"TYPE SEMUT" AS A TEST MODEL ON ELECTRONIC ENGINEERING TECHNIQUE STUDENTS TO DEALING INDUSTRIAL REVOLUTION 4.0

"TYPE SEMUT" SEBAGAI MODEL UJIAN PADA SISWA TEKNIK ELEKTRONIK INDUSTRI UNTUK MENGHADAPI REVOLUSI INDUSTRI 4.0

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Abstract

The vocational school needs to upgrade the knowledge and expertise in the world of business and industry. This research aimed to know how TYPE SEMUT as a model of Final Examination to electronics industries engineering students in the era of the Industrial Revolution 4.0. This model is an acronym of the (theory, prototype design, embedded systems, assembly, and fault finding). Method of research used is pre experimental design with one-shoot case study. The participants are 15 students class XI and 19 students class XII. For class XI to study the response of DU / DI in practicum program and for class XII to study the response of DU / DI using labor. The result is that students are competent reached 87,3% and the level of satisfaction of DU / DI on the implementation of the TYPE SEMUT achieved an average 80%. This test model can improve the outcomes of skills competency test. The used of the model TYPE SEMUT during final exam in SMK Negeri 1 Tambelangan can increase satisfaction levels DU / DI in employment.

Keywords: *Competence, Industrial revolution 4.0, TYPE SEMUT*

Abstrak

Sekolah kejuruan (SMK) perlu meningkatkan pengetahuan dan keahlian di dunia bisnis dan industri. Penelitian ini bertujuan untuk mengetahui bagaimana TYPE SEMUT sebagai model Ujian Akhir Semester (UAS) pada siswa-siswa program keahlian elektronik industri pada era Revolusi Industri 4.0. Model ini merupakan akronim dari (theory, prototype design, embedded systems, assembly, and fault finding). Metode penelitian yang digunakan adalah desain pre-eksperimental dengan one-shoot case study. Para peserta adalah 15 siswa kelas XI dan 19 siswa kelas XII. Untuk kelas XI untuk mempelajari respon DU/DI dalam program praktikum dan untuk kelas XII untuk mempelajari respon DU/DI menggunakan tenaga kerja. Hasilnya adalah kompetensi siswa mencapai 87,3% dan tingkat kepuasan DU/DI pada pelaksanaan TYPE SEMUT mencapai rata-rata 80%. Model tes ini dapat meningkatkan hasil tes kompetensi kejuruan. Penggunaan model TYPE SEMUT dapat meningkatkan tingkat kepuasan DU/DI dalam pekerjaan.

Kata kunci: *Kompetensi, revolusi industri 4.0, TYPE SEMUT*

INTRODUCTION

The term of Industry 4.0 was first known in Germany in 2011. The German Chancellor Angela Merkel, at the 2015 WEF annual meeting, explains Industrial 4.0 is nothing but integrating the online world with industrial production. In summary, imagine a clever factory in which machines and robots are capable of performing complex tasks, exchanging information, giving each other and taking orders automatically without human involvement [1]. All of these production processes run on the Internet as a primary support. All objects are equipped with sensor-assisted technology devices so that they can communicate themselves with information technology systems.

The smart factory as an industrial product 4.0 barely requires human labor, manpower. Human-powered machines and robots will be present. The industrial wave 4.0 still leaves room for human labor, but this is very limited

only to skilled workers. The more worrying impact, prosperity will only be concentrated on the state or company that is able to present a smart factory [2].

This is whether a threat or an opportunity for vocational school, especially the Competence of Industrial Electronics Expertise. In the world of education, especially vocational school, there is still a digital divide gap and knowledge divide with business world and industry, so vocational school needs to upgrade their knowledge and expertise in business world and industry but there is still business world and industry still do not give opportunity to vocational school to upgrade their knowledge and skill [3]. Called a threat if vocational school, especially the competence of Industrial Electronics expert cannot do upgrading knowledge in DU / DI (Digiware) and called this opportunity because the government has issued an Instruction no.9 year 2016 about vocational school revitalization. So hopefully with the provision of presidential instruction at vocational school in particular Competence of Industrial Electronics Skills into startup Bekraf.

Demography of SMK Negeri 1 Tambelangan is a small vocational school located in Tambelangan Sampang district with hilly conditions where human resources are still below average for the size of vocational school in East Java. In the face of industrial revolution 4.0 SMK Negeri 1 Tambelangan already cooperate with DU / DI that is Digiware especially Competence of Industrial Electronics Expertise, which result of such cooperation is A-UDIK (Arduino for Vocational Education). And also in the cooperation both teachers and students in upgrading his knowledge and his expertise to face the era of industrial revolution 4.0.

