction and has been as expected because the results are expected to have achieved the expected classical completeness, namely = 85%. Based on the results of the research from pre cyclical to cycle II, there was an increase in learning in class XII students on Milling Machine subjects, the percentage of graduation before using InPro-BL is 55.88% and after learning the InPro-PBL method increases to 88.23%. With an increase of 57.89%, it shows that an effective industrial project-based learning model is able to develop student competencies that have an impact on improving student learning experiences and outcomes.

In Cycle II, the steps were taken as steps taken in Cycle I. The actions taken at the stage of observation are recording the behavior and response of students to the learning carried out. The researchers observed the learning process and the teacher and observer colleagues.

From the observations of students in Cycle II, the following findings are obtained: (a) Students have dared to answer teacher and industry guest questions, express opinions, and be more active in communicating with friends and teachers; (b) The classroom atmosphere is very controlled when learning activity takes

place; (c) The work steps for all students are good; (d) Students have dared to answer the teacher's questions or their friends' questions. In addition, students have also shown courage in carrying out the work; (e) The use of tools by all students is good; (f) Occupational Safety and Health is well implemented.

Comparison of student learning outcomes in the Pre-Cycle, Cycle I, and Cycle II on students who achieved KKM is shown in Figure 3. Based on Figure 3, there is an increase before industrial project-based learning and after using industrial project-based learning.

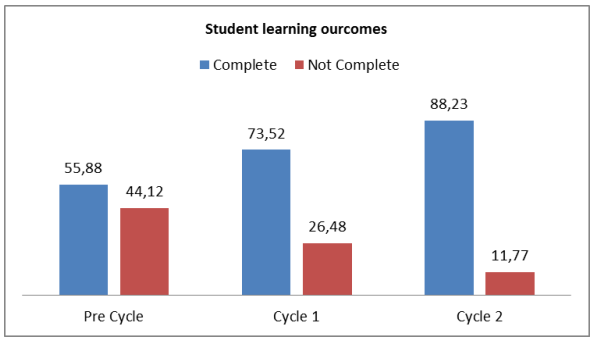


Figure 3. Comparison of Student Learning Outcomes in the Pre-Cycle, Cycle I, and Cycle II

Student experience and learning outcomes can be improved by paying attention to the management of learning time through the block system, teacher understanding in the industrial-based project learning, and mentoring industry guest teachers every learning process. Effective supervision of teachers in project learning influences student competence (Sadrina, Mustapha, & Ichsan, 2018). Teachers also need to develop an understanding of industrial project-based learning to build confidence in developing student competencies.

CONCLUSION

The research results show that industrial project-based learning is effective in increasing the experience and results of the students learning outcomes of milling machines techniques at SMKN 1 Semarang. In Cycle I, there is an increase in learning outcomes, from 19 students who completed the KKM to 25 students or 73.52%. In Cycle 2, there are 88.23% of students passed the KKM. Student experience and learning outcomes can be improved by paying attention to the management of learning time through the block system and industry guest teachers mentoring every learning process.

ACKNOWLEDGMENT

The researchers would like to thank Universitas Negeri Semarang for facilitating the research through the "Assignment of Lecturers at School (*Penugasan Dosen di Sekolah* or PDS)" program, and SMK 1 Semarang to provide opportunities in collecting the research data.

REFERENCES

Bell, S. (2010). Project-based learning for the 21st century: Skills for the future. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, *83*(2), 39–43. https://doi.org/10.1080/00098650903505415

Bukit, M. (2014). *Strategi dan inovasi pendidikan kejuruan: Dari kompetensi ke kompetisi*. Bandung: Alfabeta.

Cheng, Y. C. (2005). *New paradigm for re-engineering education: Globalization, localization and individualization*. Dordrecht: Springer Netherlands. https://doi.org/10.1007/1-4020-3620-5

Chiang, C. L., & Lee, H. (2016). The effect of project-based learning on learning motivation and problem-solving ability of vocational high school students. *International Journal of Information and Education Technology*, *6*(9), 709–712. https://doi.org/10.7763/IJIET.2016.V6.779

Ganefri, G. (2013). The development of production-based learning approach to entrepreneurial spirit for engineering students. *Asian Social Science*, *9*(12), 162–167. https://doi.org/10.5539/ass.v9n12p162

Gonczi, A. (2004). *The new professional and vocational education*. Crows Nest: Allen and Unwin.

Hamalik, O. (1983). *Metoda belajar dan kesulitan-kesulitan belajar*. Bandung: Tarsito.

Kaslow, N. J., Bebeau, M. J., Lichtenberg, J. W., Portnoy, S. M., Rubin, N. J., Leigh, I. W., … Smith, I. L. (2007). Guiding principles and recommendations for the assessment of competence. *Professional Psychology: Research and Practice*, *38*(5), 441–451. https://doi.org/10.1037/0735-7028.38.5.44

Mitchell, A., Petter, S., & Harris, A. L. (2017). Learning by doing: Twenty successful active learning exercises for information systems courses. *Journal of Information Technology Education: Innovations in Practice*, *16*, 21–46.

Müller-Frommeyer, L. C., Aymans, S. C., Bargmann, C., Kauffeld, S., & Herrmann, C. (2017). Introducing competency models as a tool for holistic competency development in learning factories: Challenges, example and future application. *Procedia Manufacturing*, *9*, 307–314. https://doi.org/10.1016/J.PROMFG.2017.04.015

Prosser, C. A., & Allen, C. R. (1959). *Vocational education in a democracy*. Chicago, IL: American Technical Society.

Raihan, M. A. (2014). Collaboration between TVET institutions and industries in Bangladesh to enhance employability skills. *International Journal of Engineering and Technical Research (IJETR)*, *2*(10), 50–55.

Rentzos, L., Doukas, M., Mavrikios, D., Mourtzis, D., & Chryssolouris, G. (2014). Integrating manufacturing education with industrial practice using teaching factory paradigm: A construction equipment application. *Procedia CIRP*, *17*, 189–194. https://doi.org/10.1016/J.PROCIR.2014.01.126

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/CEPS.1999.1020

Sadrina, S., Mustapha, R., & Ichsan, M. (2018). The evaluation of project-based learning in Malaysia: Propose a new framework for polytechnics system. *Jurnal Pendidikan Vokasi*, *8*(2), 143–150. https://doi.org/10.21831/jpv.v8i2.19100

Sastrika, I. A. K., Sadia, W., & Muderawan, I. W. (2013). Pengaruh model pembelajaran berbasis proyek terhadap pemahaman konsep kimia dan keterampilan berpikir kritis. *Jurnal Pendidikan Dan Pembelajaran IPA Indonesia*, *3*(2), 1–10. Retrieved from http://oldpasca.undiksha.ac.id/e-journal/index.php/jurnal_ipa/article/view/799

See, Y. G., Rashid, A. M., & Bakar, A. R. (2015). The effect of project based learning on level of content knowledge of pre-vocational subject. *Mediterranean Journal of Social Sciences*, *6*(6 S4), 369–375. https://doi.org/10.5901/mjss.2015.v6n6s4p369

Short, H., Lundsgaard, M. F. V., & Krajcik, J. S. (2008). How do geckos stick? Using phenomena to frame project-based science in chemistry classes. *The Science Teacher*, *75*(8), 38–49. Retrieved from https://www.questia.com/library/journal/1G1-191011805/how-do-geckos-stick-using-phenomena-to-frame-project-based

Sumbodo, W., Pardjono, Samsudi, & Rahadjo, W. D. (2018). Implementation of partnership management model of SMK (Vocational High School) with existing industries in mechanical engineering expertise in Central Java. In *AIP Conference Proceedings* (Vol. 1941, p. 020038). https://doi.org/10.1063/1.5028096

Suswanto, H., Hamdan, A., Mariana, R. R., Dardiri, A., Wibawa, A. P., Nafalski, A., & Vianiryzki, A. F. (2017). The effectiveness of project-based learning and STAD learning on improving Web programming competency. *World Transactions on Engineering and Technology Education*, *15*(4), 368–373.

Thomas, H. W., Mergendoller, J. R., & Michaleson, A. (2000). *Projects based learning: A handbook for middle and high school teachers*. Navato, CA: The Buck Institute for Education.

Wena, M. (2008). *Strategi pembelajaran inovatif kontemporer*. Malang: Bumi Antariksa.

Yalçin, S. A., Turgut, Ü., & Büyükkasap, E. (2009). The effect of project based learning on science undergraduates' learning of electricity, attitude towards physics and scientific process skills. *International Online Journal of Educational Sciences*, *1*(1), 81–105.

Yudiono, H. (2017). The alignment of productive competence on machinery between vocational education institutions and industry. *World Transactions on Engineering and Technology Education*, *15*(3), 256–259. Retrieved from http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.15, No.3 (2017)/10-Yudiono-H.pdf

Yudiono, H., Soesanto, S., & Haryono, H. (2018). An industrial competency-based curriculum alignment model. *World Transactions on Engineering and Technology Education*, *16*(1), 18–22. Retrieved from http://www.wiete.com.au/journals/WTE&TE/Pages/Vol.16, No.1 (2018)/03-Yudiono-H.pdf

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (161-171)
Online: http://journal.uny.ac.id/index.php/jpv

IMPLEMENTATION OF CREATIVE ECONOMY ENTREPRENEURIAL CHARACTER DEVELOPMENT THROUGH THE CULTURE OF SUSTAINABLE DEVELOPMENT AND VOCATIONAL STAKEHOLDERS PARTNERSHIP

I Gusti Kade Siladana
Universitas Negeri Yogyakarta

Putu Sudira
Universitas Negeri Yogyakarta

Abstract

This ethnography research aims to find the concepts and implementation in developing creative economic entrepreneur characters through sustainable development culture and stakeholder partnership in vocational high school (VHS). Research data were collected inductively through in-depth interviews, participant observation, documentation study, and internet site tracing based on research questions in the data generation manual. The data from the finding were interpreted deductively through coding process, and crystallization to produce informants shared cultural pattern and values, including (a) three sequences of life-based learning; (b) taksu's entity of creative economy; (c) seven perspectives for developing entrepreneurial characters (SEMESTA); (d) catur guru's essential enculturation for sustainable development and stakeholders partnership in vocational high school (VHS).

Keywords: *creative economy, entrepreneurial character, sustainable development, stakeholder partnership*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.24354*

Contact I Gusti Kade Siladana gk.siladana@gmail.com
Department of Technology and Vocational Education,
Graduate School of Universitas Negeri Yogyakarta
Jl. Colombo No. 1, Karangmalang, Depok, Sleman,
Yogyakarta 55281, Indonesia

INTRODUCTION

The existence of vocational high school (VHS) or *Sekolah Menengah Kejuruan* (SMK) graduates as the highest contributor to the open unemployment rate among graduates of other educational institutions based on data from the National Statistics Agency raises a big question mark about the role of VHS in preparing graduates who are ready to work in business and industry. It is known that the open unemployment contribution of graduates from VHS, based on the data in February 2015 and August 2015, was 9.05% and 12.65%. The data on the unemployment contribution of VHS graduates in February 2016 and August 2016 were 9.84% and 11.11%, from the national open unemployment rate (The Central Bureau of Statistics, 2016a). Besides, within the scope of the Province of Bali, the contribution of VHS graduates for the open unemployment rate in February 2015 and August 2015 was 0.24% and 3.62%. The data on the open unemployment contribution of VHS graduates in February 2016 and August 2016 were 3.01% and 3.96% (The Central Bureau of Statistics, 2016b).

To overcome this problem, it is not wise to charge the VHS parties working alone. However, collective awareness is needed to help provide analysis, suggestions, and alternative solutions for solving the problem of open unemployment graduates of these VHS. All parties should try to look at these labor issues comprehensively and analyze their determinant factors holistically. Furthermore, collective awareness contributes to concrete thoughts and actions to unravel the labor problems.

Some factors that are thought to be the causes include: (1) the gap in the number of vocational school job seekers with the number of available jobs; (2) the existence of skills mismatch or incompatibility between competency profiles taught in VHS with demands on work competencies (industrial skills and entrepreneurship); (3) the entrepreneurial character has not been formed and inadequate creative economic insight among the VHS graduates; (4) the culture of sustainable development has not been established in all elements of the implementation of vocational education; and (5) systemic synergies have not been formed among the elements of VHS stakeholders. For this reason, a comprehensive study is needed to reveal the praxis of the character development of creative economic entrepreneurship, a culture of sustainable development, and synergy in VHS stakeholder partnerships. Furthermore, the findings will result in the crystallization of patterns, shared culture and values, which become the basic concepts, formulation of ethic rules or indicators, and technical implementation of concepts and rules that are evident in the implementation of vocational education.

RESEARCH METHOD

This research is qualitative ethnographic research. Ethnographic research is essentially trying to uncover facts based on the perspective of informants or insider's perspective of reality (Fraenkel, Wallen, & Hyun, 2012; Given, 2008). This ethnographic research aims to explore the meaningfulness or philosophy behind social facts or symptoms of creative economic entrepreneurial character development, enculturation of sustainable development, and stakeholder partnerships that occur in the vocational environment through various data selection methods and carried out in a participatory manner. In other words, researchers blended and dissolved in the social experience of the community or became an integrated part of the community. The subject of this ethnographic research includes all members of the stakeholder community of SMKN 3 Tabanan and SMKN 2 Sukawati. The selection of informants was not based on proportional samples but based on their capabilities in providing information that supports the building of research theory. This ethnographic research was carried out for approximately eight months, from November 2016 to June 2017.

The main instrument in ethnographic research is the researchers themselves concerning the guidelines of the research data generation manual. Data generation was done inductively by referring to research questions. The method of generating data used includes (1) in-depth interviews; (2) participatory observation; (3) documentation; and (4) internet site tracing. Furthermore, the interpretation of findings data was made deductively, to produce crystallization of patterns, shared culture, and values in the context of vocational education. The crystallization of the pattern was carried out by applying the rules of cluster K mindset, namely the Idealization of Integration mindset. The characteristics of the K cluster mindset include

rules of mindset: (1) correspondence; (2) relevance; (3) convergence; (4) gestalt; (5) integration; (6) triangulation; (7) synchronization; (8) congruence; (9) concurrency; (10) harmonization; (11) conformity; (12) coherence; and (13) morphogenetic, among data elements of research findings (Muhadjir, 2011).

RESULTS AND DISCUSSION

The Concept and Implementation of VHS

The finding data show that the basic reference to the concept of implementing vocational education is the creation of graduates who have the adaptive capacity in a career in the world of work and the world of entrepreneurship which is very dynamic and also provides an opportunity to continue to a higher level of education. The data finding is reflected from participatory observation in classroom learning activities, labs or workshops, partner industries, school libraries, and studies of VHS curriculum documents (the curriculum books, competency structures, syllabus and also learning implementation plans or lesson plans).

The finding data were then followed up by in-depth interviews with several key informants related to the meaning of the observed symptoms of participatory observation data and document studies to obtain the perspectives of the actors of these educational activities. The aim is to explore the concept of implementation, describe the actualization of the concept to the level of implementation, and how they assess the level of compatibility or harmony between the concepts and implementation.

The findings of the three methods are then crystallized by applying the idealization mindset of integration. The crystallization results in the main hierarchical structure in the vocational curriculum, in which the research consists of four skills groups, including (a) fundamental skills; (b) generic-work skills; (c) industry-specific skills; and (d) employer-specific skills. Fundamental skills and generic-work skills groups are given in order to equip graduates with adaptation skills (soft skills). The description of fundamental skills includes: first, basic skills such as the ability to listen, read, write, speak; second, high order thinking skills such as creative thinking, critical thinking, critical decision making, and problem solving; and third, personal qualities such as responsibility, integrity, self-confidence, morality. The next skill group is generic-work skills, including the ability to use resources utilization, information processing, technology mastery, system understanding, communication, and collaboration skills (team working). Meanwhile, industry-specific skills and employer-specific skills are given in order to equip students to be able to work in certain industrial clusters, as well as skills in working on the specific tasks of the certain industrial sub-section (hard skills).

Furthermore, in the implementation of vocational education in VHS, the pattern of learning orientation movement was in spiral sequential (mosquito repellent), moving from an expert-centered learning paradigm held in classrooms or school labs. Then it extends to the work-oriented learning skills paradigm, namely work-based learning in schools and workplace learning in business and industry, which is facilitated by project-based or work-based scaffolding. Scaffolding means that the level of guidance in the project work is reduced or released step by step gradually. Moreover, the latter extends to the life-based learning paradigm, through extracurricular activities, social inquiry, interactive discussions, activities in the production and service units. Based on the results of participatory observation, the learning process occurs independently (self-directed) or on-demand based on the student's needs and continuous inquiry. The orientation is so that graduates can always adapt to the dynamics of technological developments in the world of work. Further, graduates will be able to survive in solving their own life problems. The concept and implementation of vocational education, where the research takes place, turns out to follow the pattern as seen in Figure 1.

Concept and Implementation of Creative Economy Entrepreneurial Character Development in Vocational Schools

Based on the results of interviews with several key informants, it was obtained an indication that creativity and entrepreneurship are the basic capital of developing creative economic entrepreneurial character. In fact, some informants saw creativity and entrepreneurship from the local wisdom of Balinese

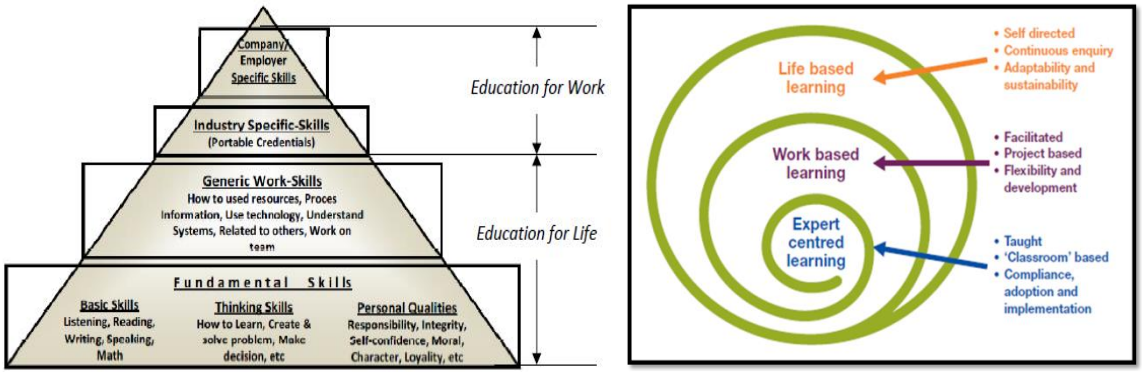


Figure 1. Structure of the Curriculum Hierarchy and Sequence of Movement of the Vocational Life-Based Learning Paradigm.
Source: adapted from Sudira (2016)

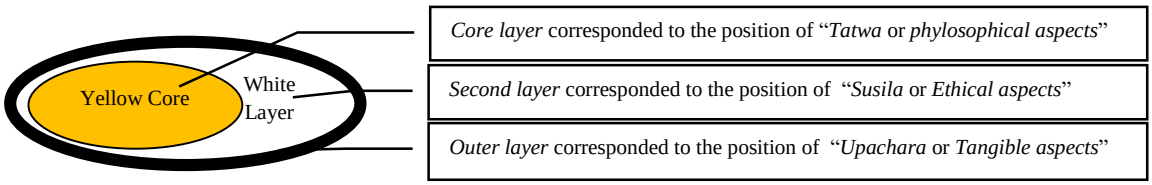


Figure 2. Rule of Correspondence Metaphor Structure of Egg Theory with Three Entities of Taksu in Creative Work or Creative Activity

Hinduism, namely the concept of "*tri* frame of *taksu* cosmology". They see that a job is said to be metaksu when it is built with a three-skeletal structure, namely: *tatwa* or tough, *susila* or ethic, and *upachara* or tangible ritual. In var-ious participatory observation activities com-bined with in-depth interview activities, it was concluded that every creative work/product or creative activity carried out generally always involved the three entities of the *taksu* cos-mology framework. From *tatwa* elements or thought studies, the subject of research always starts from the concept of creating creative products or creative activities. In essence, there are always logical reasons why a work is done or creative activity is done with consideration and specific ways (Why aspects). The next in-dication, the subject of research always for-mulates certain rules related to how a work should be done or activity should be carried out (aspects of the How). Furthermore, the subject of research determines what must be displayed in creative products or their creative activities in order to meet the initial rules and concepts that have been formulated (What aspect). The crystallization of the three entities or the three basic frameworks of creativity and entrepreneurship resulted in a metaphor for the structure of an egg (egg theory). When the correspondence rule is applied to the main structure of an egg which also consists of three layers, as presented in Figure 2, then: (a) egg yolk as the core layer, can be corresponded to the position of the *tatwa* (philosophical aspects); (b) white part as the second layer, can be corresponded to the position of *susila* (ethical aspects); and (c) eggshell as the skin or outer layer, the position is commensurate with *upachara* or tangible aspects.

The three concepts of the *taksu* cosmological framework turned out to be coherent with Sinek's Golden Circle theory (Sinek, 2009). The Golden Circle theory divides the main structure of creative economic entrepreneurial works or activities, including (a) Why (aspects of apprehension); (b) How (aspects of ethical rules or procedures); and (c) What (physical aspect or final appearance). These three entities, when they are able to be harmonized by their makers properly, are believed to be able to produce creative works that are very expressionist, have strong appeal, and are of high value (Wiryomartono, 2014, p. 72).

Likewise, the concept of entrepreneurial character, based on the results of the source and research data triangulation, it was indicated that entrepreneurial character converged on the three main group attributes, namely: (a) mind-sets; (b) heart-sets; and (c) action sets. Some informants also pursued the formulation of entrepreneurial character development strategies from the perspective of the local wisdom of Balinese, namely the concept of *Catur Guru* (four guiding roles or themes). The concept includes: (a) *rupaka* teacher (family role contribution); (b) *pengajian* teacher (the school parties role contribution); (c) *wisesa* teacher (community role contribution); and (d) *swadhyaya* teacher (spiritual value as the justification control over the role of the other three elements). Based on informants' views, the three elements (family, school, and community) coordinate, unite commitment and share roles in forging the character of students. Starting from home, school, and when in their community life, by placing spiritual values as a justification for the role of these three elements.

