# Vocational High School Readiness for Applying Curriculum

# Outcome Based Education (OBE) in Industrial 4.0 Era

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**Abstract**

This study is a curriculum relevance study of the Vocational High Schools (VHS) Curriculum 2013 on the implementation and impact of graduates in the workforce in the Industrial 4.0 era. The population is the teachers of VHS in Jakarta-Indonesia, who teach productive groups in the fields of Machining and Automotive expertise. Using purposive sampling obtained 193 respondents. The data were collected using an instrument that consists of indicators include 4 criteria, that is (1) Graduate Competency Orientation, (2) Learning Implementation, (3) Expected Learning Outcomes Assessment, and (4) Continuous Improvement. The results of the study can be concluded as follows (1) Graduate Competency Orientation criteria, showing 87% of respondents think the competency of VHS graduates using the "very high" and "high. (2) Learning Implementation criteria describe the suitability of the results of "very high" and "high" of 88.6%. (3) The Expected Learning Outcomes Assessment criteria are illustrated as "very high" and "high" categories of 90.7%. (4) The Continuous Improvement criteria describe that there are categories of "very high" and "high" obtained by 92.8%. (5) Aggregat OBE criteria obtained a description that the category of "very high" and "high" of 94.8%. The results of this study can be concluded that the Vocational High School (VHS) Curriculum 2013 is in accordance with the OBE criteria in the Industrial 4.0 era in the State and Private Vocational High Schools in the Jakarta-Indonesia environment.

*Keywords:* First Outcome Based Education; Industrial 4.0 era and VHS Curriculum 2013

## 1. Introduction

Currently in Indonesia there are formal vocational education institutions called Vocational High Schools (VHS) of 13,710 (Statistics Data for Vocational Schools 2017/2018) which include public and private education units, consisting of various groups

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of expertise. In addition there are also vocational non-formal education units called the Institute of Courses and Training of 16,000 with various fields of expertise. The education unit has the same goal that is to provide skilled workers in accordance with the competencies in their fields of expertise.

Labor data shows that only 23% of graduates at the senior secondary level can be absorbed in the workforce. There are more than 77% who are not absorbed due to various reasons, including incompatibility with their field of work and most because they do not have the competency in accordance with the formation of expertise required.

Vocational High Schools which are part of the education unit that prepares skilled workers for the business world and the industrial world, should always innovate to adjust to their main objectives. The development of an increasingly complex era, of course must be a thought of change that is continuously carried out by vocational education units. The ability to adapt to this education unit is demonstrated by the outcomes of graduates who occupy suitable job formations and are even able to open new jobs.

Now it has entered the era of Industry 4.0 which has a different character from the previous period. The digital age encompasses all jobs in the Industrial 4.0 era. Disruption is happening to workers who are unable to adapt to the developing digital technology at this time, even many workers have been replaced by robotic machines that have the ability to include accuracy, precision, speed, free working hours, and free from social and humanitarian problems. Although this does not mean that robot machines do not have flaws or weaknesses, this gap should be filled by human resources (HR) who have adequate competence. Industrial 4.0 that can not be avoided can be anticipated by continuing to improve the capacity of human resources with a variety of things that are not owned by robot machines. Digital mastery becomes the main thing, the utilization of data systems owned by digital systems called "big data ", and other information based on information technology.

Vocational readiness resources at stake with all daring late to change the educational paradigm that is more open to adapt to the Industry 4.0 era. The education curriculum becomes part of the education process that must adapt to the development of the Industrial 4.0 era, being the key to structured change, becoming the pulse of education towards success in preparing the nation's children to face future changes.

Outcome Based Education (OBE) is one model of education that is currently widely used in universities to achieve the learning outcomes (LO) graduates, have a future himself in accordance with the field of interest and usefulness in society. The OBE model is expected to have a positive impact in preparing graduates in accordance with the Industrial 4.0 era. This also has an impact on curriculum changes, assessment systems, learning patterns, and the involvement of many stakeholders in networking to prepare the nation's young generation.