PROBLEM

Since the revolution of the industrial revolution era 4.0 has been very influential on SMK Negeri 1 Tambelangan, where the potential of Industrial Electronics Competency Competence in the last 3 years (2011-2014) gradually began to decrease

both in terms of the number of new students and the competence of graduate students. When viewed from the competence of graduated students have been standardized by DIT PSMK (Directorate of Training and Technical Education) as stakeholders, but the competence of Industrial Electronics graduates SMK Negeri 1 Tambelangan in the last 3 years (2011-2014) of 70% has not been absorbed in the world of work in accordance with its competence.

Conditions like the above may not only our schools as well as other vocational schools also face the same problem. A direct observation conducted in SMK Negeri 1 Tambelangan on competence of industrial electronics skill turned out to lead to the evaluation of students who need improvement in providing an evaluation, especially at the final exam Semester. From the above explanation then how *TYPE SEMUT* as a model of final exam of vocational school competence on students that expertise Industrial Electronics Engineering in the era of industrial revolution 4.0?

STUDY OF LITERATURE
A. Four Principles of Industrial Revolution Design 4.0

According [4] there are four design principles in industry 4.0. These principles support companies in identifying and implementing industry 4.0.

1. *Interoperability*, the ability of machines, devices, sensors, and people to connect and communicate with each other through Internet of Things (IoT)
2. Dis*closure of information*, the ability of information systems to create virtual copies of the physical world by enriching the digital plant model with sensor data. This requires the aggregation of raw sensor data for higher-value context information.
3. *Technical assistance*, first, the ability of the support system to support humans by combining and visualizing comprehensibly information to make decisions and solve immediate

problems in a short time. Secondly, the physical cyber-physical system's ability to support humans by performing various tasks is fun, too tiring, or unsafe for their human colleagues.

4. *Decentralized*, decisions: the ability of cyber-physical systems to make their own decisions and perform their tasks as autonomous as possible. Only in the case of exclusion, interference, or conflicting objectives, the task is delegated to a higher level.

B. TYPE SEMUT Evaluation

Evaluation of student learning outcomes conducted through skills competence test (UKK) both theory and practice [5]. To evaluate student learning outcomes SMK vocational practice involves the business world / industry / professional association relevant to the competence of expertise. The results of the evaluation of the learning outcomes are shown by competence certificates issued by the business world / industry / institutional partner or professional association relevant to the competency of expertise.

From the above explanation it is clear that in doing an evaluation of learning outcomes required theory and practice for vocational students [6], but it is implemented only at the final evaluation or in other words only done at the end of class XII or also called competency skill test. For class X and class XI do not perform competency test but only do theoretical evaluation only.

With the industrial revolution 4.0 which can be a threat and opportunity for all SMK in Indonesia especially SMK Negeri 1 Tambelangan with the competence of Industrial Electronics expertise, **TYPE SEMUT** is a new model test of final exam for electronic engineering expertise. **TYPE SEMUT** is an acronym of (**TheorY**, **P**rototype d**E**sign, embedded **S**yst**E**m, asse**M**bly, and fa**UlT** finding). Explanation of the model as follows:

1. *Theory*: Problem theory is of multiple choice with the number of questions 50 for classes XI and XII, and 40 questions for class X which has a duration of 60 minutes, which is the maximum value of 10%. Problem theory is a combination of some basic competencies in accordance with the class where previously there has been an agreement from some vocational teachers Industrial Engineering Electronics in making the problem.

2. *Prototype Design*: Problem in the form of full practice where in question given some electronic components to be made a prototypeElectronic design that is useful for society or DU/DI. In the prototype design will have to be titled and also the form of electronics design is practiced on a breadboard. Maximum weight of 30%. For the assessment of prototype design in the form [7]:

   a. Electronic drawing design
   b. Giving the name of the series so that the usefulness for the community and business / industry more clear.
   c. List of components used
   d. The circuit on the breadboard is neat and works when given a DC voltage Duration of work for 240 minutes, the above provisions apply to all classes. What distinguishes each class is only the number of components it provides: Class X: at least 5 components and a maximum of 10 components of the electronics provided
   1) Class XI: minimum 8 components and maximum 15 electronic components provided.
   2) Class XII: minimum 10 and maximum 20 electronic components provided.