Based on the triangulation of data obtained from the study of learning program documents, participatory observation of classroom learning activities; in the industrial world, followed up by in-depth interviews with key informants, conceding to some of the essences of values and perspectives on creative economic entrepreneurial character development that needs to be instilled in students. From the results of crystallized data triangulation, seven perspectives on the character development of creative economic entrepreneurs that are integrally idealized are pursued, namely the *SEMESTA Sapta Pratyaksa* (Table 1 and Figure 3).

Triangulation of research data from the results of participatory observation and in-depth interviews also confirmed the implementation framework of creative economic entrepreneurial character development through three stages: (1) input; (2) process; and (3) output. The description of the three stages can be understood through the flow chart presented in Figure 4.

Table 1. Seven Creative Economy Entrepreneurial Character Development Perspectives (*SEMESTA Sapta Pratyaksa*)

Seven Perspectives	Perspective Descriptions
Scientific (S)	The planning, implementation and evaluation perspectives on character development programs that prioritize ways of thinking and acting according to scientific logic procedures (scientific procedure).
Engineering (E)	The planning, implementation and evaluation perspective of character development programs that involve aspects of engineering or engineering design, for example: construction, ergonomics, composition, and structure).
Mathematical (M)	The planning, implementation and evaluation perspective of character development programs involving elements and numerical calculation procedures.
Economical (E)	The planning, implementation and evaluation perspective of character development programs involving essential elements of economics (business-model) such as: accounting, logistics management, production, marketing, and resource management (financial, human resources, tools and equipment resources)
Sosiocultural (S)	The planning, implementation and evaluation perspectives of character development programs that involve consideration of social and cultural factors that develop in a particular community, such as: the values of philosophy and norms of local wisdom, community behavior preferences, social structure, community interaction patterns and so on.
Technological (T)	The planning, implementation and evaluation perspective of character development programs that involve consideration of the utilization of devices, tools/equiments or media used in everyday life.
Artistical (A)	The planning, implementation and evaluation perspective of character development programs that involve consideration of aspects of beauty, texture, composition, aesthetic values in creating a work.

Figure 3. Seven Learning Perspectives in Developing Creative Economy Entrepreneurial Character (SEMESTA Sapta Pratyaksa)

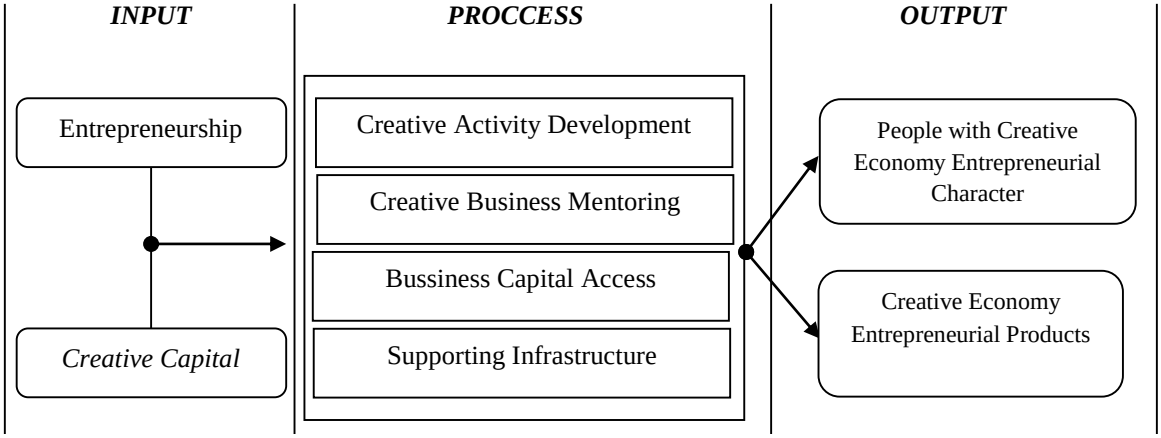


Figure 4. Stages of Creative Economy Entrepreneurial Character Development

The praxis of creative economic entrepreneurial character development generated from the crystallization of understanding and experience of the informants turned out to be coherent with macro strategies implied in "Creative Economy Green Paper for the Nordic Region" compiled by Fleming (2007, pp. 11–12) in the form of six key scenarios (key themes). The six scenarios can be adapted in the form of (1) growth of entrepreneurial character and creative spirit in the frame of academic activities (intracurricular); (2) developing creative activities (extracurricular); (3) the formation of creative communities in schools; (4) building critical interactions between creative economic actors and the school parties (school management, teachers and students); (5) facilitating the acquisition of costs or capital in pioneering creative businesses (school budgets, government assistance or third party funds/sponsors); and (6) providing supporting infrastructure as a means/place for expressing creative ideas and products for teachers, students and all school members.

Concept and Implementation of Culture of Sustainable Development in Vocational Schools

Crystallization of research findings data obtained by the informants' views converged on defining school culture as a standard set of beliefs or assumptions, values and norms and physical activities which became guidelines for thinking and acting of the School community member in order to foster a shared commitment

to realizing the institution's vision and mission. In the context of the culture of sustainable development, several research informants alluded to metaphors stemming from the local wisdom of Balinese Hinduism, namely the symbolic meaning of Dewi Saraswati as the goddess of science and art very relevant to the spirit of sustainable development, as shown in Figure 5.

The symbolic meanings referred to by the informants include: (1) the never-ending process of learning in the symbolic meaning of genitri or chain; (2) learn to be wise in the symbolic meaning of white swans; (3) learning by reading various literature in the symbolic meaning of petals or *lontar*; (4) learning by listening in the symbolic meaning of a *wina*/ guitar as musical instrument; (5) learning by practicing (hands-on experiences) in symbolic meaning with four arms; (6) learning with appreciation that science is sacred, giving leverage effect to authority and attractive effect for those who possess it in the symbolic meaning of white lotus, beautiful peacocks and goddesses. These symbolic meanings are in line with the theory of accelerated learning (Meier, 2000): (1) somatic namely learning by practicing; (2) auditory which is learning through the sense of hearing; (3) visual, which is learning through the sense of sight, and (4) intellectual, namely learning through intellectual processes (SAVI).

Related to the strategy of civilizing sustainable development, based on the explanation of the informants in several in-depth interview sessions, it can be mapped three forms of intervention strategies that are sorted based on main priority ethical considerations: (1) intervention strategies through sociocultural approaches, which prioritize the generation of individual inner motivation through social-engineering techniques, rewarding or appreciation; (2) intervention strategies through figure modelling approaches using the adherence of figures from external or internal schools, who put forward examples of the success of certain figures to tap the motivation of others to follow in the footsteps of their achievements; and (3) intervention strategies through the functionalization of the school's organizational structure, which is the last choice when previous strategies are considered unsuccessful. It is because the third strategy is more intimidating, which is motivation arises because of an individual's external drive, and its effects tend to be temporary (not permanent). The three intervention strategies for continuous development culture when idealized integratively produce the pattern shown in Figure 6.

The findings of ethnographic research turned out to have coherence with one of the grounded research findings of Raharjo (2013). One of the results of research recommended three types of intervention strategies, namely: (1) structural intervention; (2) figure intervention; and (3) cultural intervention. However, his research does not confirm which strategy prioritizes ethical use.

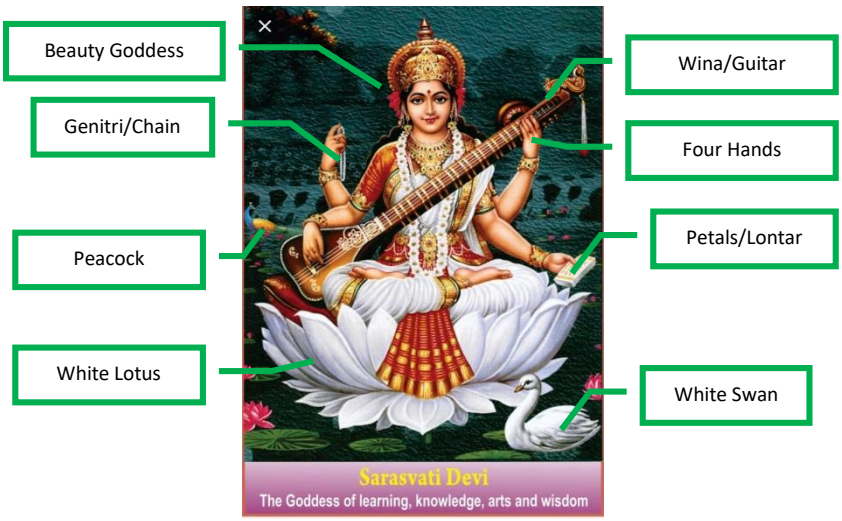


Figure 5. Goddess Saraswati as the Goddess of Science and Art

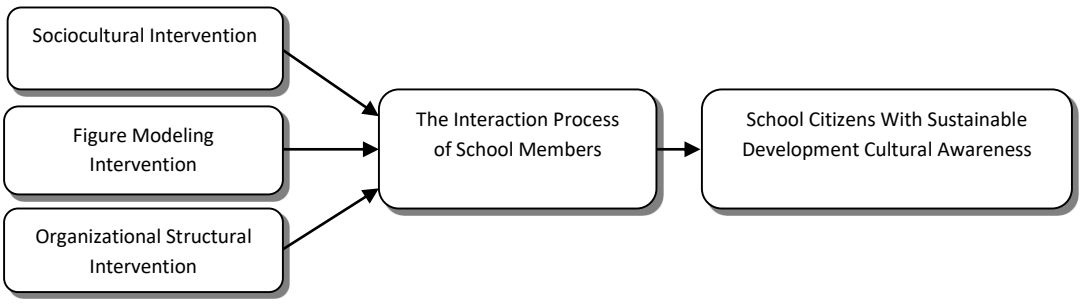


Figure 6. Strategic Intervention of Sustainable Development Culture in Vocational Schools

Concept and Implementation of Partnership in Education Stakeholders in Vocational Schools

Based on the perceptions of the research informants, if it is drawn to its essence, it defines Vocational education stakeholders as individuals, groups or institutions that participate critically in the progress of the long-term development of educational activity in Vocational Schools, to produce a various consensus decided by all elements democratically. From these definitions, two main substances can be drawn: (1) Vocational education stakeholders can be individuals, groups or institutions; and (2) in their interactions, stakeholder partnerships focus on participation, consensus formation (joint commitment) and the decision-making process is carried out democratically.

Furthermore, by combining the essence of information summarized from the views of the research informants, there were identified four groups of vocational education stakeholders: (1) the community, both individually and in groups; (2) educational institutions (VHS) along with all of their elements; (3) business and industrial actors, both individuals and institutions; and (4) government parties. Based on in-depth interview data, it was identified that each of these groups had different contributions and interests. For example, as an individual, parents of students have an interest in sending their children to a vocational school. As part of a community group, they act as social control of the quality education policy of the Vocational School. Also, educational institutions (VHS) and all of their elements play a role as organizers of vocational education activities. Next, business and industry players (*Dunia Usaha dan Dunia Industri* or DuDi), besides acting as vocational school users, they should also participate in providing learning experiences about the world of work for vocational students, and as critical partners of Vocational Schools in terms of updating vocational education curriculum content. Meanwhile, the government, in addition to providing financial assistance to support vocational education activities, also acts as a provider of the legal umbrella (rules of the game) for every vocational education activity in vocational schools.

Based on in-depth interview data with several key informants from each of the Vocational education stakeholder group, and also through participatory observation, identified several forms of partnership activities between the Vocational School and other stakeholders or stakeholder groups. For example, school partnerships with families (parents) in handling cases of violations of juvenile discipline and delinquency, through guidance and counseling services in terms of in-school service or home visit. Besides, the partnership of the Vocational School with the business and industry in terms of: (1) workers recruitment through a special labor market program; (2) CSR (corporates social responsibility) programs in the form of resources sharing in terms of the procurement of facilities for vocational practices requiring very expensive investment costs if provided by the Vocational School; (3) industrial practice (workplace learning) for vocational students; (4) development of teaching staff competencies; and (5) development of vocational education curriculum (VHS).

The results of in-depth interviews with business actors and creative industries provide information in the form of important experience sharing as input for the development of vocational curriculum content in the context of changing perspectives on creative economic entrepreneurship management. The pattern crystallization that can be generated is related to changes in the informants' perspective of creative economic entrepreneurial management: the need for a shift in the quantitative

economic paradigm towards the qualitative economic paradigm. In essence, the crystallization of the pattern has coherence with the comparative study of blue ocean strategy and red ocean strategy theory by Kim and Mauborgne (2005). In short, both the sharing of experience from business people and the creative industry or the blue ocean strategy theory recommends shifting the mindset of the owning economy towards the pattern of sharing economy thinking.

From the perspective of the owning economy, all business supporting resources are held or owned by the business owner. The impact is that the investment costs are very high, and require the allocation of costs for the maintenance of assets and business infrastructure. In the perspective of sharing economy, all business support resources do not have to be owned by the business owner. However, by utilizing the resources of other parties who become business partners. It provides a chain advantage for the competitiveness of the products or services produced. The investment costs for the procurement and maintenance of business facilities and infrastructure can be more efficient. It will impact the smaller production costs, where the subsequent impact is the cost of goods sold (COGS) for the offering products or services to be more competitive (cheaper).

Regarding the business revenue sector, Blue Ocean Strategy recommends adding channels and implementing value chain policies, so that revenue streams (income structure) are greater because of the addition of income channels and added value at each stage of the business circulation carried out. In essence, to win a business competition in the creative economy era does not need to be done in the old way (red ocean strategy), which is bleeding with a head to head competition pattern. There are still many creative ways to win the business competition more elegantly, for example, by creating a new market niche, offering more value to certain customer segments, such as the concept of home shopping or the convenience of shopping from home with delivery services. The key to victory in business competition in the era of the creative economy lies in creativity in reformulating the "business model".

The formulation of a business model crystallized from sharing the experiences of research informants covers nine aspects of consideration: (1) aspects of the cost structure: material costs, labor costs, overhead costs, etc; (2) revenue aspects: income at the stage of creation, production, distribution and commercialization of creative products; (3) more value offered to consumers (value proposition), determined based on the mapping of consumer behavior (consument behavior survey); (4) aspects of business activities that become mainstay (key activity), determined based on the feasibility study; (5) aspects of key resources, determined based on business circulation analysis; (6) aspects of key partners: investment, production, marketing, distribution, and transaction mechanism partners (cash or non-cash with financial technology or fintech services); (7) the channel aspect that is the mainstay (key channel), determined based on business circulation analysis; (8) aspects of consumer relations (consument relationship), reviewed through customer satisfaction surveys; and (9) aspects of market segmentation, determined based on the feasibility study. The nine aspects of the business model can be converted into analytical templates known as business model canvas (Kasali, 2017), shown in Figure 7.

<table>
<tr>
<td rowspan="2">Key Partners :
1.....
2.....
3.....
4. etc.</td>
<td>Key Activities :
1.....
2.....
3.....
4. etc.</td>
<td rowspan="2">Value Propositions :
1.....
2.....
3.....
4. etc</td>
<td>Customer Relationships :
1.....
2.....
3.....
4. etc.</td>
<td rowspan="2">Market Segment :
1.....
2.....
3.....
4. etc.</td>
</tr>
<tr>
<td>Key Resources :
1.....
2.....
3.....
4. etc.</td>
<td>Channels:
1.....
2.....
3.....
4. etc.</td>
</tr>
<tr>
<td colspan="2">Cost Structures :
1.....
2.....
3.....
4. etc</td>
<td colspan="2">Revenue Streams :
1.....
2.....
3.....
4. etc.</td>
</tr>
</table>

Figure 7. Business Model Canvas Template
Source: adapted from Kasali (2017)

CONCLUSION AND SUGGESTIONS

Conclusion

Based on the results of data triangulation revealed through in-depth interviews, participatory observation, documentation studies and internet site tracing, some conclusions can be drawn as follows: (1) The concept of vocational education (VHS) is a form of secondary level vocational education program that combines vocational learning and general learning, so as to be able to equip graduates with vocational skills (industrial specific skills and employer-specific skills) and life skills as capital the basis for entering the workforce, entrepreneurship and or continuing education. The implementation of the concept is that the learning moves in a sequential spiral (such as insect repellent) from: (a) expert centered learning; (b) extends to work-based learning (in the lab/school workshop), workplace learning (in the industrial world); and (c) expanding into life-based learning to equip students with fundamental skills and generic-work skills.

The concept of creative economic entrepreneurial character development in VHS refers to the concept of the *Taksu*'s three entity, including *tatwa* as the philosophical aspects, *susila* as the ethical aspects, and *upachara* as the tangible aspects. Meanwhile, the implementation integrates the seven perspectives (*SEMESTA*) on the study of creative economic entrepreneurship learning, including perspectives: scientific, engineering, mathematical, economic, sociocultural, technological, and artistic.

The concept of a sustainable development culture in Vocational Schools is understood as a set of standards of beliefs or assumptions, values and norms and physical activities that serve as guidance for thinking, and acting in the community members of the school community sustainable development in all elements to realize the vision and mission of the VHS. Furthermore, intervention strategies for civilizing sustainable development in Vocational Schools (VHS) include: (a) sociocultural interventions; (b) figure interventions; and (c) organizational structural intervention.

The concept of education stakeholders in Vocational High Schools (VHS) is individuals, groups or institutions that participate critically on the long-term development progress of educational activity in VHS, in order to produce a various consensus that is decided democratically by all elements. The scope of the partnership includes (a) family and school partnerships; (b) school and business and industry partnerships; and (c) school parties with the governmental institution partnerships.

Suggestions

The findings of cultural patterns and value systems (shared cultural patterns and values) from ethnographic research are essential to be published or disseminated to the stakeholders of vocational education. That way, there will be a similar perspective in planning, implementing and evaluating the implementation practices of vocational education among stakeholders, starting from the provincial education office of Bali, business and industry in Bali, vocational curriculum developers in Bali and community observers of vocational education, especially in the context of character development of creative economic entrepreneurship through a culture of sustainable development and vocational stakeholder partnerships.

REFERENCES

Fleming, T. (2007). *A creative economy green paper for the Nordic Region*. London: Nordic Innovation Centre. Retrieved from http://tfconsultancy.co.uk/reports/CreativeEconomy_NordicRegion.pdf

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). New York, NY: McGraw Hill.

Given, L. M. (2008). *The SAGE encyclopedia of qualitative research methods*. Thousand Oaks, CA: Sage Publications.

Kasali, R. (2017). *Disruption*. Jakarta: PT. Gramedia Pustaka Utama.

Kim, W. C., & Mauborgne, R. (2005). *Blue Ocean Strategy: How to create uncontested market space and make the competition irrelevant*. Boston, MA: Harvard Business School.

Meier, D. (2000). *The accelerated learning handbook: A creative guide to designing and delivering faster, more effective*

training programs. New York, NY: McGraw Hill.

Muhadjir, N. (2011). *Metodologi penelitian: Paradigma positivisme objektif, phenomenologi interpretif, logika bahasa Platonis, Chomskyist, Hegelian & Hemeneutik, paradigma studi Islam, matematik recursion, set-theory & structural equation modeling dan mixed*. Yogyakarta: Rake Sarasin.

Raharjo, N. E. (2013). *Model pengembangan kultur sekolah berbasis karakter kewirausahaan di Sekolah Menengah Kejuruan*. Dissertation, Universitas Negeri Yogyakarta. Retrieved from https://eprints.uny.ac.id/22738/

Sinek, S. (2009). *Start with why: How great leaders inspire everyone to take action*. New York, NY: Portfolio Peguin Group.

Sudira, P. (2016). *TVET abad XXI: Filosofi, teori, konsep, dan strategi pembelajaran vokasional*. Yogyakarta: UNY Press.

The Central Bureau of Statistics. (2016a). *Keadaan ketenagakerjaan Agustus 2016*. Jakarta: The Central Bureau of Statistics of Indonesia.

The Central Bureau of Statistics. (2016b). *Keadaan ketenagakerjaan Provinsi Bali Agustus 2016*. Denpasar: The Central Bureau of Statistics of Bali.

Wiryomartono, B. P. (2014). *Perspectives on traditional settlements and communities: Home, form and culture in Indonesia*. Gateway East: Springer Singapore.

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (172-184)
Online: http://journal.uny.ac.id/index.php/jpv

EVALUATION OF THE IMPLEMENTATION OF WORKSHOP AND LABORATORY MANAGEMENT ON VOCATIONAL HIGH SCHOOL

Fuadillah Pangestu
Universitas Negeri Yogyakarta

Sukardi
Universitas Negeri Yogyakarta

Abstract

This research aims to reveal: the development of workshop and laboratory management implementation, also the suitability of facilities and infrastructure on Vocational High School in Banggai District, which refers to the indicator of good workshop and laboratory, according to the Directorate of Vocational Education. This research is evaluation research, which employs a goal free evaluation model and descriptive quantitative approach. The research sample involved in this study was 187 teachers and students. The data analysis technique used in this research was the average score and skewness. The result of this research shows that: (1) The workshop development is appropriate enough and good, yet it still needs further improvement with students to score at 81.19 and -0.229 also the teachers at 197.78 and -0.433. (2) The laboratory development is appropriate enough, and it still needs further improvement with students to score at 96.64 and 0.393, also the teachers at 209.03 and 0.36. (3) The suitability of the workshop's facilities and infrastructure is appropriate enough, and it still needs further improvement with the score at 250.205 and 0.549, and also the laboratory is appropriate enough and good, yet it still needs further improvement with the score at 252.80 and -1.694.

Keywords: *evaluation, laboratory management, workshop management*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.25991*

Contact Fuadillah Pangestu
fuadillahpangestu.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

Education for a country is a quite significant matter in improving human resources to be able to compete with other countries. Fitriani (2014, p. 153) defines education is an inseparable part of national development, and it is the main element in national development. Article 3 of Law of Republic of Indonesia No. 20 of 2003 states that national education is aimed at enhancing ability and building a respected nation's character and civilization in accordance to enlighten the lives of the nation, and to develop students' potency in order to be religious human and believe in God the Almighty, having noble character, having high intelligence, being capable-creative, independent, and to become democratic and responsible citizens. Education is one of the ways to achieve prosperity in a developing country and to create a better society. According to Suyanta et al. (2018, p. 1), education is one of the factors that support the development of a country to develop and build its society to be better through education.