This study wants to see (1) the VHS Curriculum 2013 in accordance with the OBE model criteria, (2) the relevance of the VHS Curriculum 2013 to the readiness of Human Resources in the Industrial 4.0 era, and (3) The existence of the VHS Curriculum 2013 is in line with the Industrial 4.0 era. The output of this research is expected to be a consideration for policy makers in determining adjustments to the VHS curriculum which graduates outcomes enter in the Industrial 4.0 era.

Outcomes Based Education (OBE) is a process that involves the practice of assessment and evaluation in education to reflect the expected learning achievements and show mastery in the field of the program. OBE can be regarded as an education that achieves predetermined tangible results that includes results-oriented knowledge, abilities and behavior. OBE involves curriculum restructuring, assessment and practice that reflects learning achievement and mastery levels from the accumulation of the educational process.

OBE focuses on student learning by (1) Using statements of learning outcomes to make explicit what is expected to be known, understood or done by students; (2) Provides learning activities that will help students to achieve this result; and (3) Assessing the extent to which students meet these results through the use of explicit assessment criteria.

Following is the comparison between Input-Output Based Education and Outcome Based Education.
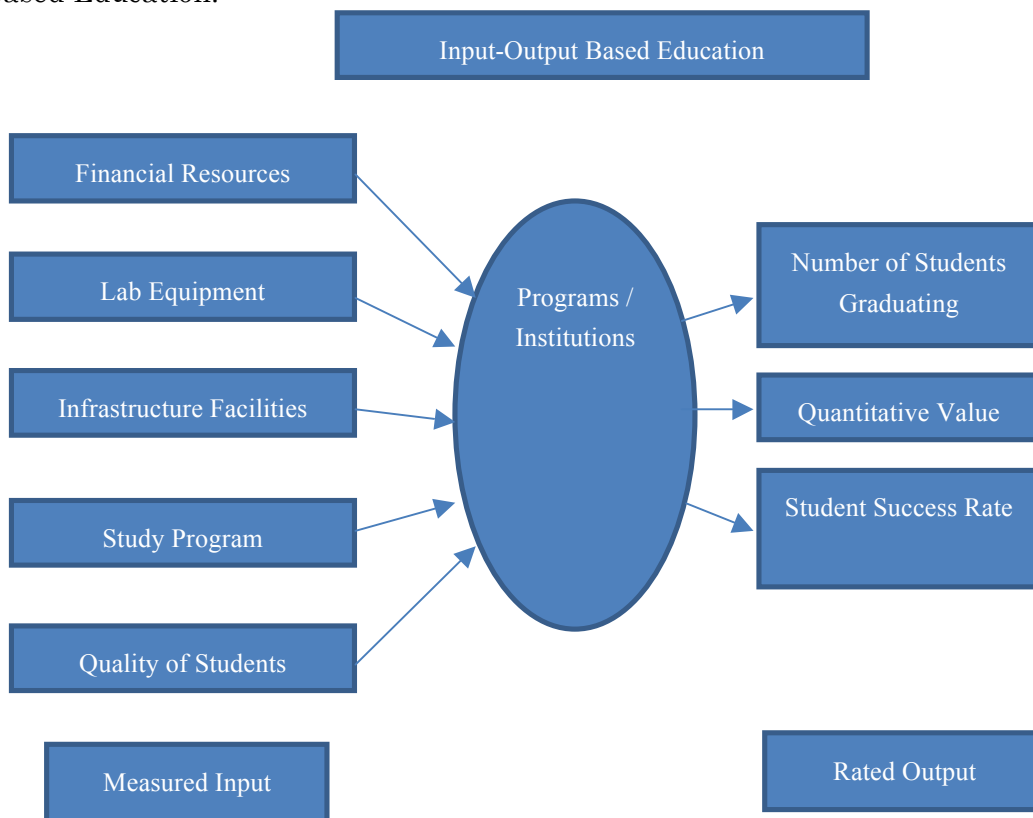
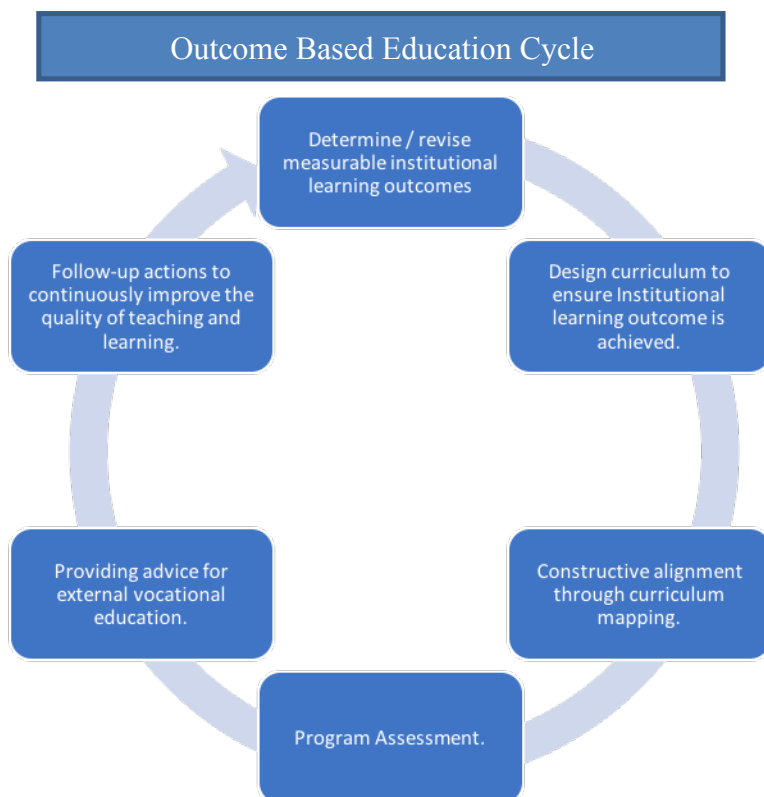Figure 1. Input and Output Based Education