3. *Embedded System*: Problem embedded system in the form of a microcontroller program design in the form of flowchart, programming

algorithm and source code writing [9]. For class X only in the form of flowchart, programming algorithm and writing source code but not tested to microcontroller. For class XI same as class X but tested to microcontroller, while microcontroller used is microcontroller ATMega 16. As for class XII is almost same with class XI but that distinguish is microcontroller used is Genuino 101 and all use of microcontroller that according to industry standard that is digiware. For the maximum weight of this problem is 20%. Duration of the workman for 180 minutes.

4. *Assembly*: Assembly is a matter of assembling electronics automation system that the level of complexity ranging from simple to complex, for the matter of Assembly class X is a matter of simple electronics automation systems (sensors and actuators). For class XI is about electronically complex automation systems (sensors, actuators, electropneumatics and IoT). While for class XII is a matter of complex electronic automation systems (sensors, actuators, electropneumatics, IoT and PLC). The maximum weight for this problem is 30% with the duration of the process for 360 minutes.

5. *Fault Finding*: is a continuation of Assembly problem which will be the measurement in every point of electronics automation system, its measurement is using avometer, Osciloscope, AVG or other electronic measurement tools. After the measurement is continued in the form of repair and maintenance of electronic automation system which previously given the case or problem. For a maximum weight of this problem of 10% with a duration of workmanship for 180 minutes.

RESEARCH METHOD

Research method used is pre experimental design with one-shoot case study [10]. The design of this study there is a group treated (treatment) and then observed the results (treatment is as independent variables and the result is as a dependent variable). In this experiment the subject is presented with some type of treatment and then measured the results.

$$X \qquad O$$
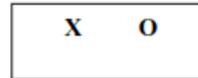
Explanation:
X = Treatment (variabel independen)
O = Observation (variabel dependen)

The subjects of this study include classes X, XI and XII in which the number of students at class X numbered 15 Students, Class XI amounted to 15 Students and Class XII amounted to 19 students. The dependent variable in the study is the student's learning outcome while the independent variable is TYPE SEMUT. Data analysis techniques to meet the requirements of good and correct test we do the validity,

$$r_{pbi} = \frac{M_p - M_t}{s_t} \sqrt{\frac{p}{q}}$$

Reliabel,

$$r_{11} = \left(\frac{k}{k-1}\right)\left(\frac{s^2 - \sum pq}{s^2}\right)$$

Difficulty level

$$P = \frac{B}{JS}$$

As well as distinguishing matter

$$D = \frac{BA}{JA} - \frac{BB}{JB}$$

As a final-stage analysis we used the normality and t-test. H0 accepted if the student learning outcomes using the type of ant is smaller or equal to minimum criteria of mastery learning (KKM) and if Ha accepted if there are changes in student learning outcomes using the type of ant is greater than the KKM.

RESULT AND DISCUSSION

TYPE SEMUT is done at the final exam semester on semester year 2015/2016. The subjects of this research are students of SMK Negeri 1 Tambelangan with Competence of Industrial Electronics Engineering class X, XI and XII. The number of students of class X number 15 students, class XI number 15 Students and class XII a number of 19 Students. TYPE SEMUT model used in all classes to see the students competence in facing UAS (Final Exam Semester), and want to know the response directly from Business World / Industry. For class X as preparation to field practicum, while for class XI to know the response of DU / DI in field practicum program and for class XII to know response of DU / DI which use labor from SMKN 1 Tambelangan specially Industrial Electronics Technique.

A. Student Competency Level

Since the introduction of TYPE SEMUT model in Industrial Electronics Technique gradually increased this can be seen the value of the final exam of Class X and Class XI and Test Competency skills (UKK). At the time of Skill Competency Test SMK Negeri 1 Tambelangan do the assessment by DU / DI that is Digiware.

Table 2. One-Sample Kolmogorov-Smirnov Test

		Hasil Belajar X
N		15
Normal Parametersa,b	Mean	81,8333
	Std. Deviation	4,31205
Most Extreme Differences	Absolute	,164
	Positive	164
	Negative	-,160
Test Statistic		,164
Asymp. Sig. (2-tailed)		,200c,d

a. Test distribution is Normal.
b. Calculated from data.
c. Lilliefors Significance Correction.
d. This is a lower bound of the true significance.