One of the ways to create a better society in Indonesia is through education system applied on Vocational High School, which is ruled in the Regulation of the Minister of Education and Culture No. 34 of 2018 stating that Vocational High School is a formal education on the secondary level of education that carries on the vocational program. According to Martono, Saputro, Wahyono, Laksono, and Isnantyo (2018, p. 2), education is one of the factors that support the development of a country to develop and build its society to be better through education. Estriyanto, Kersten, Pardjono, and Sofyan (2017, p. 28) also claim that the Vocational High School is a work-oriented education at the secondary level of education in the national education system. The graduates of Vocational High School are skill-ready workers who have capabilities of success since its education program are measured from the employment acceptance level in its relation to industries or world of work.

Vocational education is a part of Technical and Vocational Education Training (TVET). Yasin, Nordin, Rahim, and Yunus (2014, p. 28) define vocational education is education that provides individuals with specific skills for a particular job field. TVET is aimed at preparing skill-ready workers, having entrepreneur skills, and competitive based on the vocational skills that have been chosen with the needs of industries world. TVET also has the same definition in preparing skill-ready workers in order to work in the workplace. Hadi, Hassan, Razzaq, and Mustafa (2015, p. 1163) also claim that Technical and Vocational Education Training (TVET) plays a role in producing workers with reflexes that allow them to interact with job duties in the organization of the workplace. The students' skills in Vocational High School must balance with the needs of the business or industry world. The unbalance amount of the needs in business or industries world can cause unemployment since there is an inequality of the skills owned by the students with the business or industries world. Based on the data provided by the Central *Bureau* of *Statistics* of Banggai district in 2018, there are 1,440 secondary-level school graduates, in which the vocational high school graduates are dominant. The standard competency for Vocational High School/Vocational *Madrasah Aliyah* graduates in Indonesia is adopted from the aim of national education, and the graduates profile in graduate area competence. Vocational High School/Vocational *Madrasah Aliyah* in Indonesia has a purpose as a vocational institution in Indonesia in preparing skillful workers who have skills based on the needs of business or industries world.

VHS or TVET has the purpose of building someone to have vocational skills in accordance to enable him or her to work in business or industries world and to develop the economic growth both private and national economy. Slamet (2010, p. 107) states that vocational education is one of the institutions to prepare the workers in the industry. Technical and Vocational Education and Training (TVET) plays a crucial role in transforming economies by providing a skilled human resource (Baryamureeba & Karukuza, 2014, p. 7). Vocational skills that have been gained by the students in VHS or TVET will make them have an important role in coping with some challenges to achieve sustainable economic development. Majumdar (2012, p. 1) claims that TVET can play an instrumental role in developing a new generation of individuals who will face the challenge of achieving sustainable socio-economic development.

Entering the new era of Industry 4.0, the students of Vocational High School are expect-

ed to have skills in which they are ready for the change. The vision of Industry 4.0 is to bring some new approaches, methodologies, and technologies. The vision of Industry 4.0 will bring not only new approaches but also the methodologies and technologies (Benešová & Tupa, 2017, p. 2195). For vocational education in Indonesia in coping with Industry 4.0, the concept of competency has been converted into a capability that enables VHS graduates to have skills which suitable for the needs of new business or industries world. Samani (2018, p. 45) also has the same opinion about it. In coping with the industrial era 4.0, the concept of competency in vocational education must be converted into the capability to enable graduates to engage with the latest work patterns. In industrial revolution 4.0, the graduates are demanded to have more than one vocational skill. Dwiyanti, Ana, and Widianingsih (2018, p. 98) also state that in disruption and industry revolution 4.0 era, more skills must be mastered by them, such as social skills.

Industry 4.0 also expects the good and appropriate supporting curriculum for Vocational High School in which it is used for improving the suitable vocational skill that enables the graduates to work in industries or business world. In coping with Industry 4.0, the curriculum of Vocational High School has to be revised to adjust with the students' skills and the business and industries world. Janis and Alias (2017, p. 1052) also state that Vocational Education and Training (TVET) educators improvise the TVET curriculum structure with the aim of producing the technical graduates that are capable of working in the Industry 4.0 work environment. The curriculum in the vocational field should concern the needs of Industry 4.0. According to Durmus and Dağlı (2017, p. 1), curriculums need to be refreshed so that they can be integrated into the Philosophy of Industry 4.0 of the Vocational School laboratories.

The purpose of vocational education is to give students some provisions of good vocational skills and build them to be skill-ready workers or entrepreneurs. Practicing skills in laboratory and workshop is the media for students to understand and strengthen their lesson materials; it is also aimed to develop students' work orientation. The insufficient condition of laboratory and workshop is one factor that triggers to students' lack of curiosity and orientation toward their work orientation (Syafrudie, 2016, p. 163). Facilities and infrastructures of Vocational High School in Indonesia have been ruled on the Regulation of the Minister of National Education No. 40 of 2008, about facilities and infrastructures to support the teaching-learning activity. Sajidan, Baedhowi, Triyanto, Totalia, and Masykuri (2018, p. 60) also claim that those factors would be the main guard of the teaching-learning process, especially for laboratory and workshop that has modern equipment and facilities based on the demand for science and technology development. The graduates of vocational high school (VHS) or TVET are trained to have good skills and training in a workshop or laboratory. According to Bakri and Zakaria (2018, p. 153), under TVET education, the graduates will undergo several skills and technical training in either laboratories or workshops. A laboratory or workshop has a different quality in which they can disturb the learning process, so the policymaker must cooperate with the industries party. Oviawe, Uwameiye, and Uddin (2017, p. 7) also state that TVET educational institutions must collaborate with the industry towards bridging the skill gap. The quality of vocational education can be seen from the effectiveness of all education systems; class, workshop, and laboratory. Referred to Lucas, Spencer, and Claxton (2012, p. 13), it is stated that the effectiveness of all education systems depends critically on the quality of teaching and learning in the classrooms, workshops, laboratories, and other spaces in which education takes place.

Substantially, Vocational High School is one of the education institutions aimed to prepare skill-ready graduates, having entrepreneur skill, intelligent, competitive, having nation identity, and capable to develop local wisdom and also to be able to compete in the global market (Sajidan et al., 2018, p. 1). A workshop or laboratory is a place that provides a simulation atmosphere for students to implement their theory that they have learned into real practice (Ghufron et al., 2018, p. 3). The improvement of skills in laboratories or workshops for students should be relevant to industrial needs. Anindo, Mugambi, and Matula (2016, p. 103) claim that it was also established that the relevance of training equipment influences the acquisition of employable skills. Laboratory or workshop as the primary facility

for students in transferring their knowledge and skill development. Sharipova and Wesseler (2018, p. 27) conclude that workshops function to transfer some knowledge and to develop some skills or competencies. Laboratory and workshop in vocational education are facilities that form students' competencies. Wijanarka (2011, p. 1) believes that laboratories and workshops on vocational education are the primary facilities in the formation of student competence. Therefore, vocational education has a big role in building students' skills in which it is useful for them to work and to be an entrepreneur. A laboratory or workshop must be free from problems that can cause students or workers to have bad skills. Egbri and Chukwuedo (2013, p. 74) state the same thing that Technical Vocational Education and Training (TVET) is meant to infuse in the learners the appropriate skills needed to be self-employed or be employable, but the problem of ill-equipped laboratories/workshop culminating in poor skill. Workshop and laboratory are useful and important for students to help their teachers in conducting the learning process. Besides, workshop and laboratory is a facility in building a vocational skill based on competency skill needed by industries.

RESEARCH METHOD

This research is evaluation research employing a descriptive quantitative methodological approach. The model of this evaluation research is the goal free evaluation model. The research was conducted in three Vocational High Schools or *Sekolah Menengah Kejuruan* (SMK) in Banggai district; they are SMK Negeri 2 Luwuk, SMK Negeri 1 Toili, and SMK Negeri 1 Moilong. The population of the research was teachers and 363 of 11th-grade students. There were 187 samples from three Vocational High Schools in this research. The teachers and students that become the subjects of the research were determined using proportional random sampling technique. The technique of data collecting used in the research was by distributing a questionnaire to gain data from the teachers and students. Besides, there was an interview to obtain additional information directly from the respondents; they are the teachers/the chief of workshop/the chief of program and students.

RESULTS AND DISCUSSION

The result of the research can be seen by the improvement of workshop and laboratory at some Vocational High School in Banggai district on how far the improvement of implementation conducted in laboratory and workshop based on the standard of Vocational High School Directorate Supervisor. To observe the improvement of laboratory and workshop, the respondents used in the research were teachers and students. Therefore, the data of the research were divided into two, between teacher respondent and student respondent. In this research, there were six indicators used to measure the quality of the workshop and laboratory; namely, as follow practice area, atmosphere, temperature, lighting, maintenance, and work station. Meanwhile, to see the applicability of facilities and infrastructures in the workshop and laboratory, the researchers used an observation sheet.

Table 1. Table of Average Score and Skewness of Student-Respondent Workshop

Indicator	Workshop	
	Average of Score	Skewness
Practice Area	24.31	0.164
Atmosphere	4.27	-1.091
Temperature	4.30	-1.412
Lighting	4.33	-1.456
Maintenance	8.36	-0.533
Workstation	35.61	-0.356

In the research result in Table 1, it shows that there are two types of analysis used in observing the improvement of the workshop. If it is seen from the average of the score on the practice area in Vocational High School workshops in Banggai district, it can be concluded that the result of Vocational High School workshops in Banggai district has appropriate enough tendency with the average score at 24.31 from students as respondent. In addition, the researchers observed the practice area in the workshop, which is seen by the skewness with a positive result at 0.164. It shows that it is necessary to improve the suitability of the practice area in vocational high school (VHS). The atmosphere in VHS in Banggai district, based on the research result, indicates that the result of the workshop atmosphere in the VHS

in Banggai district has appropriate enough tendency if it is seen from the mean score at 4.27 from students as respondent. Besides, if it is seen from the atmosphere in the workshop, it has negative skewness at -1.091. It shows that it is good to have an atmosphere in the workshop. The temperature in Vocational High School workshops in Banggai district has appropriate enough tendency if it is seen from the average score at 4.30 from students as respondents. In addition, this research observes the improvement of the practice area in which there is negative skewness at -1.412. It shows that it is good to have temperature in the workshop.

Based on Table 1, the lighting in VHS workshops in Banggai district has appropriate enough tendency with the average score at 4.33 from students as respondents. Besides, if it is seen from the lighting in the workshop, it has a negative lighting score at -1.456. It shows that it is good to have lighting in the workshop. From the research result, the maintenance in Vocational High School workshops in Banggai district has appropriate enough tendency with the average score at 8.36 from students as respondents. In addition, if it is seen from the maintenance in the workshop, it has negative maintenance at -0.533. It shows that it is good to have maintenance in the workshop. Meanwhile, the workstation in VHS workshops in Banggai district has appropriate enough tendency with the average score at 35.61 from students as respondents. Besides, if it is seen from the workstation in the workshop, it has a negative workstation at -0.038. It shows that it is good to have a workstation in the workshop.

Table 2. Average of Score and Skewness of Student-Respondent Laboratory

Indicator	Laboratory	
	Average of Score	Skewness
Practice Area	41.37	-0.038
Atmosphere	3.80	0.008
Temperature	10.50	-0.356
Lighting	3.53	0.138
Maintenance	8.36	0.247
Workstation	24.47	0.981

Based on the research result in Table 2, it indicates that when we analyze the indicator findings of the research in the laboratory, there are two types of analysis, namely: the average of score and skewness, which is seen from its improvement. In accordance with the whole statements or questions on the indicators, the respondent of the research are the students. The practice area in Vocational High School laboratories in Banggai district shows that it has an appropriate enough tendency if it is seen from the average score at 41.73 of students as respondents. Besides, if it is seen from the practice area in the laboratory, which is seen from the skewness, it has a negative result with skewness at -0.038. It shows that it is good for the practice area. The atmosphere in Vocational High School laboratories in Banggai district has appropriate enough tendency if it is seen from the average score at 3.80 from students as respondents. Besides, it can be concluded that the atmosphere in the laboratory if it is seen from the skewness, it has a positive result with skewness at 0.008. It shows that it still needs further improvement in the suitability of the atmosphere in the laboratory. The temperature in Vocational High School in Banggai district has appropriate enough tendency if it is seen from the average score at 10.50 from students as respondents. Besides, it can be concluded that temperature in the laboratory if it is seen from the skewness, it has a negative result with skewness at -0.356. It shows that it is good from the temperature.

The lighting in Vocational High School laboratories in Banggai district has appropriate enough tendency if it is seen from the average score at 3.53 from students as respondents. Besides, it can be concluded that the atmosphere in the laboratory if it is seen from the skewness, it has a positive result with skewness at 0.138. It shows that it still needs further improvement from its suitability of lighting in the laboratory. The maintenance in Vocational High School laboratories in Banggai district has appropriate enough tendency if it is seen from the average score at 8.36 from students as respondents. Besides, it can be concluded that maintenance in the laboratory if it is seen from the skewness, it has a positive result with skewness at 0.247. It shows that it still needs further improvement from its suitability of maintenance in the laboratory. The workstation in Vocational High School laboratories in Banggai district has appropriate enough tendency if it is seen from the average score at 24.47 from students as respondents. Besides, it can be concluded that the workstation in the

laboratory if it is seen from the skewness, has a positive result with skewness at 0.981. It shows that it still needs further improvement from its suitability of workstation in the laboratory.

Table 3. Table Average of Score and Skewness of Teacher–Respondent Workshop

Indicator	Workshop	
	Average of Score	Skewness
Practice Area	96.83	-0.568
Atmosphere	9.52	-0.093
Temperature	6.48	-0.299
Lighting	19.35	-0.452
Maintanance	8.36	-0.186
Workstation	49.83	-0.262

The research result in Table 3 shows that in analyzing the findings of the indicators in the workshop, there are two types of analysis, which are average of score and skewness that is seen from the development perspective. Based on the entire result of statements or questions on this indicator in which the respondent is the teacher, the practice area takes place on the workshop of Vocational High School in Banggai district. According to the result, it can be concluded that the result of the practice area on the workshop of Vocational High School in Banggai district has an appropriate enough tendency if it is seen from the average score 96.83 from the teacher as the respondent. Moreover, this research sees the development of the practice area in the workshop, which is seen from skewness that shows the negative results with skewness at -0.568. The result shows that the practice area is already good. The atmosphere on the workshop of Vocational High School in Banggai district based on the result can be concluded that the atmosphere on the workshop of Vocational High School in Banggai district is considered appropriate enough if it is seen from the average score at 9.52 from the teacher as respondent. In addition, this research sees the development of the atmosphere in the workshop, which is seen from skewness that shows the negative result with skewness -0.093. The result shows that the atmosphere in the workshop is good, yet it still needs further improvement of the atmosphere suitability in the workshop. The temperature on the workshop of Vocational High School in Banggai district based on the result can be concluded that the temperature on the workshop of Vocational High School in Banggai district has an appropriate enough tendency if it is seen from the average score at 96.83 from the teacher as respondent. Furthermore, this research sees the development of the temperature in the workshop, which is seen from skewness that shows the negative result with skewness at -0.299. The result shows that the temperature in the workshop is considered good, yet it still needs further improvement of the temperature suitability in the workshop.

The lighting on the workshop of Vocational High School in Banggai district based on the result can be concluded that the result of the lighting on the workshop of Vocational High School in Banggai district has an appropriate tendency if it is seen from the average of the score at 15.78 from the teacher as respondent. Besides, this research sees the development of the lighting in the workshop, which is seen from skewness that shows the negative result with skewness -0.452. The result shows that the lighting in the workshop is considered good. The maintenance on the workshop of Vocational High School in Banggai district based on the result can be concluded that the result of the maintenance on the workshop of Vocational High School in Banggai district has an appropriate enough tendency if it is seen from the average of the score at 19.35 from the teacher as respondent. Also, in this research sees the development of the maintenance on the workshop of Vocational High School in Banggai district that is seen from skewness that shows the negative result with skewness at -0.186. The result shows that the maintenance of the workshop is considered good. The workstation on the workshop of Vocational High School in Banggai district based on the result can be concluded that the result of the workstation on the workshop of Vocational High School in Banggai district has an appropriate enough tendency if it is seen from the average score at 49.83 from the teacher as respondent. Further, this research sees the development of the workstation on the workshop, which is seen from skewness that shows the negative result with skewness at -0.262. The result shows that the workstation in the workshop is considered good.

Table 4. Table Average of Score and Skewness on Teacher-Respondent Laboratory

Indicator	Laboratory	
	Average of Score	**Skewness**
Practice Area	120.83	0.152
Atmosphere	12.00	-0.399
Temperature	6.47	-0.671
Lighting	11.57	0.467
Maintenance	8.36	0.159
Workstation	47.03	-0.330

The result of the research in Table 4 shows that in analyzing the findings of the indicators in the laboratory, there are two types of analysis, which are average of score and skewness that is seen from the development perspective. Based on the entire result of statements and questions on the indicator in which the respondent of this research is the teacher, the practice area on the laboratory of VHS in Banggai district has an appropriate enough tendency if it is seen from the average score at 120.83 from the teacher as respondent. Moreover, this research sees the development of the practice area on the laboratory seen from skewness that shows the positive result with skewness 0.152. The result shows that it still needs further improvement in the practice area suitability in the laboratory. The atmosphere in the laboratory of VHS in Banggai district, based on the result, the atmosphere in the laboratory of VHS in Banggai district has an appropriate enough tendency if it is seen from the average of the score at 12.00 from the teacher as respondent. In addition, this research sees the development of the atmosphere in the laboratory that is seen from skewness that shows the negative result with skewness at -0.399. The result shows that the atmosphere in the laboratory is considered as good. The temperature in the laboratory of VHS in Banggai district based on the result can be concluded that the temperature results in the laboratory of VHS in Banggai district have an appropriate enough tendency if it is seen from the average score at 6.47 from the teacher as respondent. Furthermore, this research sees the development from the temperature on the laboratory that is seen from skewness that shows the negative result with skewness at -0.671. The result shows that the temperature in the laboratory is considered good.

The lighting in the laboratory of Vocational High School in Banggai district has an appropriate enough tendency if it is seen from the average score at 12.27 from the teacher as respondent. Further, this research sees the development of the lighting on the laboratory that is seen from skewness that shows the positive result with skewness at 0.467. The result shows that it still needs further improvement in the suitability of the lighting in the laboratory. The maintenance in the laboratory of Vocational High School in Banggai district based on the result it can be concluded that it has an appropriate enough tendency if it is seen from the average score at 11.57 from the teacher as respondent. Besides, this research sees the development of the maintenance in the laboratory that is seen from skewness that shows the positive result with skewness at 0.159. The result shows that it still needs further improvement in the maintenance suitability in the laboratory. Also, this research sees the development of the maintenance in the laboratory that is seen from skewness that shows the positive result with skewness at 0.159. The result shows that it still needs further improvement in the maintenance suitability in the laboratory. Workstation in the laboratory of Vocational High School in Banggai district based on the result can be concluded that the result of the work station in the laboratory of Vocational High School in Banggai district has an appropriate enough tendency if it is seen from the average of the score at 47.03 from the teacher as respondent. Furthermore, this research sees the development of workstations in the laboratory that is seen from skewness that shows the negative result with skewness -0.330. The result shows that the workstation is considered good in the laboratory.

Table 5. Table Average of Score and skewness of Student-Respondent Workshop and Laboratory

X1	Average of Score	Skewness
Workshop	81.19	-0.229
Laboratory	96.64	0.393

Based on Table 5, the average score of the students' achievement is 81.19. It figures out that the workshop is appropriate enough and the skewness score is at -0.229, which figures out that it still needs improvement on

five indicators, including atmosphere, temperature, lighting, maintenance, and workstation, to create proper and adequate workshop that meets the main standards in developing good and adequate workshop also tools necessity or supportive building in the continuity of workshop and laboratory for the students in practicing. In creating a good workshop, there are six indicators that become the basic standard to refer to a good workshop, according to the Directorate of Vocational Education stated in a book entitled *Modernisasi Bengkel Laboratorium Abad 21*. Furthermore, according to the Regulation of the Minister of National Education No. 40 of 2008 on the standard of facilities and infrastructure for Vocational Secondary School/Vocational Madrasah Aliyah (SMK/ MAK), a school, especially Vocational High School (VHS), must provide adequate workshop or practice area so that it makes the students feel comfortable when they are practicing. A workshop is a place where the students are gaining professional vocation skills so that they are ready to work by exploiting their in-line skills with the competence in industrial and entrepreneurship world. In fact, workshops and laboratories on Vocational High School are the facilities and places that support the main teaching-learning activity in developing their skills. Ismara and Prianto (2017, pp. 206–207) claim that a workshop or laboratory is a place that supports the training activity and a place to elevate skills, in order to develop the comprehension and skills that suit the areas of expertise. It also has a function as a place that provides completeness of the theoretical learning that has been accepted so that both theory and practice are not two separate things, but integrated one another. Based on the data in Table 5, the workshop is being analyzed by using goal free evaluation model that the emerging weaknesses to achieve the main goal that is seen in this model. According to the students, the workshop still needs further improvement so that it can be a good and comfortable place for the students. The inadequacy of the workshop management implementation on Vocational High School has become the consideration in the future in order to meet the criteria as a good and comfortable workshop for the students in practicing that refers to the standard from the Directorate of Vocational Education and a workshop that becomes the replica of the industrial world.

Laboratory, based on the average score at 96.64, is considered appropriate enough. Skewness 0.393 figures out that the laboratory still needs further improvement on two indicators, which are practice area and temperature, to develop proper and adequate, in addition to the tools necessity or supportive building, which support the continuity of the laboratory for the students in practicing. There are six indicators of the appropriate laboratory that become the reference from the Directorate of Vocational Education, as stated on a book entitled *Modernisasi Bengkel Laboratorium Abad* 21 and the Regulation of the Minister of National Education No. 40 of 2008 on the standard of facilities and infrastructure for Vocational Secondary School/Vocational Madrasah Aliyah. A laboratory is a place where the students doing some experiments and improving their skills, in this case, is the theory that has been taught. The laboratory is also being designed in such a way to become a place where the students can improve their skills optimally that meet industrial needs. Martono et al. (2018, p. 60) define that vocational high school should conduct synchronization of their laboratory with the industrial condition, so that the students can practice by using suitable system that is used in the industry and it is expected that the competence of Vocational High School graduate is relevant with the industrial needs. Based on the data on Table 5 in which the workshop is being analyzed by using goal free evaluation model that the emerging weaknesses to achieve the main goal that is seen on this model. According to the students, the laboratory still needs further improvement so that it can be a good and comfortable place for the students.