Figure 2. Outcome Based Education

Industry 4.0 is the name of the latest automation and data exchange trends in manufacturing technology. This term includes the cyber-physical system, the internet for everything, cloud computing, and cognitive computing (https://id.wikipedia.org/wiki/Industri_4.0 #cite_note-2). In general, the definition of an industrial revolution is when major technological advancements are accompanied by significant socio-economic and cultural changes. The industrial revolution 4.0 is in sight, Indonesia is no exception. Since our president, Joko Widodo, inaugurated a roadmap called "Making Indonesia 4.0", this topic has become a subject of discussion in various sections of the community.

The concept of the Industrial Revolution 4.0 is a concept that was first introduced by Professor Klaus Schwab. He is a well-known economist from Germany as well as the originator of the World Economic Forum (WEF), which through his book, The Fourth

Industrial Revolution, states that the Industrial Revolution 4.0 can fundamentally change the way we live, work and relate to one another.

This computer-based automation system made industrial machines no longer human-controlled, beginning in 2018 until now the Industrial Revolution 4.0. Industry 4.0 is an industry that combines automation technology with cyber technology. This is a trend of automation and data exchange in manufacturing technology. In this era, industry began to touch the virtual world, in the form of human, machine and data connectivity, all of which were everywhere. This term is known as the Internet of Things (IoT).

The curriculum is a tool to achieve educational goals, as well as a guide in implementing education. The curriculum developed with the national scope in a country reflects the philosophy of life of the nation, in which direction and how the life forms of a nation will be determined by the curriculum used by the nation today. The curriculum can plan the expected educational or teaching outcomes because it can show what needs to be done and what activities must be experienced by students. Educational outcomes can sometimes not be known immediately or after students complete an education program. Curriculum reform must be done immediately because there is no suitable curriculum of all time. The curriculum must be able to adjust to the changing times. In the process, the curriculum undergoes changes that always follow the times to lead to a better life for humans.

Curriculum development is a process that runs through different stages and is carried out after each specified period. All educational institutions regardless of type, origin and size must consider: (1) environmental variables around the institution; (2) pedagogical strategies that will be used to carry out learning and teaching activities that are considered in the curriculum; (3) competencies to be developed; and (4) leadership of educational institutions needed.

Curriculum development with an integrative approach is a curriculum that balances cognitive aspects (understanding concepts and theories), aspects of attitudes and psychomotor aspects, which are obtained from co-curricular or extracurricular with various strategies used to improve student soft skills and hard skills. Curriculum development aims to improve student abilities in learning and socializing. The change in curriculum is expected to be able to increase the learning opportunities of students, that is increasing planned and controlled relationships between students, teachers, materials, equipment, and the environment in which students learn.