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From those above table data obtained that the normality test of the learning outcomes of students of class X, XI and XII Sig. (2-tailed) > 0.05. Where class X, XI and XII normality test value is 0.200 which is greater than 0.05. The T-Test results are as follows:

Table 4. One-Sample Statistic

	N	Mean	Std. Deviation	Std. Error Mean
Hasil Belajar X	15	81,8333	4,31205	1,11337
Hasil Belajar XI	15	76,73667	7,49663	1,93562
Hasil Belajar XII	19	81,20526	4,20839	,96547

a. Test distribution is Normal.

b. Calculated from data.

c. Lilliefors Significance Correction.

d. This is a lower bound of the true significance.

KKM Competency test of students for all classes of 75, and the result for class XII is 95% of competent students, class XI of 67% of competent. while the class X of 100% of students so that the average level of students' competency ranging from class XII to class X is 87.3%

Table 5. One Sample-Test

	Test Value = 0					
	t	df	Sig. (2.tailed)	Mean Differences	95% Confidence Interval of the Difference	
					Lower	Upper
Hasil Belajar X	73,501	14	,000	81,83333	79,4454	84,2213
Hasil Belajar XI	39,644	14	,000	76,73667	72,5852	80,8882
Hasil Belajar XII	84,110	18	,000	81,20526	79,1769	83,2336

Based on the above table results Sig (2-tailed) value of 0.000 <0.05, it can be concluded H0 rejected Ha received.
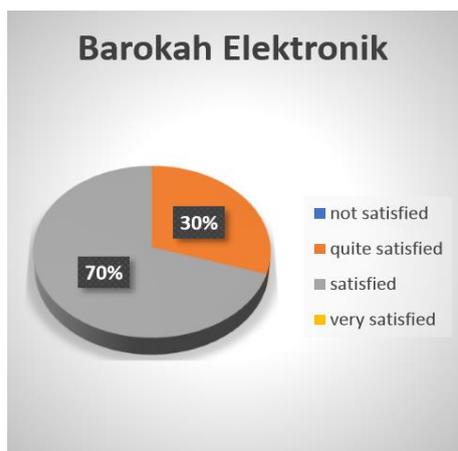
While for the level of satisfaction of DU/ DI of Industrial Electronic Engineering Graduates can be seen from the chart below.

Figure 1. Graph of DU / DI PT Wilmar Nabati Indonesia
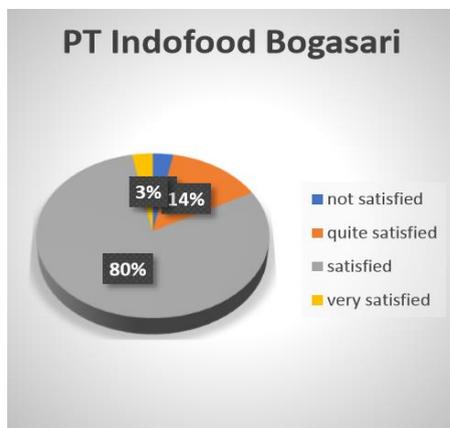
Figure 2. The graph of DU/ DI PT Indofood Bogasari

Figure 3. The graph of DU/ DI PT Barokah Eloektornik

Those diagram showed that the biggest percentage of DU/DI of PT Wilmar Nabati, PT Indofood Bogasari, and PT Nipsea Paint and Chemicals which related to industrial Electronic Engineering employment is quite satisfied. The second percentage is satisfied, the third is very satisfied and the last is not satisfied.

The *TYPE SEMUT* seemed like can be a new model test to evaluate students' competence and skill. However, it may need some evaluation and development on the model so the result of DU / DI can be increased also. The percentage of very satisfied result can be received more.

CONCLUSION AND AUTHOR'S EXPECTATIONS

From the discussion and solution it can be concluded that:

1. The use of *TYPE SEMUT* model at the end of Electronics Industrial Students at SMK Negeri 1 Tambelangan can improve the results of Competency Test Expertise

2. The use of *TYPE SEMUT* model at the end of Electronics Industrial Student at SMK Negeri 1 Tambelangan can Increase the level of satisfaction DU / DI in employment

The *TYPE SEMUT* model at the Final Exam Semester is expected to provide quality. Improvement graduates of Industrial Electronics Engineering for all Indonesia. The use of the *TYPE SEMUT* model is only limited to the competence of Industrial Electronics or cognate technics. It is expected that the model of *TYPE SEMUT* can be developed on other competencies so that vocational school is ready to face Industrial Revolution 4.0 especially Industrial Electronics Technique.

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