Table 6. Table Average of Score and Skewness of Teacher–Respondent Workshop and Laboratory

X1	**Average of Score**	**Skewness**
Workshop	197.78	-0.433
Laboratory	209.03	0.36

Based on the result of the research in Table 6, in which the teacher as the respondent, the average score of the workshop at 197.78 is considered as appropriate enough, and skewness at -0.433 on both tools necessity or the supportive building for the teacher to teach the

students to practice their skill that covers six indicators that become the basic standard to refer a good workshop according to the Directorate of Vocational Education. A workshop is a place where the students gain professional vocation skills so that they are ready to work by exploiting their in-line skills with the competence in industrial and entrepreneurship world. The workshop, from the result above, if it is being analyzed by using goal free evaluation model that the emerging weaknesses to achieve the main goal that is seen on this model. According to data in Table 6, the workshop still has some weaknesses in order to meet the criteria of a good workshop as a place to improve not only the vocation skills but also to produce good quality goods which can be sold and become the students' provision to become an entrepreneur. Ghufron et al. (2018, p. 1) state that a workshop is not only just a place to conduct an experiment, but also a place to conduct serious tasks that have a real product. The inadequacy of the workshop management implementation on Vocational High School has become the consideration in the future in order to meet the criteria as a good and comfortable workshop for the teacher in teaching that refers to the standard form of the Directorate of Vocational Education and a workshop that become the replica of the industrial world.

Laboratory, based on the average score at 209.03, is considered as appropriate enough, and skewness at 0.36 still needs further improvement on three indicators, which are atmosphere, temperature, and workstation from the tools necessity or supportive building that support the continuity of the laboratory for the teacher in teaching. A good laboratory in this research has six indicators that refer to the criteria from the Directorate of Vocational Education. The role of a laboratory on Vocational High School is a place in which the teacher implements scientific teaching-learning activity with the students. Suyanta et al. (2018, p. 83) also define that laboratory is a place to conduct scientific research, experiment, measurement, or scientific training. The laboratory, based on the result, if it is analyzed by using a goal free evaluation model, the inadequacy that emerges to achieve the main purpose is the thing that is seen from the model. Based on Table 6, the laboratory is considered as appropriate enough, yet it still has some inadequacy, and it still needs further improvement to meet the criteria of good and comfortable laboratory for the teacher to implement teaching-learning activity. The inadequacy of the laboratory management implementation on Vocational High School has become the consideration in the future in order to meet the criteria as a good and comfortable workshop for the teacher in teaching that refers to the standard form of the Directorate of Vocational Education and a workshop that becomes the replica of the industrial world.

Table 7. Table Average of Score the Facilities and Infrastructure Suitability in Workshop and Laboratory

X1	**Average of Score**	**Skewness**
Workshop	250.20	0.549
Laboratory	252.80	-1.694

Based on the research result in Table 7, the average score at 250.20 is considered appropriate enough. Meanwhile, if it is seen from the skewness at 0.549, the suitability of facilities and infrastructure according the Directorate of Vocational Education still needs further improvement on nine standards, covering building standard, door standard, partition standard, hearing-comfort standard, vent and heat standard, disaster mitigation standard, energy efficiency standard, and additional facilities standard in developing good and proper workshop. In addition, not only the tools necessity, but also the supportive building that supports the workshop continuity for the teacher in teaching and the students in their practice covering 16 indicators that become the basic standard that should be noticed by the workshop and laboratory manager. A workshop is a place where the teacher implements the teaching-learning process, and the students are practicing to obtain professional vocation skills so that they are ready to work by exploiting their in-line skills with the competence in the industrial and entrepreneurship world. The workshop at three different Vocational High School (VHS) in Banggai district consists of 10 study programs. Based on the data, if it is being analyzed by using goal free evaluation model, it only focuses on the weaknesses, not the main purpose, that emerges when the program is being implemented. Based on the data in Table 7, those 10 study programs have a workshop

that still needs further improvements in developing a good and comfortable workshop to facilitate the teacher in teaching and the students to easily improve their vocation skills without any burden which can be emerged from the condition of the workshop.

Based on the research result in Table 7, the average score achievement at 252.80 of the suitability of the facilities and infrastructure in the laboratory, according to the Directorate of Vocational Education, is considered appropriate enough. Meanwhile, if it is seen from the skewness at 1.649, the laboratory is considered good, yet it still needs further improvement on eight out of 16 indicators which cover the building standard, partition standard, sight-comfort standard, energy efficiency standard and additional facilities standard. If it is seen in creating good and proper laboratory and the necessity of the tools, also the supportive building that support the workshop continuity for the teacher in implement teaching-learning activity and the students in their practice, there are 16 indicators that become the basic standard according to the Directorate of Vocational Education that should be noticed by the workshop and laboratory manager.

The laboratory facilities and infrastructure on Vocational High School have a role as a place that makes the teacher who implements the teaching-learning activity and the students who are practicing their skills obtain professional vocation skills so that they are ready to work by exploiting their in-line skill with the competence in industrial and entrepreneurship world. Susanto and Sudira (2016, p. 57) state it is important to have the practice facilities and infrastructure in order to build the students' competency in vocational education. The laboratory at three different Vocational High School (VHS) in Banggai district consists of five study programs. Based on the data, if it is being analyzed by using goal free evaluation model, it only focuses on the weaknesses, not the main purpose, that emerges when the program is being implemented. Based on the data skewness -1.694 in Table 7, those five study programs have a laboratory that still needs some improvements in order to meet the criteria of good and comfortable laboratory to facilitate the teacher in teaching and the students to easily improve their vocation skills without any burden which can be emerged from the condition of the laboratory.

CONCLUSION

Based on the result of the research and the discussion, the workshop on Vocational High School (VHS) in Banggai district, according to students as respondents, still needs further improvement on the practice area to create proper and adequate workshop that meets the main standards in developing good and comfortable in order to achieve the main goal of workshop itself. Meanwhile, according to the teacher–respondent, the workshop is already proper and good. The laboratory on VHS in Banggai district is considered appropriate enough, yet it still needs further improvement to create a proper and adequate workshop that meets the main standards in developing a good and comfortable workshop in order to achieve the main goal of the workshop itself. The laboratory on VHS in Banggai district still needs further improvement if it is seen from four indicators which are atmosphere, lighting, maintenance, and workstation from student-respondents. Meanwhile, the laboratory on VHS in Banggai district still needs further improvement if it is seen from three indicators, which are the practice area, lighting, and maintenance from teacher-respondent.

The suitability of workshop facilities and infrastructure on VHS in Banggai district that the suitability of the facilities and infrastructure from the entire 10 study programs on VHS in Banggai district still needs further improvement if it is seen from nine out of 16 indicators which are the building standard, door standard, partition standard, hearing-comfort standard, vent and heat standard, disaster mitigation standard, energy efficiency standard, and additional facilities standard.

The suitability of workshop facilities and infrastructure figure out, if it is seen from 16 indicators, that the suitability of the facilities and infrastructure from the entire five study programs on VHS in Banggai district still needs further improvement if it is seen from eight indicators, including building standard, partition standard, sight-comfort standard, disaster mitigation standard, tools and machine standard, energy efficiency standard, and additional facilities standard. The conditions become the implication for the entire school elements to continuously coordinate between the school manager in forming good workshop and laboratory that meets the standard according to

the Directorate of Vocational Education and the Regulation of the Minister of National Education No. 40 of 2008.

REFERENCES

Anindo, J., Mugambi, M. M., & Matula, P. D. (2016). Training equipment and acquisition of employable skills by trainees in public technical and vocational education and training institutions in Nairobi County, Kenya. *International Journal of Advanced Research in Education & Technology (IJARET)*, *3*(4), 103–110. Retrieved from http://ijaret.com/wp-content/themes/felicity/issues/vol3issue4/mugambi.pdf

Bakri, A., & Zakaria, I. H. (2018). Uplifting the function of maintenance management towards sustainable performance of laboratory and workshop in TVET institutions. *The Journal of Social Sciences Research*, *6*(Special Issue), 153–160. https://doi.org/10.32861/jssr.spi6.153.160

Baryamureeba, V., & Karukuza, W. (2014). The role of TVET in building regional economies. *International Journal of Vocational Education and Training*, *22*(1), 7–15. Retrieved from http://hdl.voced.edu.au/10707/430424

Benešová, A., & Tupa, J. (2017). Requirements for education and qualification of people in industry 4.0. *Procedia Manufacturing*, *11*, 2195–2202. https://doi.org/10.1016/J.PROMFG.2017.07.366

Durmus, A., & Dağlı, A. (2017). Integration of vocational schools to industry 4.0 by updating curriculum and programs+. *International Journal of Multidisciplinary Studies and Innovative Technologies*, *1*(1), 1–3. Retrieved from https://dergipark.org.tr/tr/download/article-file/372843

Dwiyanti, V., Ana, A., & Widianingsih, I. (2018). Industrial education impact on vocational student social skills. *Innovation of Vocational Technology Education*, *14*(2), 98–103. https://doi.org/10.17509/invotec.v14i2.14362

Egbri, J. N., & Chukwuedo, S. (2013). Re-engineering technical vocational education and training (TVET) in Nigeria through school-industry collaboration for capacity building. *Nigerian Vocational Association Journal*, *18*(1), 74–82.

Estriyanto, Y., Kersten, S., Pardjono, P., & Sofyan, H. (2017). The missing productive vocational high school teacher competency standard in the Indonesian education system. *Journal of Technical Education and Training*, *9*(1), 26–44. Retrieved from https://publisher.uthm.edu.my/ojs/index.php/JTET/article/view/1499

Fitriani, K. (2014). Pengaruh motivasi, prestasi belajar, status sosial ekonomi orang tua dan lingkungan sekolah terhadap minat melannjutkan pendidikan ke perguruan tinggi pada siswa kelas XII Akuntansi SMK Negeri 1 Kendal. *Economic Education Analysis Journal*, *3*(1), 152–159. Retrieved from https://journal.unnes.ac.id/sju/index.php/eeaj/article/view/4229

Ghufron, A., Suwarna, S., Sudiyatno, S., Sunarto, S., Andayani, S., Setiadi, B. R., & Ismara, I. (2018). *Modernisasi bengkel dan laboratorium kejuruan abad 21*. Jakarta: Directorate of Vocational Education, Directorate General of Primary an Secondary Education, Ministry of Education and Culture. Retrieved from http://psmk.kemdikbud.go.id/konten/4232/modernisasi-bengkel-dan-laboratorium-kejuruan-abad-21

Hadi, M. Y. A., Hassan, R., Razzaq, A. R. A., & Mustafa, M. Z. (2015). Application of thinking skills in career: A survey on technical and vocational education training (TVET) qualification semi-professional job duties. *Procedia - Social and Behavioral Sciences*, *211*, 1163–1170. https://doi.org/10.1016/J.SBSPRO.2015.11.155

Ismara, I., & Prianto, E. (2017). *Bagaimanakah agar laboratorium dan bengkel pendidikan vokasi menjadi nyaman, selamat dan sehat?* Yogyakarta: UNY Press. Retrieved from http://psmk.

kemdikbud.go.id/konten/2705/bagaimana-agar-laboratorium-dan-bengkel-pendidikan-vokasi-menjadi-nyaman-selamat-dan-sehat

Janis, I., & Alias, M. (2017). A systematic literature review: Human roles, competencies and skills in industry 4.0. In *Proceeding of Asia International Multidisciplinary Conference 2017* (pp. 1052–1072). Johor Bahru: Universiti Teknologi Malaysia. https://doi.org/10.15405/epsbs.2018.05.84

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

Lucas, B., Spencer, E., & Claxton, G. (2012). How to teach vocational education: A theory of vocational pedagogy. London: City & Guilds Centre for Skills Development. Retrieved from https://www.educationinnovations.org/sites/default/files/How-to-teach-vocational-education.pdf

Majumdar, S. (2012). Integrating sustainable development in TVET curriculum. In *The 11th UNESCO-APEID International Conference* (pp. 1–14). Bangkok: UNESCO Bangkok. Retrieved from https://www.voced.edu.au/content/ngv%3A54369

Martono, T., Saputro, H., Wahyono, B., Laksono, P. W., & Isnantyo, F. D. (2018). *Optimalisasi kompetensi lulusan SMK dalam industri/teknologi terapan*. Jakarta: Directorate of Vocational Education, Directorate General of Primary an Secondary Education, Ministry of Education and Culture. Retrieved from http://psmk.kemdikbud.go.id/konten/4121/optimalisasi-kompetensi-lulusan-smk-dalam-industri-teknologi-terapan

Oviawe, J. I., Uwameiye, R., & Uddin, P. S. O. (2017). Bridging skill gap to meet technical, vocational education and training school-workplace collaboration in the 21st century. *International Journal of Vocational Education and Training Research*, *3*(1), 7–14. https://doi.org/10.11648/j.ijvetr.20170301.12

Regulation of the Minister of Education and Culture No. 34 of 2018 on the national standard of education in vocational secondary school (2018). Republic of Indonesia. Retrieved from http://www.smkn3bandung.sch.id/wp-content/uploads/2018/12/Permen-34-Tahun-2018-Websiteedukasi.com-1.pdf

Regulation of the Minister of National Education No. 40 of 2008 on the standard of facilities and infrastructure for Vocational Secondary School/ Vocational Madrasah Aliyah (2008). Republic of Indonesia.

Sajidan, S., Baedhowi, B., Triyanto, T., Totalia, S. A., & Masykuri, M. (2018). *Peningkatan proses pembelajaran dan penilaian pembelajaran abad 21 dalam meningkatkan kualitas pembelajaran SMK*. Jakarta: Directorate of Vocational Education, Directorate General of Primary an Secondary Education, Ministry of Education and Culture.

Samani, M. (2018). Vocational education in the era of Industry 4.0: An Indonesia sase. In *Proceedings of the International Conference on Indonesian Technical Vocational Education and Association (APTEKINDO 2018)* (pp. 45–47). Paris, France: Atlantis Press. https://doi.org/10.2991/aptekindo-18.2018.10

Sharipova, N., & Wesseler, M. (2018). Strengthening the innovative potential of project-based learning for TVET: The USPECH experience. In *Technical and Vocational Education and Training* (Vol. 28, pp. 27–42). Springer Nature. https://doi.org/10.1007/978-3-319-73093-6_3

Slamet, S. (2010). Identifikasi sarana prasarana dan kondisi peralatan praktik mekanik otomotif SMK swasta di daerah polisi wilayah Bojonegoro dan Madiun. *Teknologi Dan Kejuruan: Jurnal Teknologi, Kejuruan Dan Pengajarannya*, *33*(1), 107–120. https://doi.org/10.17977/TK.V33I1.3092

Susanto, R., & Sudira, P. (2016). Evaluasi sarana dan prasarana praktik teknik komputer dan jaringan di SMK Kabupaten Sukoharjo. *Jurnal Pendidikan Vokasi*, *6*(1), 54–65. https://doi.org/10.21831/jpv.v6i1.8115

Suyanta, S., Darmono, D., Prianto, E., Subiantoro, A. W., Dwandaru, W. S. B., Marwati, M., … Syauqi, K. (2018). *Desain pengembangan fasilitas sekolah di era Revolusi Industri 4.0*. Jakarta: Direktorat Pembinaan SMK. Retrieved from http://psmk.kemdikbud.go.id/epub/reader/4123/desain-pengembangan-fasilitas-sekolah-di-era-revolusi-industri-40

Syafrudie, H. A. (2016). Sarana praktikum sebagai lingkungan belajar yang menumbuhkan orientasi pemilihan pekerjaan siswa SMK. *Teknologi Dan Kejuruan: Jurnal Teknologi, Kejuruan Dan Pengajarannya*, *39*(2), 163–170. https://doi.org/10.17977/TK.V39I2.7790

Wijanarka, B. S. (2011). Conventional to virtual laboratory in vocational education. In *Proceedings of International Conference on Vocational Education and Training (ICVET) 2011* (pp. 187–190). Yogyakarta: Yogyakarta State University. Retrieved from http://staffnew.uny.ac.id/upload/131808327/penelitian/Proceeding+ICVET+2011.pdf

Yasin, R. M., Nordin, N. M., Rahim, M. B., & Yunus, F. A. N. (2014). Vocational education readiness in Malaysia on the use of e-portfolios. *Journal of Technical Education and Training*, *6*(11), 57–71. Retrieved from https://publisher.uthm.edu.my/ojs/index.php/JTET/article/view/886/577

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (185-196)
Online: http://journal.uny.ac.id/index.php/jpv

MAKSI FOR ICT-BASED ACCOUNTING LEARNING AT VOCATIONAL HIGH SCHOOLS

Vivi Pratiwi
Universitas Negeri Surabaya

Moh. Danang Bahtiar
Universitas Negeri Surabaya

Han Tantri Hardini
Universitas Negeri Surabaya

Abstract

This study aims to produce ICT-based learning media for Vocational High Schools (VHS) in the form of ICT-based accounting multimedia application, named "Multimedia Akuntansi" (MAKSI) on bank reconciliation material. The development of learning media is done because of the limited number of innovative learning media available for VHS students, especially in the accounting field. The condition is influential on the students' low level of understanding. This research was research and development using the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. The use of the ADDIE model is because the model is flexible, so it can be used for learning instrument development. At each phase of development, evaluation and revision were conducted so that the resulting product became a valid and reliable product. This development resulted in MAKSI proven to be suitable for use in accounting learning. The feasibility of MAKSI was evaluated from the average score of product feasibility validation from the material expert by 87%, from the media expert of 96%, and the result of the students' evaluation by 88.7%. MAKSI can help the learning process more enjoyable so that the media is interesting and proven to improve students' understanding significantly. MAKSI can be a complement, alternative, and variation of learning media in VHS. This product can be operated via laptops/computers as well as smartphones through free downloads in Play Store. The utilization of MAKSI is in accordance with the curriculum demand on the utilization of ICT in the learning process to support independent and student-centered learning.

Keywords: *learning media, ICT, multimedia, vocational high school, accounting learning, accounting multimedia application*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.26013*

Contact Vivi Pratiwi
vivipratiwi@unesa.ac.id
Department of Accounting Education, Faculty of Economy, Universitas Negeri Surabaya
Jl. Ketintang No. 2, Ketintang, Kec. Gayungan, Kota Surabaya, Jawa Timur 60231, Indonesia

INTRODUCTION

Currently, the use of Information and Communication Technologies (ICT) is deeply embedded in everyday activities and touches many areas of life, such as work-field, recreation, and learning (Yuen, Fox, Sun, & Deng, 2009). The development of ICT usage is evident from the increasing number of internet users as technology develops (Dong, Chang, & Fan, 2017). The impact of ICT advancement is the development of various technologies and supporting applications to facilitate human life activities, including learning activities in education. The success of learning depends heavily on the accuracy of teachers in utilizing technology to fit the learning objectives and particularly on creating meaningful learning for students (Wankel & Blessinger, 2013). Thus, it is necessary to design learning by using technology to maximize student learning activities.

The use of ICT in education is suggested as it can make learning more relevant and effective (Kang, Kim, & Heo, 2011; Pate, 2016). The utilization of ICT in education has received much attention in the educational literature as a medium of learning and a strategy to address global challenges and provide a hands-on learning experience for students (Dawson, Heathcote, & Poole, 2010). Learning media is a means or educational tool that can be used as an intermediary in the learning process to enhance effectiveness and efficiency in achieving learning objectives (Sanaky, 2013). In addition, learning media can provide variation in learning that is focused on not only teacher explanations, but opportunities for learning activities that enable students to be active in learning. Therefore, media can help teachers and students actively engage in two-way communication (Indriastoro & Rofiq, 2014, p. 210). The use of technology in some media can support collaborative activities between teachers and students so that students can be more active and interactive in the learning process (Pratiwi, Siswandari, & Santosa, 2018, p. 153; Susanti, Murtini, & Harini, 2018, p. 303).

The benefits of ICT in education have influenced many countries to apply it in education to address global challenges (Buabeng-Andoh, 2015), including Vocational High Schools (VHS or *Sekolah Menengah Kejuruan* (SMK)) in Indonesia. VHS is a secondary education that prepares students primarily to work in a particular field. Learning in VHS is a combination of theory and practice from the departments the students choose. These areas of expertise must be deeply understood by the students. One department available in VHS is accounting. However, so far, the availability of media used to help the process of learning and understanding of students in VHS is still limited. Textbooks that support the subject of expertise are not too much found. Learning becomes focused on teacher explanations, so students cannot learn independently, whereas the curriculum requires creative, innovative, fun, and student-centered rather than teacher-centered learning. Moreover, the Directorate of Vocational High School Development (*Direktorat Pembinaan SMK*) continues to work hard to socialize the use of the internet for VHS through education and training, workshops for teachers and provision of infrastructure, so that the use of the internet is expected to be widely used in the field of education, especially in VHS (Arnanto & Triyono, 2014, p. 320).

These conditions affect the students' low level of understanding and learning outcomes. Without the proper use of instructional media, students' knowledge will be more abstract. They only know that without understanding the material taught (Arsyad, 2013). The selection and design of appropriate learning media can improve students' ability to understand difficult principles, concepts, and procedures in accounting (Sithole, 2017). The demands and availability of existing technology should also be taken into consideration in designing appropriate learning for students. Thus, one of the proper ways to improve students' understanding is using innovative ICT-assisted learning (Butler & Reddy, 2010). One of the various ICT-based learning media is an interactive multimedia application that can be used as an easy-to-understand learning alternative for students (Adedokun-Shittu & Shittu, 2015; Trieb, 2016).

Multimedia has the potential to be used in many situations, such as showing the process in action or increasing the opportunity for students to interact with learning materials which are set realistically according to real conditions (Oud, 2009). Moreover, multimedia is a combination of several learning media that combine text, graphics, sound, animation, and video that together display information as a whole (Kulasekara, Jayatilleke, & Coomaraswamy,

2008). If multimedia is designed in an integrated, purposeful, and meaningful way in a particular material context, it can be a powerful medium for increasing student engagement in learning. Multimedia provides opportunities for active student-centered learning, in which students can choose the relevant words and images that can change their learning styles (Piyayodilokchai, Panjaburee, Laosinchai, Ketpichainarong, & Ruenwongsa, 2013).