The learning material in the integrated curriculum is actual according to the development and needs of the community and students as whole individuals so that it can be functionally useful and will be able to improve student ability to learn (Hadijaya, 2015: 310). To implement an integrative curriculum, teachers must have the ability to implement a variety of teaching and learning strategies. Finally, curriculum evaluation as a component in decision making is very useful for developing educational programs

(Hadijaya, 2015: 280). The achievements that the teachers want to produce in this curriculum are the cognitive, affective, and psychomotor domains, which certainly cannot be separated from one another to improve students soft skills and hard skills.

## 2. Method

This research was conducted at the Vocational High School (VHS) in Jakarta-Indonesia, from April to September 2019. The research was carried out using the Outcome Based Education (OBE) Model. Data collected using instruments. The instrument consists of 75 statements with 4 (four) alternative answer choices. The instrument was used to obtain data on the implementation of the VHS Curriculum 2013 in public and private schools based on the OBE model criteria in dealing with the Industrial 4.0. The instrument includes 4 criteria, that is (1) Graduate Competency Orientation, (2) Implementation of Learning, (3) Expected Learning Outcomes Assessment, and (4) Continuous Improvement.

Sources of data in this study are teachers who teach productive group subjects in the field of Machining and Automotive expertise. Information that is expected is information about the suitability of the implementation of the VHS Curriculum 2013 to the application of OBE criteria and the current curriculum readiness to anticipate Industrial 4.0 era.

The research instrument used has been tested for reliability and validity. A reliability test is needed to show the extent to which a measuring device can be trusted or reliable or show the consistency of a measuring device in measuring the same symptoms. Validity test is done to measure the validity or validity of a questionnaire, carried out using the content validity approach using R Test statistics and analyse using quantitative descriptive.

Success criteria used are based on ideal criteria. The ideal criteria if the score (X) meets the following Table 1:

Table 1. Ideal criteria

| Score (X) | Category |
|---|---|
| X ≥ Mi + 1.5 SDi | Very high |
| Mi + 0.5 SDi ≤ X <Mi + 1.5 SDi | High |
| Mi - 0.5 SDi ≤ X <Mi + 0.5 SDi | Medium |
| Mi - 1,5 SDi ≤ X <Mi - 0.5 SDi | Low |
| X <Mi - 1.5 SDi | Very low |

Information:
Mi: The average is ideal
SDi: Ideal standard deviation

The study was conducted in the Jakarta-Indonesia involving 193 respondents consisting of Teachers who were divided into 61 Teachers from State Vocational Schools and 132 Teachers from Private Vocational Schools

## 3. Results

In this study the data will be divided into two major groups, that is the State VHS and Private VHS. This is intended to see whether there are similarities between the two groups, so that the VHS which is the object of research has the same characteristics of the teaching and learning process and the quality of teacher capacity in managing curriculum. The instruments are grouped into 4 (four) criteria, that is (1) Graduate Competency Orientation, (2) Learning Implementation, (3) Expected Learning Outcomes Assessment, and (4) Continuous Improvement. The results of data acquisition through a questionnaire for each criterion are as follows.

### 3.1. Graduate Competency Orientation Criteria

Retrieval of data on the criteria of graduate competency orientation is divided into several sub-variables and several indicators, sub-variables and indicators referred to are as follows:

Sub-variable data includes 3 (three) aspects, that is (1) Graduate Profile, (2) Formation Profile, and (3) Competency of learning outcomes, this aspect includes 10 sub aspects, that is (a) mathematical ability, (b) Ability utilize the potential of engineering resources, (c) the ability to analyze technical problems, (d) the ability to solve engineering problems, (e) the ability to engineer skills, (f) the ability to communicate effectively, (g) the ability to plan, complete and evaluate engineering tasks, (h) Ability to work in multidisciplinary and multicultural teams, (i) Ability to comply responsibly, and (j) Ability to continue learning.