Based on these conditions, it is necessary to develop accounting learning media in the form of accounting multimedia, which is a combination of various forms of technology-based learning media to support the learning process by emphasizing the process of solving problems scientifically. The material used as the content of ICT-based accounting multimedia application is bank reconciliation. The material was chosen because students stated that the bank reconciliation material was difficult to understand. The development of this media is expected to make students motivated to seek information and communicate actively so they can conclude the material they learn by themselves. Multimedia is an appropriate tool, enables students to engage in learning actively, facilitates them in learning, as well as enables them to make decisions or take active action involving them in the learning process (Arenas-Márquez, Machuca, & Medina-López, 2012). The use of multimedia in learning will make students more interested in participating in the teaching and learning process because the material contained in multimedia learning is made as attractive as possible and inserted with animations that support the material (Admadja & Marpanaji, 2016, p. 175). Therefore, this study aims to produce ICT-based learning media for VHS in the form of ICT-based accounting multimedia application (MAKSI) on bank reconciliation material.

RESEARCH METHOD

This research is research and development in education. Research and development is a research method used to develop or validate products used in education and learning (Gall, Gall, & Borg, 2003). The development model used in this research is the ADDIE model consisting of five phases: *Analysis, Design, Develop, Implementation,* and *Evaluation* developed by Reiser and Mollenda (Pribadi, 2010, p. 115). The researchers employed the model because the model is general and flexible, so it can be used for learning instrument development. At each phase of development, evaluation and revision were conducted so that the resulting product became valid and reliable.

The development of ICT-based accounting multimedia (MAKSI) on bank reconciliation material is a series of processes undertaken to develop a new product in instructional media based on the existing development theory. In this research, the developed product and its feasibility were tested based on the validation of the experts and the students. In addition to developing and validating learning media, this research also aims to solve learning problems and find the knowledge that can be used as practical solutions. The outcomes of this research are expected to be ICT-based learning media solution that is used not only by the target schools but also by those all over Indonesia through application downloads in the Android Play Store. The research and development procedure of MAKSI is illustrated in Figure 1.

Analysis Phase

The analysis phase begins with information-gathering activity and learning problem identification to serve as a basis for developing new products. This phase includes the implementation of performance and needs analyses used to formulate learning objectives. Performance analysis aims to define the circumstances occurring in the field and to clarify what performance problems are encountered. At this phase, an observation is made to identify the gap between the current learning conditions and the desired learning conditions related to the students' understanding of the learning materials. The observations were conducted at SMK Negeri 1 Surabaya, Indonesia, a vocational high school that has an accounting department. Based on the results of the performance analysis, needs analysis was then conducted for product development. At this phase, an analysis of the material was carried out in the development of the bank reconciliation material. Then, the researchers determined the learning objectives based on the results of needs analysis.

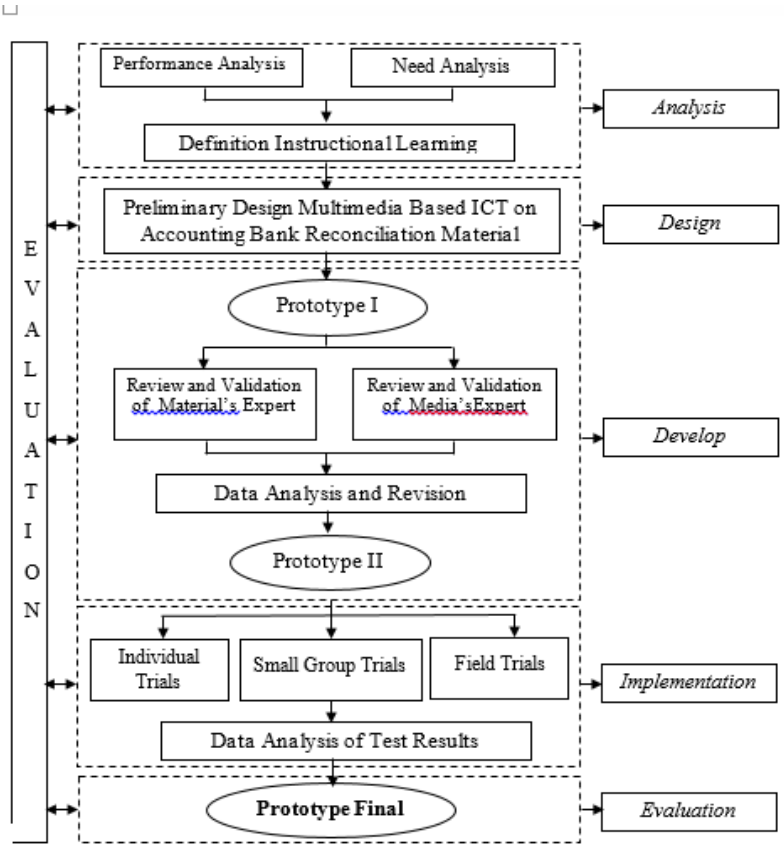


Figure 1. Development Framework Model of MAKSI

Design Phase

Design phase is done to facilitate the design of products to be developed in the form of a solution to the problem that has been described in the analysis phase, which consists of pre-production and storyboard preparation phases. Pre-production activities begin with designing the contents of the developed product that is the material and presentation appropriate to the learning objectives. Then, the concept of the developed accounting multimedia is set up. The components needed in the development are also prepared in this phase, such as creating animated figures in accounting multimedia, background design, preparing audio, and other visual and audio components needed for product development. MAKSI was created using Adobe Flash Professional software. The next step is making the learning media storyboard in the form of a product development program script.

Development Phase

The development phase is the realization of the development plan in the designing phase that aims to produce product development whose validity, feasibility, and effectiveness furthermore need to be tested This phase consists of production activities as well as product review and validation. Production activities were based on a storyboard that has been created at the design phase so as to produce the initial product of MAKSI (Prototype I). Next, Prototype I was validated by the experts, consisting of material and media experts. From the results of experts' validations, opinions, and suggestions for improvement of product development were obtained. The next revision of Prototype I was in accordance with the opinions and suggestions of improvement from the experts. The revised Prototype I was then revalidated by the expert to provide a media feasibility assessment. This phase resulted in MAKSI ready for trials (Prototype II).

Implementation Phase

This phase is a pilot phase, in which MAKSI product that has been reviewed and validated (Prototype II) was tested on the individual, small group, and field trials. The

trial was conducted on the eleventh students of the accounting department in SMK Negeri 1 Surabaya, Indonesia. The population in this study was all eleventh students of the accounting department in SMK Negeri 1 Surabaya amounted to 252 people divided into six classes. The sampling technique in selecting the class used in individual, small group and field trials was simple random sampling because all students in the population received the same material with the same methods, learning media, and curriculum so that the population is considered homogeneous.

The individual trial was conducted on three selected students with high, medium, and low ability so that they can be viewed as representative samples. This trial was conducted to obtain evidence of the initial product (Prototype II) feasibility on a limited basis emphasizing the suggestions and feedback on the product from the students as the users to be taken into consideration in revising the product. The revised Prototype II was based on the experts' opinions and suggestions, and three students proceeded to the small group trial phase. At this phase, the product was tested on a small group of students consisting of ten not included in the individual trial. This trial aims to obtain product feasibility data from the students as users. Based on the results of the trial, the ICT-based accounting multimedia was appropriate for use in the field test for product effectiveness test. The field test is a test conducted in the field with a minimum sample size of 30 people. Therefore, a well-tested Prototype II of small group trial results was tested on 40 students to determine the effectiveness of the developed products. The effectiveness test of the product use was done by giving pre-test and post-test in the form of an essay test about bank reconciliation material.

Evaluation Phase

This phase aims to assess whether the product developed in accordance with expectations or not. In the ADDIE development model, the evaluation phase is not only at the end of the development but also at each phase. The evaluation is needed for revision needs or formative evaluation. From the evaluation phase, it was found that the final product of ICT-based accounting multimedia tested was feasible and ready to be used in the accounting learning process on bank reconciliation material.

The types of data obtained in this research are qualitative and quantitative data. The data collection techniques used in this research are observation, interview, questionnaire, and test. The form of the test used in this study is the test of learning outcome in the form of an essay test which is aimed at revealing the data of students' understanding of bank reconciliation material. MAKSI is considered feasible if the average result of all aspects in the expert validation questionnaire and the students' assessment gets a percentage of $\geq 61\%$ to obtain a feasible or very feasible interpretation (Riduwan, 2013). Pre-test and post-test results were calculated using a t-test to determine whether there was an increase in the students' scores after using MAKSI.

RESULTS AND DISCUSSION

The results of MAKSI development research on bank reconciliation material were based on the development process, feasibility, and effectiveness of the media through five phases of the ADDIE model, namely: *Analysis, Design, Development, Implementation,* and *Evaluation* phase. The results of the study can be explained as follows:

Analysis Phase

From the analysis phase, it was obtained that the appropriate school for the research was SMK Negeri 1 Surabaya, which is the best vocational high school in Surabaya, Indonesia, and has an accounting department. The school already has enough facilities in the form of a computer lab, free-wifi, and LCD-projector provided in each class. With such conditions, ICT-based learning is feasible because the facilities are adequate. Then, the observation and interview with students about the condition of perceived learning were conducted. The students said that one of the difficult accounting materials was bank reconciliation material. It was found that the students had difficulties in understanding the terms of the bank reconciliation because they were only given knowledge of the theories, which led to the differences in bank reconciliation. It made them just memorizing without really understanding where the differences in bank reconciliation that should be recorded in the company report or bank

statements are from. They also expressed the need for the development of instructional media used. They felt that the learning was monotonous and boring because almost all subjects only used textbooks and sometimes only relied on the teachers' explanations.

Based on the results of the above performance analysis, it indicates that there are problems in learning accounting, especially on bank reconciliation material. The problem lay in the limited learning media used in accounting learning so that the students' understanding of bank reconciliation material was still low. The selection of instructional media in the form of textbooks had not been optimal because the school facilities are complete, and ICT-based facilities are available. It also made the students get tired and feel that learning is not so interesting that they tend to be passive, and the learning is teacher-centered. In addition, the demands of the curriculum and the development of the era associated with the use of ICT in the learning process need to be considered. With these conditions, it is necessary to improve accounting learning with the selection of appropriate learning media to improve students' understanding by utilizing ICT.

The development of ICT-based learning media is a form of ICT utilization in learning. One of ICT-based learning media is interactive multimedia that can be used in on-line/off-line learning. Multimedia provides many benefits in learning. It makes the material closer to real conditions (Oud, 2009); it creates active, student-centered learning (Piyayodilokchai et al., 2013), fun, and also exciting learning (Téllez, 2008); and improves students' understanding in accounting learning (Sithole, 2017). Therefore, ICT-based multimedia is an appropriate learning medium to be developed based on the problems encountered.

Design Phase

The product was designed with the concept of responsive design, meaning that the developed accounting multimedia display fits in various media, such as smartphones, computers, and laptops. The application used for making the product was Adobe Flash Professional, so that the output file format is adapted to the media used. For Android-based mobile phones (smartphones), it uses .apk format so it can be downloaded in the Android Play Store. For computers and laptops, the format is .swf. Thus, the developed product was accessible either by teachers or students according to the devices they have. Then the presentation of ICT-based accounting multimedia as outlined in the storyboard in the form of a script program was made. The program script consists of the content displayed in each scene consisting of the opening, content, and closing sections. Furthermore, the making of animated characters in multimedia accounting, background design, music accompaniment (audio), and other visual and audio components is also prepared at this stage. In the end, the name of the product was developed, namely ICT-Based Accounting Multimedia (MAKSI).

Development Phase

Development phase consists of production activities as well as a product review and validation activities. Production activities were done based on the program script (storyboard) previously made. This production activity produced the initial product of MAKSI (Prototype I) presented in Figure 2.

The Prototype I was reviewed and validated by the experts of materials and media. The validation resulted in suggestions and also feedbacks consisting of: (1) back sound variation, (2) the addition of the narrative material, (3) the arrangement of the narrator and back sound volume so as not to collide, (4) the clarification of the instructions for use in each section. Based on these suggestions, improvements were made to produce a revised Prototype I and then validated by the experts. Material expert validation results are depicted in Figure 3.

Figure 3 shows that the accuracy of MAKSI is 90% of feasibility, which means that MAKSI has clearly defined learning objectives and materials. Similarly, the aspect of interest shows the percentage of the feasibility of 90%, which means that the concept developed in ICT-based accounting multimedia allows students to understand bank reconciliation material. The completeness aspect obtains a 90% of feasibility, which means that the bank reconciliation material contained in MAKSI is presented in an actual, complete, logical, clear, and coherent manner. The material delivered is also packaged in an interesting and related to the knowledge that students have so that the aspect of attention obtains a percentage of the feasibility of 90%. MAKSI also has good con-

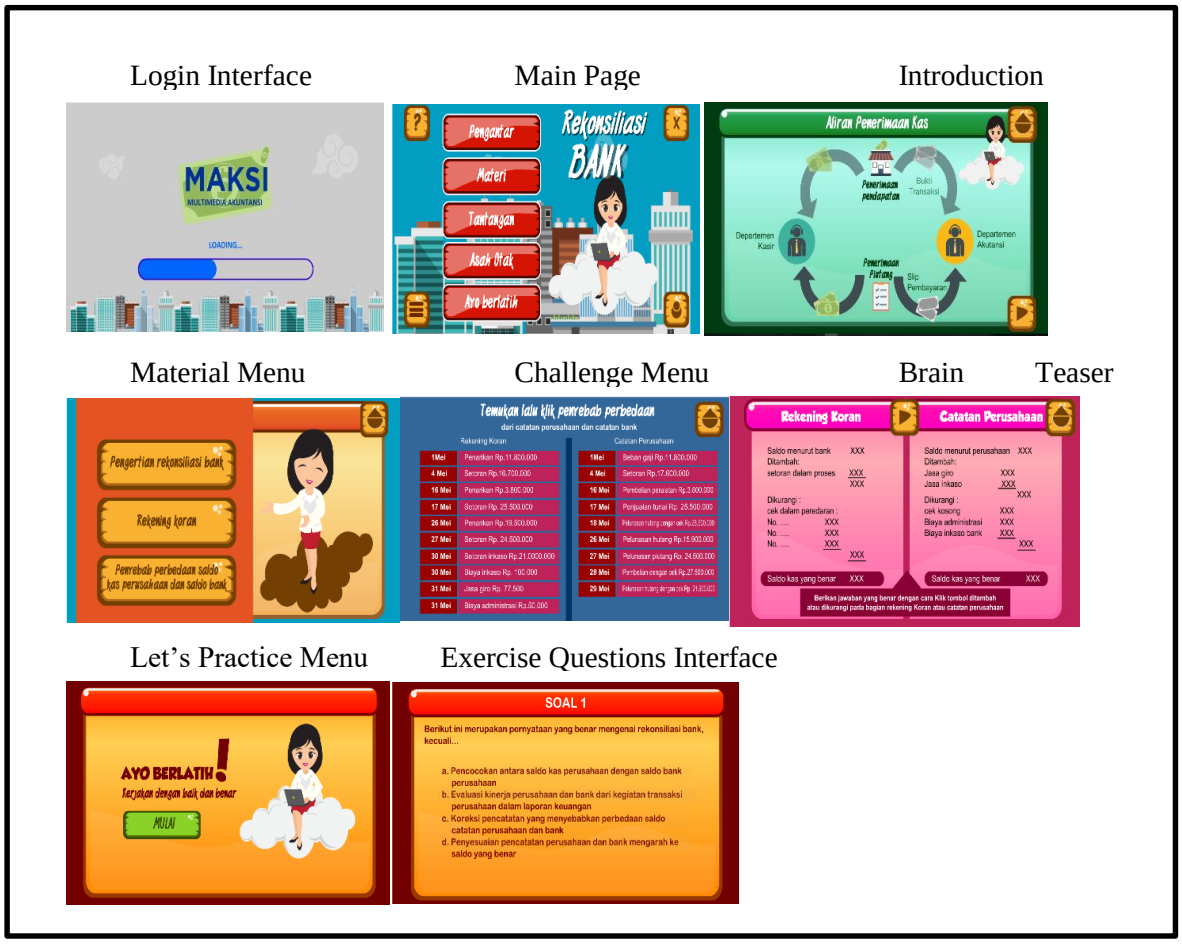


Figure 2. MAKSI Features and Interface

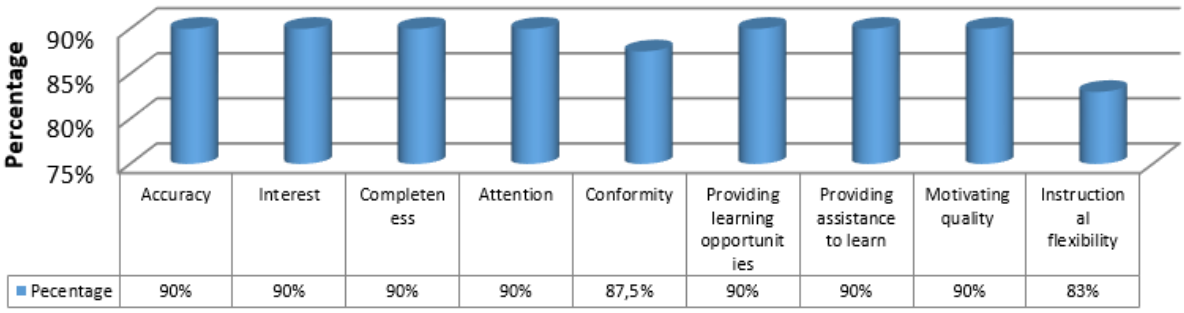


Figure 3. Feasibilty of MAKSI from Material

formity so as to obtain the percentage of the feasibility of 87.5%. On the aspect of providing learning opportunities, the feasibility is 90%, which means that MAKSI was also proven to provide learning opportunities for students to develop knowledge independently and equipped with simulation on bank reconciliation exercises. MAKSI provides solutions and assistance to improve students' understanding because the design and illustrations used to make it easier for students to learn bank reconciliation material so that the aspect of providing assistance to learn gets a 90% percentage of feasibility. Then the aspect of motivating quality gets 83% feasibility percentage which means that the presentation of material concept in MAKSI cultivates students' curiosity, creativity, liveliness, and learning motivation. It is evident from the change in the students' attitudes when using MAKSI to be more active in asking questions and more diligent when working on questions and exercises provided. The bank re-

conciliation material presented in MAKSI can also be reused in the next school year so that the instructional flexibility aspect gets an 80% percentage of feasibility.

Based on the validation score from those some aspects, it was obtained the average score of MAKSI feasibility by the material expert is 87%, which is included in the category of "Very Eligible". Thus, it can be concluded that in terms of material conformity, MAKSI is very suitable to be used as a medium of learning on bank reconciliation material. Then, the validation of media experts to the feasibility of MAKSI can be described in Figure 4.

The percentage of the readability aspect is 100%, which means that the selection of letters, models, sizes, colors, the layout of text, and the use of language is appropriate so that it can be read very well by the users. MAKSI is also very easy to use, evident from the feasibility percentage in the aspect of ease of use of 100%. MAKSI is easy to use because it provides instructions for the use of media and can run on a variety of hardware specifications, laptops/computers, and android-based smartphones. MAKSI is also packed with an eye-catching look on each page by considering color and background alignment, text and image layout, music illustrations and sound effects, and the use of animations that are appealing and tailored to the students' age. Therefore, the aspect of display quality obtains a feasibility percentage of 95%. MAKSI program quality obtains a percentage of the feasibility of 100%, which means the selection of media and applications developed is appropriate and in accordance with the times. MAKSI file is not large and simple in operation so that it is effective and efficient to develop and use the availability of navigation, clear instructions, and feedbacks for the users in every menu contained in MAKSI also maximize the quality of the developed media. Based on the results of the validation of media experts on the four aspects above, MAKSI obtains an average percentage of 96%. It can be concluded that the development of MAKSI is very feasible to be used as an ICT-based accounting learning media.

Implementation Phase

After obtaining validation from material and media experts, the product was tested to find out the students' opinions and assessments as MAKSI users. From the product testing on the individual trial conducted on three students, it was suggested that the number of questions provided on the *let's practice!* menu should be increased. Based on these suggestions, there were additional questions, as many as 20 multiple-choice questions greater than the initial questions of ten multiple-choice questions. Then, the small-group trial was conducted on ten students to find out the feasibility of ICT-based accounting multimedia from the students as the users. They were asked to try to use ICT-based accounting multimedia then fill out student assessment questionnaires. MAKSI feasibility assessment from the students as the users can be described in Figure 5.

Based on the students' assessment of MAKSI, the average percentage of feasibility is 88.7%, which indicates that three aspects assessed in MAKSI, i.e., the quality of content and objectives, instructional quality, and technical quality, get excellent responses from the students. According to the students' opinions, the presentation of bank reconciliation material in MAKSI is good and complete in accordance with the material contained in textbooks that they normally use. The material contained in MAKSI is also in accordance with the learning objectives of the financial accounting subject.

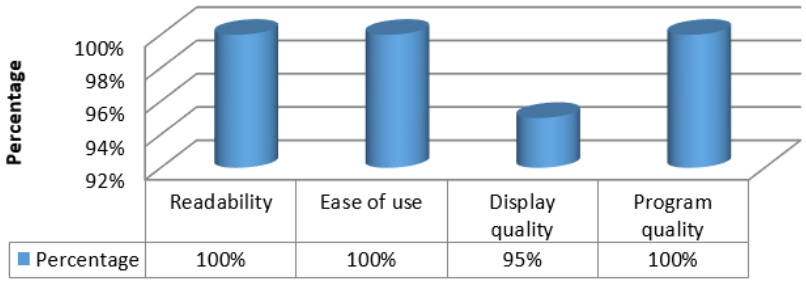


Figure 4. Feasibilty of MAKSI from Media Expert

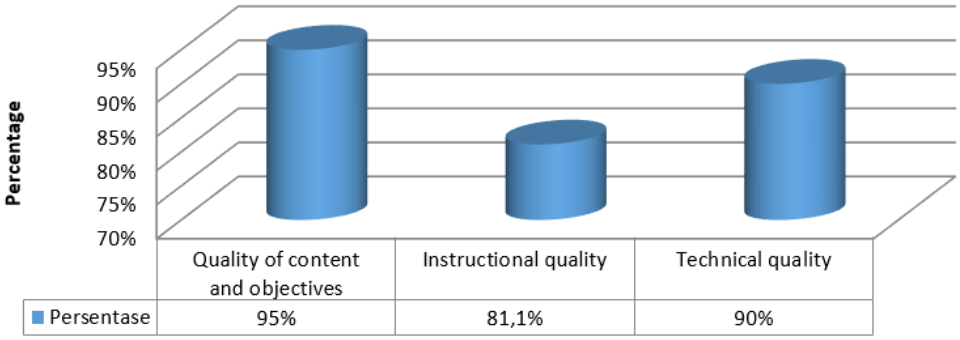


Figure 5. Feasibilty of MAKSI from Students' Assesment

Therefore, the feasibility of content and objective quality aspect is 95%. The students thought that the use of MAKSI did not interfere with learning and even made them learn more and understand the bank reconciliation material more deeply. The use of MAKSI made learning more enjoyable so that students paid more attention to the lesson. Although they felt that they would not often use MAKSI because the material is still limited to bank reconciliation, the students thought that many people would learn faster with the help of MAKSI. Therefore, the aspect of instructional quality obtained a feasibility percentage of 81.1%. In the technical aspect, the percentage of feasibility is 90%. Students felt the language used was appropriate so that they more easily understood the material after learning with MAKSI.

A further field trial was conducted to determine the effectiveness of ICT-based accounting multimedia to improve students' understanding of bank reconciliation material. The test was performed on 40 students by giving pre-test and post-test. The differences in the students' understanding were analyzed using the t-test. The test results are presented in Table 1, which indicates that there are significant differences in students' understanding between pre-test and post-test (p = .000).

Table 1. Pre-test and Post-test Score

	n	Mean	sd	df	t	p
Pre-test	40	52.18	9.235	39	15.382	.000
Post-test	40	76.23	12.624			

Source: The data process in 2018

Based on Table 1, it can be seen that the significance value of the t-test is 0.00. The significance value is smaller than 0.05 (0.00 <0.05), so that it can be stated that there is a difference between students' understanding before and after using MAKSI. These results indicate that in general, after using MAKSI, learning can increase students' understanding (Pratiwi et al., 2018, p. 151).

Evaluation Phase

The results of the overall validation score analysis obtains a score of 90.6%. It indicates that the MAKSI on bank reconciliation material is considered very feasible to be used in learning with average material expert validation of 87%. The average validation from the media expert is 96%, and the student's average assessment is 88.7%. Thus, it was found that the use of MAKSI can help the learning process to become more fun and improve students' understanding because it is easy to use and interesting for students. MAKSI has complete features/menu ranging from introductory material, core material, simulation, and practice questions that can be operated on laptops/ computers and smartphones. The use of this medium was also able to make students more active and curious so that they were motivated to learn independently. The test results also show that after using MAKSI, the students' understanding increases. This is evidenced by the increase in the average students' test scores from 52.18 (pre-test) to 76.23 (post-test).

The results of this discussion indicate that multimedia applications and practical experience can deepen students' abilities and knowledge and increase student motivation (Adedokun-Shittu & Shittu, 2015, p. 191; Nickchen & Mertsching, 2016, p. 482; Scott & Cong, 2010, p. 280; Trieb, 2016, p. 310; Wankel & Blessinger, 2013, p. 7). Students' understanding can also be developed by using

innovative, interesting, and fun learning with the help of ICT (Butler & Reddy, 2010, p. 772; Lindberg, Olofsson, & Fransson, 2017, p. 126; Zweekhorst & Maas, 2015, p. 15). In addition, the opinion of Riduwan (2013, p. 89) states MAKSI in the material of bank reconciliation can be said to be feasible if the average percentage of questionnaires validated by material experts and media experts as well as student evaluations averaged 61%. Based on the results of the research and the data obtained in the field, it can be stated that MAKSI is proven to be very feasible to use in accounting learning. Therefore, MAKSI is expected to be a fun alternative learning media and to improve students' understanding.

CONCLUSION

This research and development resulted in the form of ICT-based accounting multimedia (MAKSI) on bank reconciliation material suitable for use in accounting learning in vocational high schools. The development process conforms to the ADDIE development model through five stages of development consisting of analysis, designing, development, implementation, and evaluation stage. Based on the validation of material and media experts, ICT-based accounting multimedia on bank reconciliation material is very feasible to be used as a medium of learning with the average validation score from the material experts by 87% and the average validation score from the media expert of 96%. In respect to the result of the assessment of students as the users, ICT-based accounting multimedia on bank reconciliation material is very feasible to use as a medium of learning indicated by the average percentage of students' assessment of 88.7%.

The utilization of MAKSI in learning can increase the average students' score. Before using ICT-based accounting multimedia (pretest), the average score was 52.18, and after using ICT-based multimedia accounting (posttest), the score increased to 76.23. Hence, it can be concluded that the average score after using ICT-based accounting multimedia (post-test) is better than that before using the application. The results are consistent with those of Trieb (2016), Adedokun-Shittu and Shittu (2015), and Sithole (2017) studies which stated that a multimedia is a tool that enables students to engage in learning actively, facilitates learning, and enables them to make decisions or take active action involving them in the learning process. Multimedia applications and practical experience can deepen the students' ability and understanding, as well as increase their motivation (Butler & Reddy, 2010; Nickchen & Mertsching, 2016).

REFERENCES

Adedokun-Shittu, N. A., & Shittu, A. J. K. (2015). Assessing the impacts of ICT deployment in teaching and learning in higher education: Using ICT impact assessment model. *Journal of Applied Research in Higher Education*, *7*(2), 180–193. https://doi.org/10.1108/JARHE-02-2013-0012

Admadja, I. P., & Marpanaji, E. (2016). Pengembangan multimedia pembelajaran praktik individu instrumen pokok dasar siswa SMK di bidang keahlian karawitan. *Jurnal Pendidikan Vokasi*, *6*(2), 173–183. https://doi.org/10.21831/jpv.v6i2.8107

Arenas-Márquez, F. J., Machuca, J. A. D., & Medina-López, C. (2012). Interactive learning in operations management higher education. *International Journal of Operations & Production Management*, *32*(12), 1395–1426. https://doi.org/10.1108/01443571211284160

Arnanto, G. C., & Triyono, M. B. (2014). Keefektifan pembelajaran berbantuan internet di SMK se-Kota Yogyakarta kompetensi keahlian teknik komputer dan jaringan. *Jurnal Pendidikan Vokasi*, *4*(3), 318–332. https://doi.org/10.21831/jpv.v4i3.2557

Arsyad, A. (2013). *Media pembelajaran*. Jakarta: PT. Raja Grafindo Persada.

Buabeng-Andoh, C. (2015). ICT usage in Ghanaian secondary schools: Teachers' perspectives. *International Journal of Information and Learning Technology*, *32*(5), 1–15. https://doi.org/10.1108/IJILT-09-2015-0022

Butler, M. J. R., & Reddy, P. (2010). Developing critical understanding in HRM students. *Journal of European*

Industrial Training, *34*(8/9), 772–789. https://doi.org/10.1108/03090591011080968

Dawson, S., Heathcote, L., & Poole, G. (2010). Harnessing ICT potential. *International Journal of Educational Management*, *24*(2), 116–128. https://doi.org/10.1108/09513541011020936

Dong, X., Chang, Y., & Fan, X. (2017). Effects of the characteristics of online multimedia synergy on consumers' message acceptance and message response. *Online Information Review*, *41*(5), 710–727. https://doi.org/10.1108/OIR-11-2016-0328

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research*. Boston, MA: Pearson Education.

Indriastoro, H. A. K., & Rofiq, Z. (2014). Pengembangan multimedia pembelajaran pada standar kompetensi memperbarui halaman web di SMK. *Jurnal Pendidikan Vokasi*, *4*(2), 208–221. https://doi.org/10.21831/jpv.v4i2.2546

Kang, M., Kim, M., & Heo, H. (2011). The impact of ICT use on new millennium learners' educational performance. *Interactive Technology and Smart Education*, *8*(1), 18–27. https://doi.org/10.1108/17415651111125487

Kulasekara, G. U., Jayatilleke, B. G., & Coomaraswamy, U. (2008). Designing interface for interactive multimedia: Learner perceptions on the design features. *Asian Association of Open Universities Journal*, *3*(2), 83–98. https://doi.org/10.1108/AAOUJ-03-02-2008-B002

Lindberg, O. J., Olofsson, A. D., & Fransson, G. (2017). Same but different? An examination of Swedish upper secondary school teachers' and students' views and use of ICT in education. *International Journal of Information and Learning Technology*, *34*(2), 122–132. https://doi.org/10.1108/IJILT-09-2016-0043

Nickchen, D., & Mertsching, B. (2016). Combining mathematical revision courses with hands-on approaches for engineering education using web-based interactive multimedia applications. *Procedia - Social and Behavioral Sciences*, *228*, 482–488. https://doi.org/10.1016/j.sbspro.2016.07.074

Oud, J. (2009). Guidelines for effective online instruction using multimedia screencasts. *Reference Services Review*, *37*(2), 164–177. https://doi.org/10.1108/00907320910957206

Pate, L. P. (2016). Technology implementation: impact on students' perception and mindset. *International Journal of Information and Learning Technology*, *33*(2), 91–98. https://doi.org/10.1108/IJILT-10-2015-0033

Piyayodilokchai, H., Panjaburee, P., Laosinchai, P., Ketpichainarong, W., & Ruenwongsa, P. (2013). A 5E learning cycle approach-based, multimedia-supplemented instructional unit for structured query language. *Journal Educational Technology and Society*, *16*(4), 146–159.

Pratiwi, V., Siswandari, S., & Santosa, D. (2018). Students' understanding through the use of ICT-based accounting multimedia (MAKSI) in vocational high schools. *Jurnal Pendidikan Vokasi*, *8*(2), 151–162. https://doi.org/10.21831/jpv.v8i2.19450

Pribadi, B. A. (2010). *Model desain sistem pembelajaran*. Jakarta: Dian Rakyat.

Riduwan. (2013). *Skala pengukuran variabel-variabel penelitian*. Bandung: Alfabeta.

Sanaky, H. A. H. (2013). *Media pembelajaran interaktif-inovatif*. Yogyakarta: Kaukaban Dipantara.

Scott, B., & Cong, C. (2010). Evaluating course design principles for multimedia learning materials. *Campus-Wide Information Systems*, *27*(5), 280–292. https://doi.org/10.1108/10650741011087720

Sithole, S. T. M. (2017). Enhancing students understanding of introductory accounting by integrating split-attention instructional material. *Accounting Research Journal*, *30*(3), 283–300.

https://doi.org/10.1108/ARJ-08-2015-0104

Susanti, A., Murtini, W., & Harini, H. (2018). Development of web-based interactive multimedia for human-resource-management learning in Vocational High Schools. *Jurnal Pendidikan Vokasi*, *8*(3), 300–312. https://doi.org/10.21831/jpv.v8i3.20364

Téllez, A. G. (2008). Authoring multimedia learning material using open standards and free software. *Interactive Technology and Smart Education*, *4*(4), 192–199. https://doi.org/10.1108/17415650880001104

Trieb, C.-A. (2016). Application of learning technologies to promote holistic thinking and consensus building in global studies. *International Journal of Information and Learning Technology*, *33*(5), 300–314. https://doi.org/10.1108/IJILT-01-2016-0005

Wankel, L. A., & Blessinger, P. (2013). Inventive approaches in higher education: An introduction to using multimedia technologies. *Cutting-Edge Technologies in Higher Education*, *6*(PART F), 3–16. https://doi.org/10.1108/S2044-9968(2013)000006F003

Yuen, A., Fox, R., Sun, A., & Deng, L. (2009). Course management systems in higher education: Understanding student experiences. *Interactive Technology and Smart Education*, *6*(3), 189–205. https://doi.org/10.1108/17415650911005393

Zweekhorst, M. B. M., & Maas, J. (2015). ICT in higher education: Students perceive increased engagement. *Journal of Applied Research in Higher Education*, *7*(1), 2–18. https://doi.org/10.1108/JARHE-02-2014-0022

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (197-206)
Online: http://journal.uny.ac.id/index.php/jpv

GRADUATES' PERCEPTION ON THE IMPORTANCE OF SPECIAL JOB MARKET IN STATE VOCATIONAL HIGH SCHOOLS IN LANGSA CITY

Al Fatahillah
Universitas Negeri Yogyakarta

Mochamad Bruri Triyono
Universitas Negeri Yogyakarta

Abstract

This study aims to determine the perceptions of graduates of state vocational high schools in Langsa City on the performance of Special Job Market in vocational high schools based on the aspects of (1) Special Job Market performance; (2) role of Special Job Market; (3) Special Job Market service; and (4) the success of the Special Job Market. This study is quantitative research employing a descriptive approach. The population of the research is 365 graduates tracked through the Special Job Market of four vocational schools in Langsa City in 2007/2008. From the population, 15% were taken for the samples of the study, so the number of respondents is 55 graduates. The result of the research shows that: (1) the percentage of Special Job Market performance aspect is 58.54% with "quite satisfied" criteria; (2) the percentage of role of Special Job Market aspect is 59.14% with "quite satisfied" criteria; (3) the percentage of Special Job Market service aspect is 51.02% with "quite satisfied" criteria; and (4) the percentage of the success of the Special Job Market aspect is 51.17% with "quite satisfied" criteria.

Keywords: *graduates' perception, special job market, vocational high school*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.26361*

Contact Al Fatahillah
alfatahillah91@gmail.com
Department of Vocational Education, Graduate School of Universitas Negeri Yogyakarta
Jl. Colombo No. 1, Karangmalang, Depok, Sleman 55281, Yogyakarta, Indonesia

INTRODUCTION

Vocational education is an education which is aimed at preparing skilled, ready, as well as productive human resources in specific fields. According to Fedorov and Tretyakova (2016, p. 9810), vocational education is required to have instructors fully involved in providing education and training in encouraging the vocational education system. Instructors in vocational education must be able to plan education that is disciplined and capable of being explained logically or according to facts.

Vocational high school is one of the educational institutions which aims to produce graduates who are ready to work. Graduation's distribution is one of the provisions and implementation of the Vocational curriculum, even as a benchmark for the success of vocational high schools, as stated in the Regulation of the Minister of Education and Culture No. 34 of 2018 concerning the national standard of education in Vocational High School (VHS) or *Sekolah Menengah Kejuruan* (SMK) and also Islamic Vocational High Schools: VHS/Islamic VHS is part of the national education system which has the aim of vocational education, that is, producing skilled workers who have the ability in accordance with the demands of the business/industrial world, and are able to develop their potential in adopting and adapting to the development of science, technology, and art. The existence of standards that regulate vocational secondary schools is expected to be able to encourage as well as strengthen the potential and guarantee of graduates with the quality that is included in the job market qualifications.

Of the existing standards for secondary education in Indonesia, the government has launched the Vocational High School revitalization program in accordance with the Presidential Instruction No. 9 of 2016. In the steps or efforts to revitalize the vocational school, there needs to be a curriculum alignment supported by the role of stakeholders, the role of the world of work (industrial world of business) in the hope that graduates have competencies in accordance with the relevant fields. Vocational curriculum dissemination is in accordance with the Presidential Instruction No. 9 of 2016 written in the vocational high school revitalization strategy that the flow of the vocational school curriculum alignment can be started from the ability of students to be supported by vital needs of education facilities and infrastructure, while in the work world identification of competency needs which is in accordance with vocational high school. If both of them have been implemented, then vocational schools and the business world in the industry can harmonize the Vocational High School curriculum.

Comprehension of the type of command or assignment of a work which is related to the development of knowledge in education is called vocational education (Sudira, 2016). Further, Pavlova (2009) said that the objectives of the tradition of vocational education include: traditionally, direct preparation for work was the primary goal of vocational education. It was perceived as providing specific training that was reproductive and based on the teachers' instruction, with the intention to develop an understanding of a particular industry, comprising the specific skills or tricks of the trade. Students' motivation was seen to be engendered by the economic benefit to them in the future. Competency-based training was chosen by most governments in western societies as a model for vocational education. Juridically, the basic definition of vocational education in Indonesia is stated in the Law of Republic of Indonesia No. 20 of 2003 concerning National Education System that vocational education is secondary education to prepare students to work in accordance with certain fields. Vocational education will be efficient if the environment is provided in accordance with the conditions of the world of work, training held in vocational education will be efficient if the tasks given have similarities with operations in the workforce or industry, and the need for habitual behavior applied in the workforce or industry.

In carrying out its roles and functions, vocational high schools (VHSs) certainly need a unit called Special Job Market (*Bursa Kerja Khusus* or BKK), as structured in Figure 1, to connect graduates to the world of work and industry. Special Job Market is an implementing unit that provides services and information on job vacancies, executors of marketing, distribution, and placement of workers.

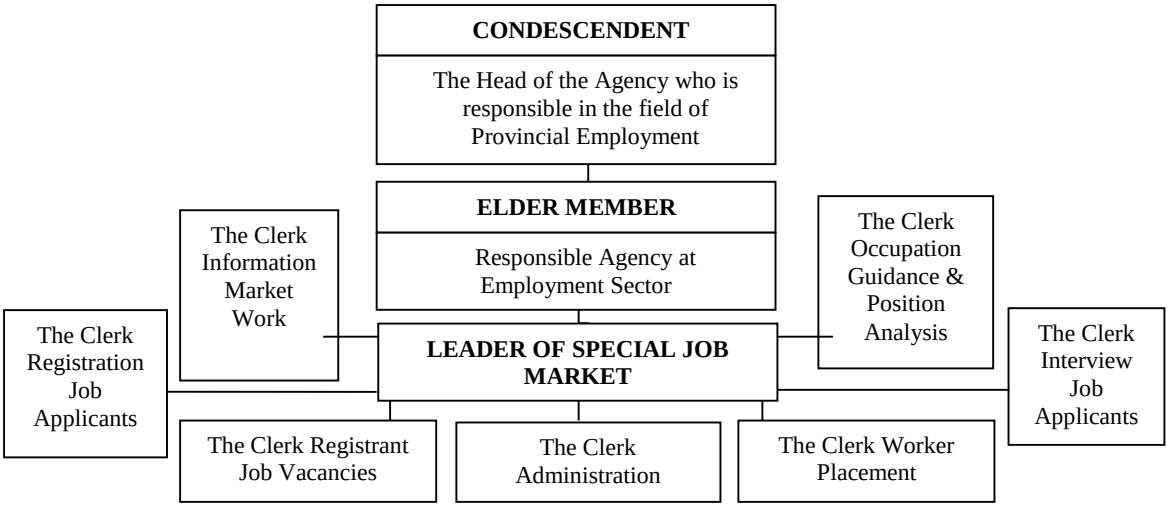


Figure 1. The Special Job Market Organizational Structure
(Source: Department of Manpower and Transmigration, 2012)

As stated in the Regulation of the Minister of Manpower No. 39 of 2016 concerning manpower placement, Special Job Market is an institution which is formed in secondary, high education, and job training institutions that carry out work placements for graduates. Furthermore, the regulation also explains that the scope of Special Job Market includes: (1) registration and data collection of job seekers who have completed their education or training; (2) registering job opportunity vacancies; (3) giving guidance to job seekers (graduates) to know their talents, interests, and also abilities according to the needs of labor users or for independent businesses; (4) offers to the labor users regarding the availability of labor; (5) implementation of verification as a follow-up of the delivery and placement that has been carried out; (6) holding a Job Exhibition (Job fair).

Perception is the responding, meaning, picturing, or interpretation of what is seen, heard, or felt by the senses in the form of attitudes, opinions, and behavior. Slameto (2010) concludes that perception is a process that involves the entry of messages or information into the human brain, through human perception continuously in contact with the environment. This relationship is done through the senses, namely the sense of sight, listener, touch, taste, and smell. Sarwono (2012) states that perception takes place when receiving a stimulus from the outside world that is captured by the organs of his aid, which then enters the brain.

The Special Job Market in carrying out its programs certainly requires assessments from parties involved in it, including graduates. The assessment of graduates in the form of perception can be one material to evaluate the performance itself.

Langsa City has ten public and private vocational high schools which are spread throughout the city. However, only four of them have the Special Job Market, namely, SMK N 1 Langsa, SMK N 2 Langsa, SMK N 3 Langsa, and SMK N 4 Langsa. The data of the graduates of the schools are clearly presented in Table 1.

Table 1. Graduate Search Data

School Name	Number of Graduates	Working
SMK N 1 Langsa	175	63
SMK N 2 Langsa	383	169
SMK N 3 Langsa	213	113
SMK N 4 Langsa	38	20
Total	809	365

(Source: Observation data, 2019)

Table 1 shows that the absorbed graduates' scores are very low, which is only about 45% of the total graduates. Therefore, it is necessary to conduct research that aims to determine the perceptions of graduates on Special Job Market performance. It is expected that the results of this research will be useful as an evaluation material for related parties to improve the absorption of vocational schools graduates through the Special Job Market.

RESEARCH METHOD

This study is a quantitative research employing a descriptive approach. It was conducted using a questionnaire which was filled out by the graduates of SMKN 1 Langsa, SMKN 2 Langsa, SMKN 3 Langsa, and also SMKN 4 Langsa of the academic year of 2007/ 2008, who had worked through the Special Job Market. Because it was constrained by great distances, the researchers sent the questionnaires online to the graduates then analyzed it. The population was 55 graduates who were obtained through the sampling method as much as 15% of the total graduates. Data analysis was carried out by three steps: (1) collecting respondents' data; (2) analyzing the data by describing the collected data; (3) presenting data in a visual form.

RESULTS AND DISCUSSION

Results

Based on Table 2, it can be explained that: (1) for the indicator of Special Job Market is an institution to bring together job seekers and users of labor (vocational graduates), there are 24 respondents (43.64%) who said they are satisfied and 31 respondents (56.36%) who said they are very satisfied; (2) for the indicator of Special Job Market performance in schools helps me to find relevant job information, 26 respondents (47.27%) said they are satisfied, and 29 respondents (52.73%) said they are very satisfied; (3) for the indicator of Special Job Market is able to carry out obligations and programs in the working distribution, 31 respondents (56.36%) said they are satisfied and 24 respondents (43.64%) said they are very satisfied; (4) for the indicator of Special Job Market is able to reduce the waiting period for graduates to get jobs, 24 respondents (43.64%) said they are satisfied, and 31 respondents (56.36%) said they are very satisfied; (5) for the indicator of Special Job Market utilizes information technology to support services, 27 respondents (49.09%) said they are satisfied, and 28 respondents (50.91%) said they are very satisfied; (6) for the indicator of Special Job Market provides good information services on employment, 29 respondents (52.73%) said they are satisfied and 26 respondents (47.27%) said they are very satisfied.

Table 2. Special Job Market Performance Aspect

No	Indicator	Disatisfied Percentage (%)	Quite Satisfied Percentage (%)	Satisfied Percentage (%)	Very Satisfied Percentage (%)
1	Special Job Market is an institution to bring together job seekers and users of labor (vocational graduates)	0	0	43.64	56.36
2	Special Job Market performance in schools, helps me to find relevant job information	0	0	47.27	52.73
3	Special Job Market is able to carry out obligations and programs in the working distribution	0	0	56.36	43.64
4	Special Job Market is able to reduce the waiting period for graduates to get jobs	0	0	43.64	56.36
5	Special Job Market utilizes information technology to support services	0	0	49.09	50.91
6	Special Job Market provides good information services on employment	0	0	52.73	47.27

(Source: Result of data analysis, 2019)

Based on Table 3, it can be explained as follows. (1) For the indicator of Special Job Market supports the absorption of graduates in the relevant workforce, there are two respondents (3.64%) who said they are quite satisfied, 21 respondents (38.18%) who said they are satisfied, and 32 respondents (58.18%) who said they are very satisfied. (2) For the indicator of Special Job Market have provided effective career guidance to students and graduates, 17 respondents (30.91%) said they are satisfied and 38 respondents (69.09%) said they are very satisfied. (3) For the indicator of Special Job Market carries out data collection and classification of students based on physical, age, grades, majors and sex periodically and have been submitted to students and graduates, 25 respondents (45.45%) said they are satisfied and 30 respondents (54.55%) said they are very satisfied. (4) For the indicator of Special Job Market provides services by presenting a consulting firm from the company as a provision to enter the workforce, 20 respondents (36.36%) said they are satisfied and 35 respondents (63.64%) said they are very satisfied. (5) For the indicator of Special Job Market has held seminars, workshops, or training on career management and strategies in finding information or job vacancies, 34 respondents (61.82%) said they are satisfied and 21 of them (38.18%) said they are very satisfied. (6) For the indicator of Special Job Market in schools has carried out regular recruitment of graduates (annually), 28 respondents (50.91%) said they are satisfied and 27 (49.09%) said they are very satisfied.

Table 3. Role of Special Job Market Aspect

No	Indicator	Disatisfied Percentage (%)	Quite Satisfied Percentage (%)	Satisfied Percentage (%)	Very Satisfied Percentage (%)
1	Special Job Market supports the absorption of graduates in the relevant workforce	0	3.64	38.18	58.18
2	Special Job Market have provided effective career guidance to students and graduates	0	0	30.91	69.09
3	Special Job Market carry out data collection and classification of students based on physical, age, grades, majors and sex periodically and have been submitted to students and graduates	0	0	45.45	54.55
4	Special Job Market provides services by presenting a consulting firm from the company as a provision to enter the workforce	0	0	36.36	63.64
5	Special Job Market has held seminars, workshops, or training on career management and strategies in finding information or job vacancies	0	0	61.82	38.18
6	Special Job Market in schools has carried out regular recruitment of graduates (annually)	0	0	50.91	49.09

(Source: Result of data analysis, 2019)

Based on Table 4, it can be explained that (1) on the indicator of Special Job Market has provided information services in the form of job fair, recruitment, assessment, training career, and professional development, 16 respondents (29.09%) said they are satisfied, and 39 of them (70.91%) said they are very satisfied. (2) On the indicator of Special Job Market helps identify skills and abilities for suitable jobs, 20 respondents (36.36%) said they are satisfied, and 35 others (63.64%) said they are very satisfied. (3) On the indicator of Special Job Market helps in building skills to get a job, 21 respondents (38.18%) said they are satisfied and 34 respondents (61.82%) said they are very satisfied. (4) On the indicator of Special Job Market helps send the job application file to the desired company or workplace, 23 respondents (41.82%) said they are satisfied, and 32 respondents (58.18%) said they are very satisfied. (5) On the indicator of Special Job Market builds intensive communication with graduates, 30 respondents (54.55%) said they are satisfied, and 25 respondents (45.45%) said they are very satisfied. (6) On the indicator of Special Job Market in schools has complete and adequate infrastructure, 29 respondents (52.73%) said they are satisfied, and 26 respondents (47.27%) said they are very satisfied. (7) On the indicator of Special Job Market conducts data collection and tracking of graduates, there are 26 respondents (47.27%)who said they are satisfied, and 29 (52.73%) who said they are very satisfied.

Based on Table 5, it can be explained that (1) on the indicator of Career services and vocational high schools graduate work placements have been achieved, there are 24 respondents (43.64%) who said they are satisfied and 31 respondents (56.36%) who said they are very satisfied. (2) On the indicator of Vocational high schools graduates in accordance with the job market qualifications (workforce), 28 respondents (50.91%) said they are satisfied and 27 respondents (49.09%) said they are very satisfied. (3) On the indicator of Special Job Market is able to help the absorption of vocational high schools graduates in the job market, 24 respondents (43.64%) said they are satisfied and 31 respondents (56.36%) said very satisfied. (4) On the indicator of Special Job Market

Table 4. Special Job Market Service Aspect

No	Indicator	Disatisfied Percentage (%)	Quite Satisfied Percentage (%)	Satisfied Percentage (%)	Very Satisfied Percentage (%)
1	Special Job Market has provided information services in the form of jobfair, recruitment, assessment, training career, and professional development	0	0	29.09	70.91
2	Centre helps identify skills and abilities for suitable jobs	0	0	36.36	63.64
3	Special Job Market helps in building skills to get a job	0	0	38.18	61.82
4	Special Job Market helps send the job application file to the desired company or workplace	0	0	41.82	58.18
5	Special Job Market builds intensive communication with graduates	0	0	54.55	45.45
6	Special Job Market in schools has complete and adequate infrastructure	0	0	52.73	47.27
7	Special Job Market conducts data collection and tracking of graduates	0	0	47.27	52.73

(Source: Result of data analysis, 2019)

is able to establish cooperation with the industrial world of business (workforce), 20 respondents (36.36%) said they are satisfied and 35 respondents (63.64%) said they are very satisfied. (5) On the indicator of Special Job Market is able to harmonize learning between the workforce and school, there are 17 respondents (30.91%) who said they are satisfied and 38 respondents (69.09%) who said they are very satisfied. (6) On the indicator of Special Job Market is able to provide soft skills as a provision to enter the workforce, 21 respondents (38.18%) said they are satisfied and 34 respondents (61.82%) said they are very satisfied. (7) On the indicator of Special Job Market is able to increase the insight to students/vocational graduates with the workforce, so graduates can choose opportunities according to their competencies, 24 respondents (43.64%) said they are satisfied, and 31 respondents (56.36%) said they are very satisfied.

After the data were analyzed, the percentage in Table 6 and the average results of graduates' perception in Figure 2 are obtained. Table 6 shows that the performance of the Special Job Market of Vocational High Schools in Langsa City is in the "Quite Satisfied" criteria. It is an obligation for the parties concerned to improve performance in order to achieve the Special Job Market goals as determined.

Table 5. The Success of the Special Job Market Aspect

No	Indicator	Disatisfied Percentage (%)	Quite Satisfied Percentage (%)	Satisfied Percentage (%)	Very Satisfied Percentage (%)
1	Career services and vocational high schools graduate work placements have been achieved	0	0	43.64	56.36
2	Vocational high schools graduates in accordance with the job market qualifications (workforce)	0	0	50.91	49.09
3	Special Job Market is able to help the absorption of vocational high schools graduates in the job market	0	0	43.64	56.36
4	Special Job Market is able to establish cooperation with the industrial world of business (workforce)	0	0	36.36	63.64
5	Special Job Market is able to harmonize learning between the workforce and school	0	0	30.91	69.09
6	Special Job Market is able to provide soft skills as a provision to enter the workforce	0	0	38.18	61.82
7	Special Job Market is able to increase the insight to students / vocational graduates with the workforce, so graduates can choose opportunities according to their competencies	0	0	43.64	56.36

(Source: Result of data analysis, 2019)

Table 6. Perception of Graduates on the Importance of Career Center of State Vocational High Schools in Langsa City

No	Aspect	Percentage (%)	Criteria
1	Special Job Market Performance	58.54	Quite Satisfied
2	Role of Special Job Market	59.14	Quite Satisfied
3	Special Job Market Service	51.02	Quite Satisfied
4	The Success of the Special Job Market	51.17	Quite Satisfied

(Source: Result of data analysis, 2019)

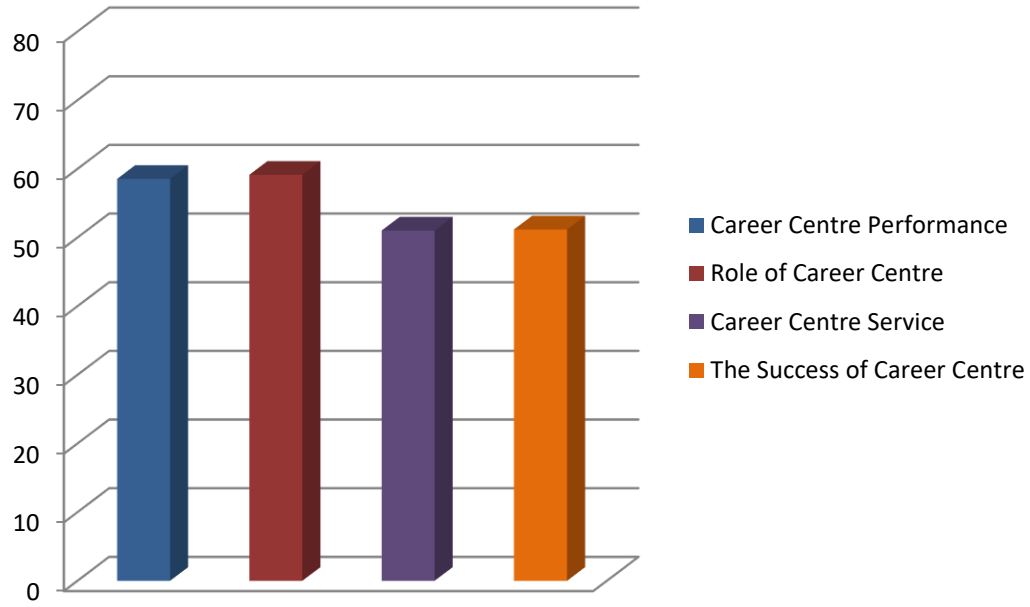


Figure 2. Average Results of Graduates' Perception of Special Job Market
(Source: Result of data analysis, 2019)

Discussion

Perception is an individual's assessment of something; it can also be said that perception is a process used by individuals to manage and interpret their sensory impressions in order to give meaning to their environment. Perception can be positive (good) or negative (not good). Good perception is formed from someone's observations of something that feels good. Similarly, negative perceptions as well. Thus, it can be concluded that someone's perception can be an indicator of judgment about someone or something. A research conducted by Yazid and Ridwan (2017) shows that the positive perception of female students in viewing the development of trends in Muslim clothing affects the rise of female Muslim-dressed students, even though this is not required at institutions where they studying.

Next, Ramadhan and Soenarto (2015) conclude that students' perceptions of teacher teaching competence, parenting patterns, motivation for student achievement, completeness of facilities practice infrastructure, and vocational theory learning achievement are directly proportional to student learning outcomes themselves. In building a positive perception of its graduates, the Special Job Market must certainly consider the components that are the main indicators of the success of the Special Job Market in channeling graduates. Istianyani (2012) states there are several Special Job Market services that can increase the absorption of graduates into the workforce, including (1) employment information services; (2) job fair; (3) recruitment; (4) assessment; (5) training, career and professional development, and (6) graduate relations. Pambayun and Wagiran (2014) said that in order to realize its purpose, Special Job Market has to (a) optimize job hunting activities so that existing job vacancies can be absorbed and conveyed to students and graduates to the maximum both in terms of quantity and relevance; (b) expand and strengthen cooperation networks with the business world and

the industrial world and other stakeholders so that the distribution and placement of graduates can run more broadly and optimally; (c) optimize career guidance activities for students both individually and classically to improve students' ability to choose and develop their careers, and can align student preferences with existing labor needs.

In line with that opinion, Septiningrum (2017) states that (1) Special Job Market needs to offer/promote graduates to the business world/industrial world by means of the Special Job Market. It can be done by registering graduates who have not yet gotten a job, then Special Job Market recommends to the business world/industrial world who open job openings according to the skills competencies possessed by graduates, so that more graduates are channeled through the Special Job Market; (2) Special Job Market should concern more on the order of the administration, because there are still administrations that have not been made. It can be done by creating a chart of organizational structure and graduates' data that are channeled through Special Job Market and a database of companies in collaboration with the Special Job Market.

Ridawati (2017) states that to achieve its objectives, preferably (1) the Chairperson of the Special Job Market should have participated in Technical Guidance as the manager of the Special Job Market so that he is able to understand the duties as manager of the Special Job Market; (2) the Special Job Market personnel should be young, so they have high morale and mobility; (3) the Special Job Market managers must be committed to developing the Special Job Market; (4) the principal must support all Special Job Market activities by providing dispositions and dispensations for Special Job Market managers to abandon teaching assignments because they have to negotiate with the business and industry; (5) the principal must also have an open attitude with the business world and industry; (6) students must have a relatively good, obedient, and ethical character; and (7) the physical criteria of the child must be in accordance with the needs of the company because they have been prepared since the selection of new student admissions. Judging from the aspects of facilities and infrastructure, achieving the Special Job Market program objectives is supported by factors: (1) adequate internet access; (2) adequate communication tools; (3) office stationery and adequate documentation tools; and (4) school cars that can be used as operational vehicles for Special Job Market activities. In terms of financing aspects, the achievement of the Special Job Market program is supported by (1) funding opportunities for School Operational Costs (*Bantuan Operasional Sekolah* or BOS) for the management of Special Job Market, (2) the existence of operational assistance from industrial partners, and (3) the existence of participation from parents through committee contributions.

The results of a research conducted by ‘Afif (2017) produce several recommendations to the vocational high schools: (1) vocational high schools need to pay more attention to activities in order to establish work readiness for students, one of which is the formation of work readiness such as physical sports activities; (2) vocational high schools need to increase the planting of work readiness to students in each learning process, so students are interested in participating in Special Job Market recruitment and are ready to be placed to work outside the area; (3) vocational high schools need to maximize counseling in the form of career guidance to provide students with knowledge about knowledge to face competition in the world of work; (4) improve service and renewal of employment information to students and graduates through information boards, social media or announced in schools so that every student knows that information; (5) increase promotion with the industrial world as a step to expand the network of cooperation with industry and improve cooperation with industry in the field of recruitment and placement of prospective workers; (6) increase activities similar to recruitment or placement of prospective workers in the industry; (7) increase the effectiveness of activities that can strengthen relationships with graduates and involve graduates in school activities; (8) maximize the search for graduates and create a group of graduate ties as a medium for communication with graduates intensively; (9) evaluate regularly as monitoring the implementation of Special Job Market activities; (10) schools need to pay more attention to the feedback made by the Special Job Market to schools as a recommendation to improve the student formation process to meet industry expectations.

CONCLUSION

The vocational high school graduates' perception towards the existing Special Job Market is still quite good. It can be seen from the research results that reveal the graduates' perception is included in "Quite Satisfied" criteria. However, it would be nice if the Special Job Market's performance was further enhanced. In accordance with its objectives, each VHS should have its own Special Job Market to realize the vision and mission itself.

REFERENCES

'Afif, M. N. (2017). *Evaluasi penyelenggaraan Bursa Kerja Khusus (BKK) di SMK Muhammadiyah 1 Bantul*. Thesis. Universitas Negeri Yogyakarta.

Department of Manpower and Transmigration. (2012). *Petunjuk teknis Bursa Kerja Khusus*. Jakarta: Department of Manpower and Transmigration of Republic of Indonesia.

Fedorov, V. A., & Tretyakova, N. V. (2016). The development of vocational pedagogical education in Russia (Organizational and Pedagogical Aspect). *International Journal of Environmental & Science Education*, *11*(17), 9803–9818. Retrieved from http://www.ijese.net/makale/1207

Istianyani, A. (2012). Upaya percepatan daya serap lulusan Fakultas Teknik melalui optimalisasi peran bursa kerja khusus UNJ sebagai mitra dari dunia usaha dan industri. In *Proceeding of National Conference of APTEKINDO (Asosiasi Pendidikan Teknologi dan Kejuruan Indonesia)* (pp. 143–148). Jakarta: Universitas Negeri Jakarta.

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

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

Pavlova, M. (2009). *Technology and vocational education for sustainable development: Empowering individuals for the future*. Queensland: Springer Science & Business Media.

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.

Ramadhan, A. N., & Soenarto, S. (2015). Pengaruh persepsi siswa terhadap faktor-faktor yang mempengaruhi prestasi belajar teori kejuruan siswa SMK. *Jurnal Pendidikan Vokasi*, *5*(3). https://doi.org/10.21831/jpv.v5i3.6485

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.

Regulation of the Minister of Manpower No. 39 of 2016 concerning manpower placement (2016). Republic of Indonesia.

Ridawati, H. (2017). *Evaluasi program Bursa Kerja Khusus (BKK) berdasarkan goal-oriented evaluation model di SMKN 3 Salatiga*. Thesis. Universitas Kristen Satyawacana.

Sarwono, S. W. (2012). *Psikologi remaja*. Jakarta: PT. Raja Grafindo Persada.

Septiningrum, I. (2017). *Kinerja Bursa Kerja Khusus (BKK) dalam membantu penyaluran kerja lulusan kompetensi keahlian Administrasi Perkantoran SMK Negeri 1 Yogyakarta*. Thesis. Universitas Negeri Yogyakarta.

Slameto, S. (2010). *Belajar dan faktor-faktor yang mempengaruhinya*. Jakarta: Rineka Cipta.

Sudira, P. (2016). *TVET abad XXI: Filosofi, teori, konsep, dan strategi pembelajaran vokasional*. Yogyakarta: UNY Press.

Yazid, T. P., & Ridwan, R. (2017). Proses persepsi diri mahasiswa dalam berbusana muslimah. *Jurnal An-Nida': Jurnal Pemikiran Islam*, *41*(2), 193–201.

Jurnal Pendidikan Vokasi
Volume 9, No 2, June (207-216)
Online: http://journal.uny.ac.id/index.php/jpv

DEVELOPING MOBILE-BASED PROJECT-BASED LEARNING MODULE FOR PROJECT MANAGEMENT COURSES IN VOCATIONAL EDUCATION

Sarwandi
Universitas Negeri Padang

M. Giatman
Universitas Negeri Padang

Sukardi
Universitas Negeri Padang

Dedy Irfan
Universitas Negeri Padang

Abstract

The purposes of this research were (1) to design and implement the development of mobile-based e-modules, (2) to know the students' and lecturers' responses toward the development of the mobile-based e-modules, and (3) to know the students' learning outcomes after using the mobile-based e-modules. The research employed a Research and Development with the 4D development model. The participants of this study were 54 students and three lecturers of construction engineering education. The data on the students' and lecturers' responses to the development of mobile-based e-modules were obtained using the questionnaire method. The results of the study show that the design and implementation of the developed mobile-based e-modules were successful based on several tests conducted. The successfully developed e-modules can be seen from the students' responses, in which 64% are included in the Very Practical category, and only 36% are in the Practical category. On the other hand, the results of the lecturers' responses show a Very Practical category by the percentage of 100%. As a consequence, the students' learning outcomes are declared complete at 100% and increase with a gain score of 0.44 (moderate) from 54 students in the project management course.

Keywords: *e-module, mobile-based, project based learning, project management, vocational education*

Permalink: *http://dx.doi.org/10.21831/jpv.v9i2.25947*

Contact Sarwandi wandikocan02@gmail.com
Department of Technology and Vocational Education, Graduate School of Universitas Negeri Padang
Jl. Prof. Dr. Hamka, Air Tawar Bar., Kec. Padang Utara, Kota Padang, Sumatera Barat 25173, Indonesia

INTRODUCTION

Changes in the world are now entering the era of industrial revolution 4.0 or the fourth world industrial revolution, where technology becomes a necessity in human life. Everything has become limitless with unlimited use of computational power and data, due to the massive development of the internet and digital technology as human and machine movements and connectivity. The industrial revolution has changed the way humans work from using hands to turning into using machine tools so that they will disrupt various human activities.

The birth of Industry 4.0 can increase digitalization which is driven by four factors (Yahya, 2018), namely: (1) increased data volume, computational power, and connectivity; (2) the emergence of analysis, capability and business intelligence; (3) the occurrence of new forms of interaction between humans and machines; and (4) improvement of digital transfer instructions to the physical world, such as robotics and 3D printing. Hermann, Pentek, and Otto (2016) suggest that there are four industrial design principles 4.0. First, interconnection (connection), namely the ability of machines, devices, sensors, and people to communicate with each other through the Internet of Things (IoT) or the Internet of People (IoP). This principle requires collaboration, security, and standards. Second, information transparency, which is an information system's ability to create virtual copies of the physical world by enriching digital models with sensor data, including data analysis and information provision. Third, technical assistance which includes: (a) the ability of the assistance system to support humans by combining and evaluating information consciously to make the right decisions and solve urgent problems in a short time; (b) the ability of the system to support humans by carrying out various tasks that are unpleasant, too tiring, or unsafe; (c) visual and physical assistance. Fourth, decentralized decisions, which are the ability of the virtual physical system to make their own decisions and carry out their tasks as effectively as possible.

If you want to compete in the current digital era, Indonesia needs to immediately improve the capabilities and skills of human resources through education, become operators, and reliable analysis as a driver of the industry to achieve competitiveness and high productivity (Syamsuar & Reflianto, 2018). By doing the aforementioned actions, Indonesia can jump into a developed country in the 4.0 industrial revolution. Wolter (Sung, 2018) identified the challenges of industry 4.0, namely: (1) information technology security issues; (2) reliability and stability of production machinery; (3) adequate shelling skills; (4) reluctance to change by stakeholders; and (5) loss of a lot of work because it turns into automation. Irianto (2017) simplifies the challenge of industry 4.0, namely: (1) industry readiness; (2) trusted workforce; (3) ease of socio-cultural arrangements; (4) diversification and job creation and industry opportunities 4.0, namely: (a) ecosystem innovation; (b) competitive industrial base; (c) investment in technology; and (d) integration of small and medium enterprises (SMEs) and entrepreneurship.

Challenges and opportunities for industry 4.0 to prevent various impacts on people's lives, one of which is the problem of unemployment. Data from the Central Bureau of Statistics (*Badan Pusat Statistik* or BPS) in 2017 also show the number of unemployed people from vocational high school (*Sekolah Menengah Kejuruan* or SMK) ranks the highest, namely 9.27%, followed by high school (*Sekolah Menengah Atas* or SMA) graduates of 7.03%, Diploma III (D3) graduates of 6.35 %, and the university graduates of 4.98%. It was identified that the cause of the high contribution of vocational education to the number of unemployed people in Indonesia was, one of which, caused by the lack of special skills and soft skills possessed. The Director-General Mukti (Sumber Daya IPTEK & DIKTI, 2018) said that human resources determine the progress of a country. Moreover, Indonesia must be ready to face the industrial revolution 4.0 or fourth-generation industry. He also believes that Indonesian Universities can survive in this era of industrial revolution if implementing 4C: (1) Critical Thinking, namely being skeptical and critical. (2) Creativity, which is, being able to produce innovations. (3) Communication, in which science and technology that are made, must be accepted by the public correctly and does not cause misunderstanding. (4) Collaboration, which is to cooperate and understand each other.

Answering the challenges of industry 4.0, Bukit (2014) states that vocational education as education is different from other educa-

tion, so it must have the following characteristics: (1) oriented to individual performance in the world of work; (2) special justification on real needs in the field; (3) curriculum focus on psychomotor, affective, and cognitive aspects; (4) the benchmark for suc-cess is not limited to school; (5) sensitivity to the world of work; (6) fulfillment of adequate facilities and infrastructure; and (7) community support. The challenge of the 4.0 industrial revolution must be answered quickly and precisely, so as not to affect increasing unemployment. The government seeks to respond to these challenges by focusing on improving the quality of human resources through vocational education in 2018. The government, through cross-ministerial and institutional policies, issued various policies. One of the government's policies is the revitalization of vocational education in Indonesia. Support from the government must include (1) a learning system, (2) education unit, (3) students, and (4) educators and education personnel. The revitalization of the learning system includes (1) curriculum and character education, (2) learning materials, (3) entrepreneurship, (4) alignment, and (5) evaluation. Adjusting the curriculum and learning system that is suitable for responding to the industrial revolution 4.0 is 21st-century learning.

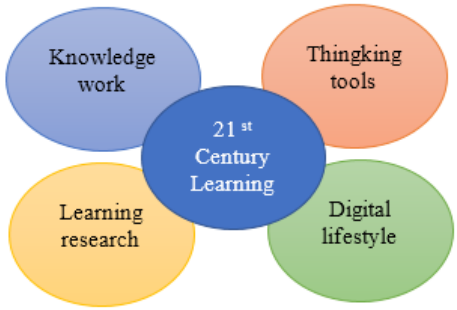


Figure 1. 21st Century Learning

According to Trilling and Fadel (2009), 21st-century learning is oriented towards digital lifestyles, critical thinking tools, learning research, and how knowledge works. The four orientations of the 21st-century learning are presented in Figure 1. Three of the orientations are very close to vocational education, namely how to work knowledge, strengthening thinking tools, and digital lifestyle. The workings of knowledge are the ability to collaborate on teams with locations, and with different tools, strengthening thinking tools is the ability to use technology, digital tools, and services, and digital lifestyle is the ability to use and adapt to the digital era.

The content of learning in the 21st century must always adjust to changes including in the era of industrial revolution 4.0. The learning process is expected to be able to fulfill 21st-century skills, namely: (1) learning and innovation skills, including mastery of diverse knowledge and skills, learning and innovation, critical thinking and problem solving, communication and collaboration, and creativity; (2) digital literacy skills, including information literacy, media literacy and ICT literacy; (3) career and life skills, including flexibility and adaptability, and leadership and responsibility (Trilling & Fadel, 2009).

Universitas Negeri Padang has several faculties and departments, one of which is the Department of Construction Engineering Education, which, in that department, students will be taught a variety of subjects, one of which is Construction Project Management (Universitas Negeri Padang, 2017) in the aim of students can master and apply the course. In addition to compulsory courses, this Construction Project Management course is one of the requirements for conducting Industrial Field Practice. The learning process of the Construction Project Management course is carried out using modules and supporting media such as powerpoint slides. However, in reality, students still do not understand the learning of Construction Project Management so that student learning outcomes are low. Students' incomprehension of the Construction Project Management module can be seen from the learning outcomes at the final grade of this course.

Table 1. Value of 135 Students

Value	2015/2016 until 2017/2018			
	Total students	Percentage (%)	Value <70 (%)	Average Quality Score
A	4	2.64%		
A-	13	8.60%		
B+	28	18.54%		
B	27	17.88%		
B-	25	16.55%		
C+	12	7.94%	**40.4%**	**B-**
C	5	3.31%		
C-	6	3.97%		
D	1	0.66%		
E	12	7.94%		
T	-	-		

In Table 1, it can be seen that the percentage of students who achieve the highest score (A) in the Construction Project Management course is only 2.64%. Meanwhile, the students who score less than 70 are 40.4% with an average quality score of B-. The data were obtained from a population of 135 students in the academic year of 2015/2016 until 2017/2018.

Based on observations of the modules which were used in the learning process, students find it difficult to understand the material, because the material which is presented is incomplete and less attractive so that students cannot learn independently. Besides, the module does not have a module format/framework that is complete and not in accordance with the needs and conditions that exist, such as the absence of module usage instructions, explanations for students, teacher roles, final goals, competencies to be achieved, and also ability checks.

Based on the Lecture Event Unit (*Satuan Acara Perkuliahan* or SAP) and direct observation in the classroom, the learning process in the Construction Project Management course is still carried out with lecture and question and answer methods. Consequently, the learning process becomes monotonous and uninteresting; students will not experience directly in understanding the material Management of the Construction Project so that it is less meaningful. Then, a learning model is needed that requires students to be active, creative, innovative, and think critically following the character of industry 4.0.

Sani (2014) defines project-based learning as learning with long-term activities that involve students in designing, making, and displaying products to overcome real-world problems. Project-based learning (PBL) is a learn-ing model that uses problems as the first step in gathering and integrating new knowledge based on their experience in actual activities. Through the PBL, the inquiry process begins by raising a guiding question and guiding students in a collaborative project that integrates various subjects (material) in the curriculum. PBL is an in-depth investigation of a real-world topic; it will be valuable for student attention and effort (Ministry of Education and Culture, 2014). The steps for implementing project-based learning can be explained by a diagram in Figure 2.

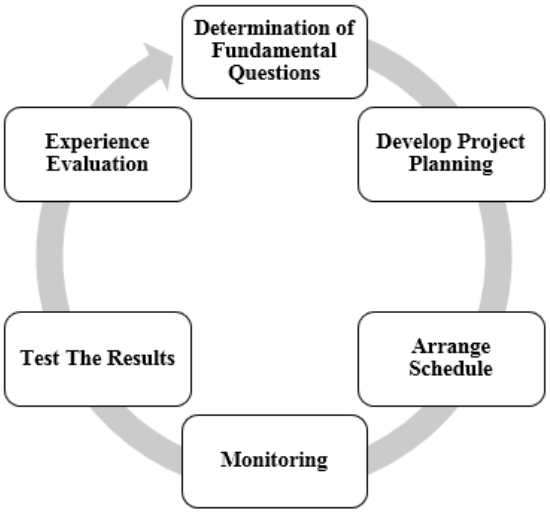


Figure 2. Project-Based Learning Steps
(Source: Ministry of Education and Culture, 2014)

Based on the problems, which are, students have difficulty understanding the material so that the low final grade of the course, the modules used are not sufficient so students cannot learn independently, and the learning process still uses lecture and question and answer methods so students do not get direct experience, then, an action needs to be taken to overcome them. The action taken is developing mobile-based project-based learning e-module as a learning module in a more effective and innovative Construction Project Management course to make it easier for students to understand the material and increase independence in learning.

RESEARCH METHOD

The research method used in this study is the Research and Development research method. It also employs a 4-D modeling technique (see Figure 3) consisting of four steps (Thiagarajan & Others, 1920).

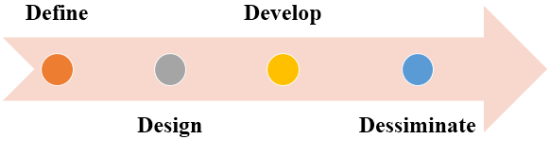


Figure 3. 4-D Modeling Steps

Research that uses the research-and-development method (Sugiyono, 2014) is a research in the form of needs analysis and is used to produce certain products as well as effectiveness tests on these products. Thus, this

development model is very suitable for developing a product so that products that are developed are valid, practical, and effective. The selection of the 4-D model in this study is based on the consideration that this type of research and model are arranged programmatically with sequences of systematic activities, aiming to produce products that are in accordance with the background of the research and are expected to support problem-solving contained within this research.

The trial subjects in this study were 54 students taking Project Management courses and three lecturers of Project Management courses. The research data were collected using the following techniques: observation, questionnaire, and test. Observations were done to observe the project management learning process related to the modules used so far. In addition, the questionnaire used in this study was a Likert scale questionnaire. The questionnaire was used to validate material and media experts, and also to assess the responses of students and lecturers to the use of e-modules developed. Then, the tests used during summative tests are pre-test and post-test to determine the effectiveness of e-modules as teaching materials that can help students understand project management material.

RESULTS AND DISCUSSION

The development of this mobile-based project-based learning module was developed using a 4-D model consisting of four stages, namely, Define, Design, Develop, and Disseminate. Each stage is elaborated as follows.

Define

The initial stage in developing the e-module was carrying out research and gathering information by several processes, such as observation, curriculum analysis, analysis of student characteristics, and analysis of the concepts. Each process is described as follows.

Observation

Observations were carried out in the Department of Civil Engineering Education of the Construction Engineering Education Study Program at the Universitas Negeri Padang, especially in the Project Management course, aimed to find out what problems were faced in the field related to the Project Management course. One of the problems that occurred was that students had difficulty in understanding Project Management material, the modules used were inadequate, and the learning process still used lecture methods and responsibilities, so students did not get a direct understanding of Project Management concepts.

Curriculum Analysis

This curriculum analysis refers to the Semester Learning Plan (*Rencana Pembelajaran Semester* or RPS) of Project Management courses. It is to find out the subject/subject being taught is in accordance with the standards of competence and basic competencies of the course. The discussion material developed in this e-module, as presented in Table 2, includes the calculation of the cost budget plan (*Rencana Anggaran Biaya* or RAB) and project work schedule preparation.

Table 2.Material Discussion

Module I	Module II
1. Calculation of volume in the budget plan 2. Calculation of unit prices in the budget plan 3. Complete calculation of the budget plan	1. Types of work schedules 2. Establishment of network planning (NWP) 3. Making an S diagram

Student Characteristics Analysis

The age of students studying this course generally 20 years old and above. Airasian et al. (2001) basically state that, at that age, every student is in the "create" category, which has been declared capable of designing, building, planning, producing, finding, renewing, perfecting, strengthening, beautifying, and also changing. Therefore, at that age, students have been given the opportunity to develop their own knowledge and understanding.

At the achievement of this stage, students are given the opportunity to increase their knowledge and understanding independently, and in the use of learning technology, it is hoped that they will be more motivated in learning. Studying the characteristics of students is also essential to make it easier to arrange the level of language in the e-module.

Concept Analysis

Concept analysis aims to determine the content and subject matter which are needed in the Project Management course. The development of this e-module is based on the main concepts that will be developed systematically and identifies supporting concepts that are relevant and related to the material in the Project Management course. The main concept in this Project Management course is that students are able to analyze volume calculations, calculate unit prices, calculate budget plans, and are able to apply the types of work schedules, making network planning, to making S curves.

Design

At this stage, the researchers design the learning e-module through several stages. Each stage is elaborated as follows.

Test Preparation

At this stage, the preparation of tests is used as a tool to determine the ability of students (pre-test) and as an evaluation tool after the implementation of lecture activities (post-test) using e-modules in the Project Management course. The tests are arranged in the form of a multiple-choice objective test. The tests that have been prepared are validated by experts in their fields with valid results or very as expected.

Media Selection

The purpose of media selection is to identify the right learning media in order to present the material presented. In this study, the selected media is a mobile-based application which is designed using an android studio. This application is the choice of researchers because it can be used in the field of learning, efficient, and lightweight for use in various types of mobile devices.

Designing Prototype

At this stage, the design framework for the display of mobile-based PBL e-module design includes the opening page, main menu, material page, presentation of material, and evaluation of multiple-choice questions. Figure 4, Figure 5, Figure 6, and Figure 7 are the display of each page in the mobile-based project-based learning e-module for Project Management courses.

Figure 4. The Opening Page

Figure 5. Home Page

Figure 4 shows the opening page to enter the main menu. Figure 5 presents the display of the home page, which is the main page that contains instructions for using e-modules, preface, material I, material II, evaluation, and profile of the developer. Figure 6 presents the material description, in which a choice of material to be studied is embedded, starting from the calculation of volume, unit price analysis, to the making of curves S. Figure 7 shows the display of material that is presented in full, making it easier for students to understand the concept of project management.

Develop

After passing the design stage, the researchers enter the development stage. This stage aims to obtain a learning e-module that is valid, practical, and effective to use. The development phase consists of evaluating material and media validation, up to practicality assessments, and the effectiveness test phase. Data retrieval validity and practicality is done by using a questionnaire. The questionnaire used previously has gone through the stage of validity testing by experts who understand the questionnaire instrument. Questionnaires that have been tested by validators have been declared appropriate for testing material validity, testing media validity, and practicality tests.

Validity Analysis

The validation test phase is done to obtain a valid learning e-module status. Validation test data are obtained through validation instruments filled in by the validator. The validator also has the right to provide input on the material and media of the e-learning module developed; then, the input can be used as a revision for researchers in the development of this learning e-module. The results of the assessment given from each validator were analyzed using the statistical Aiken's V formula. Table 3 and Table 4 present the result of the questionnaire data analysis from the results of expert validation testing.

Table 3.Results of Media Validation Analysis

Validator	Validity Result	Category
Validator I	0.85	Valid
Validator II	0.83	Valid
Validator III	0.94	Valid
Average	**0.87**	**Valid**

Figure 6. Material Description

Figure 7. Material Presentation

Table 4. Results of Material Validation Analysis

Validator	Validity Result	Category
Validator I	0.76	Valid
Validator II	0.80	Valid
Validator III	0.93	Valid
Average	**0.83**	**Valid**

Based on data analysis in Table 3 and Table 4, it can be seen that the values of media and material validation are not in the range of values <0.66 with invalid categories. Thus, so it indicates that the project of the e-module of mobile-based project-based learning in Management courses is valid.

Practicality Analysis

Practical testing is a field test that is useful to see the practicality of this mobile-based e-module. E-modules are said to have high practicality if they are practical and easy to use. Practical test data were obtained from filling in the practicality questionnaire of the e-learning module, which was filled by three lecturers who taught Project Management courses and 54 students who took Project Management courses. These data are obtained after learning using e-modules that have been developed. The results obtained from the practicality test of lecturers and students can be seen in Table 5 and Table 6.

Table 5. Results of Practical Analysis of Lecturers

Respondent	Result	Category
Respondent I	97	Very Practical
Respondent II	95	Very Practical
Respondent III	84	Very Practical
Average	**92**	**Very Practical**

Table 6.Results of Practical Analysis of Students

Respondent	Result	Category
45 Students	64%	Very Practical
	36%	Practical

Effectiveness Analysis

Summative tests were carried out in the form of field tests with pre-test and post-test designs. The instrument of data collection used to determine the effectiveness of this product is a multiple-choice written test with questions about procedural knowledge to uncover the level of understanding of students. The e-module that has been developed is then implemented to students to find out the differences caused by the use of the e-module. Summative tests are conducted on 54 VI-semester students who take Project Management courses. It is obtained that the average pre-test result of students' learning outcomes before using e-modules is 57 with the value of quality C, while the average post-test of their learning outcomes after using e-modules is 76 with a quality value of B+ or categorized as Very Good. Furthermore, the e-module is said to be effective if the gain score obtained is ≥0.30 or at least in the moderate category. The gain score obtained can be seen in Table 7.

Table 7.Gain Score Analysis

N	Pre-test Average	Post-test Average	Gain Score
54	57	76	0.44
	Category		Moderate

Student learning outcomes are said to be complete if they get a minimum score of ≤50 or a minimum in the C- category. If seen from the completeness of student learning outcomes after using the learning e-module, students get a minimum score of 65 or in the B- category, so that it indicates that all students complete 100% with the data are presented in Table 8.

Table 8.Analysis of Learning Outcomes

N	Max Value	Min Value	Range of Values	
			<50	**≥50**
54	94	65	0	54

Disseminate

The dissemination phase is carried out by applying this e-module in the teaching and learning process in the Project Management course. During the dissemination process, students seriously listen to the explanation of the e-learning module. Distribution is also carried out by promoting e-modules at other universities with the same majors as Construction Engineering Education. Moreover, dissemination is carried out by spreading the e-modules through Playstore and social media with the aim to be able to promote a wider scope, so that e-modules can be known and used by more users.

CONCLUSION

This research has produced a mobile-based project-based learning e-module that contains text and images on Project Management subject matter. The e-module consists of several sections, such as the main menu, material page, evaluation page, and others.

Experts state the e-learning module for Project Management courses as valid e-modules with an average rating of media aspects of 0.87, as well as material aspects of 0.83. For the e-module's practicality level, as assessed by subject lecturers, it obtains an average percentage of 100% in the category of Very Practical, and as assessed by students, it obtains an average percentage of 64% which is in the category of Very Practical while 36% is in the Practical category. The e-learning modules produced are also stated to be effective in improving student learning outcomes, which are known from classical judgments that there are differences in students' learning outcomes before and after the use of media in the learning process. In addition, it is also supported by the Gain score calculation, which is worth 0.44 with the moderate category.

Based on conclusions and the results of research that has been feasible and tested, the implication is that this study has produced a project-based learning e-module that can be used in lectures for Project Management courses. The mobile-based e-module is chosen because it is faster and supports more active learning so that students have a high enough ability to be able to provoke direct and independent understanding, interests, and learning experiences. This e-module can be used easily by lecturers and students. The importance of this mobile-based project-based learning e-module for Project Management courses is that the e-module developed can foster creativity, educator innovation in creating a pleasant learning environment, fostering interest and desire of students to study with lecturers' direction and independently.

ACKNOWLEDGMENTS

This research was funded by the Ministry of Research, Technology, and Higher Education. The researchers are very grateful to all the lecturers and students who helped to complete this research.

REFERENCES

Airasian, P. W., Cruikshank, K. A., Mayer, R. E., Pintrich, P. R., Raths, J., & Wittrock, M. C. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's Taxonomy of educational objectives*. (L. W. Anderson & D. R. Krathwohl, Eds.). New York, NY: Longman.

Bukit, M. (2014). *Strategi dan inovasi pendidikan kejuruan: Dari kompetensi ke kompetisi*. Bandung: Alfabeta.

Hermann, M., Pentek, T., & Otto, B. (2016). Design principles for industrie 4.0 scenarios. In *Proceedings of the Annual Hawaii International Conference on System Sciences* (Vol. 2016-March, pp. 3928–3937). IEEE Computer Society. https://doi.org/10.1109/HICSS.2016.488

Irianto, D. (2017). Industry 4.0: The challenges of tomorrow. In *Kongres VIII Badan Penyelenggara Pendidikan Tinggi Teknik Industri Indonesia (BKSTI) - Seminar Nasional Teknik Industri (SNTI) dan Seminar Nasional Terpadu Keilmuan Teknik Industri (SATELIT) 2017*. Malang: Department of Industrial Engineering, Faculty of Engineering, Universitas Brawijaya.

Ministry of Education and Culture. (2014). *Materi pelatihan guru: Implementasi kurikulum 2013 tahun ajaran 2014/2015 - mata pelajaran IPA SMP/MTs*. Jakarta: Ministry of Education and Culture of Republic of Indonesia.

Sani, R. A. (2014). *Pembelajaran saintifik*. Jakarta: Bumi Aksara.

Sugiyono, S. (2014). *Metode penelitian pendidikan pendekatan kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta.

Sumber Daya IPTEK & DIKTI. (2018). Formula 4C untuk bertahan pada era revolusi industri 4.0. *Sumber Daya Iptek Dan Dikti Kemenristekdikti*. Retrieved from http://sumberdaya.ristekdikti.go.id/index.php/2018/05/04/formula-4c-untuk-bertahan-pada-era-revolusi-industri-4-0/

Sung, T. K. (2018). Industry 4.0: A Korea perspective. *Technological Forecasting and Social Change*, *132*(C), 40–45. https://doi.org/10.1016/j.techfore.2017.11.005

Syamsuar, S., & Reflianto, R. (2018). Pendidikan dan tantangan pembelajaran berbasis teknologi informasi di era revolusi industri 4.0. *E-Tech : Jurnal Ilmiah Teknologi Pendidikan*, *6*(2). https://doi.org/10.24036/et.v2i2.101343

Thiagarajan, S., & Others. (1920). *Instructional development for training teachers of exceptional children: A sourcebook*. Washington, DC: National Center for Improvement of Educational Systems (DHEW/OE).

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

Universitas Negeri Padang. (2017). Sistem informasi kurikulum Universitas Negeri Padang. Retrieved from http://kurikulum.unp.ac.id/

Yahya, M. (2018). Era industri 4.0: Tantangan dan peluang perkembangan pendidikan kejuruan Indonesia. In *Inaugural Professorial Speech on Vocational Education*. Makassar: Faculty of Engineering, Universitas Negeri Makassar.