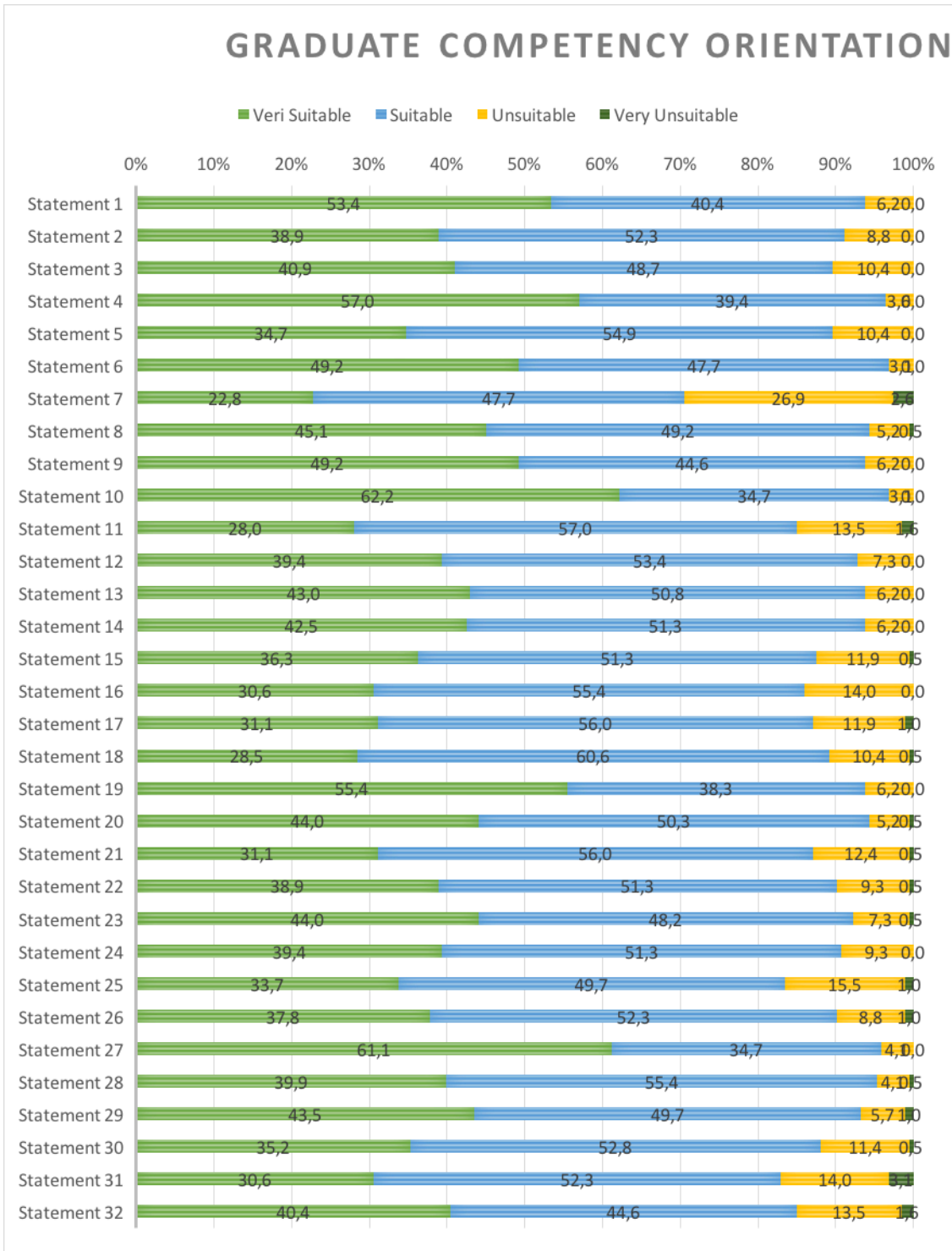The results of the data obtained from the questionnaire as in Figure 3.

Figure 3. Alternative Graph of Respondents Answers for Public and Private
Vocational High School of Graduate Competency Orientation Criteria

## 3.2. Learning Implementation Criteria

Learning Implementation Criteria include 5 (five) aspects, that is (1) Curriculum, (2) Managers, (3) Student and Academic Atmosphere, (4) Facilities, and (5) School Responsibilities. All 37 questionnaire items are part of the sub-5 (five) aspects.

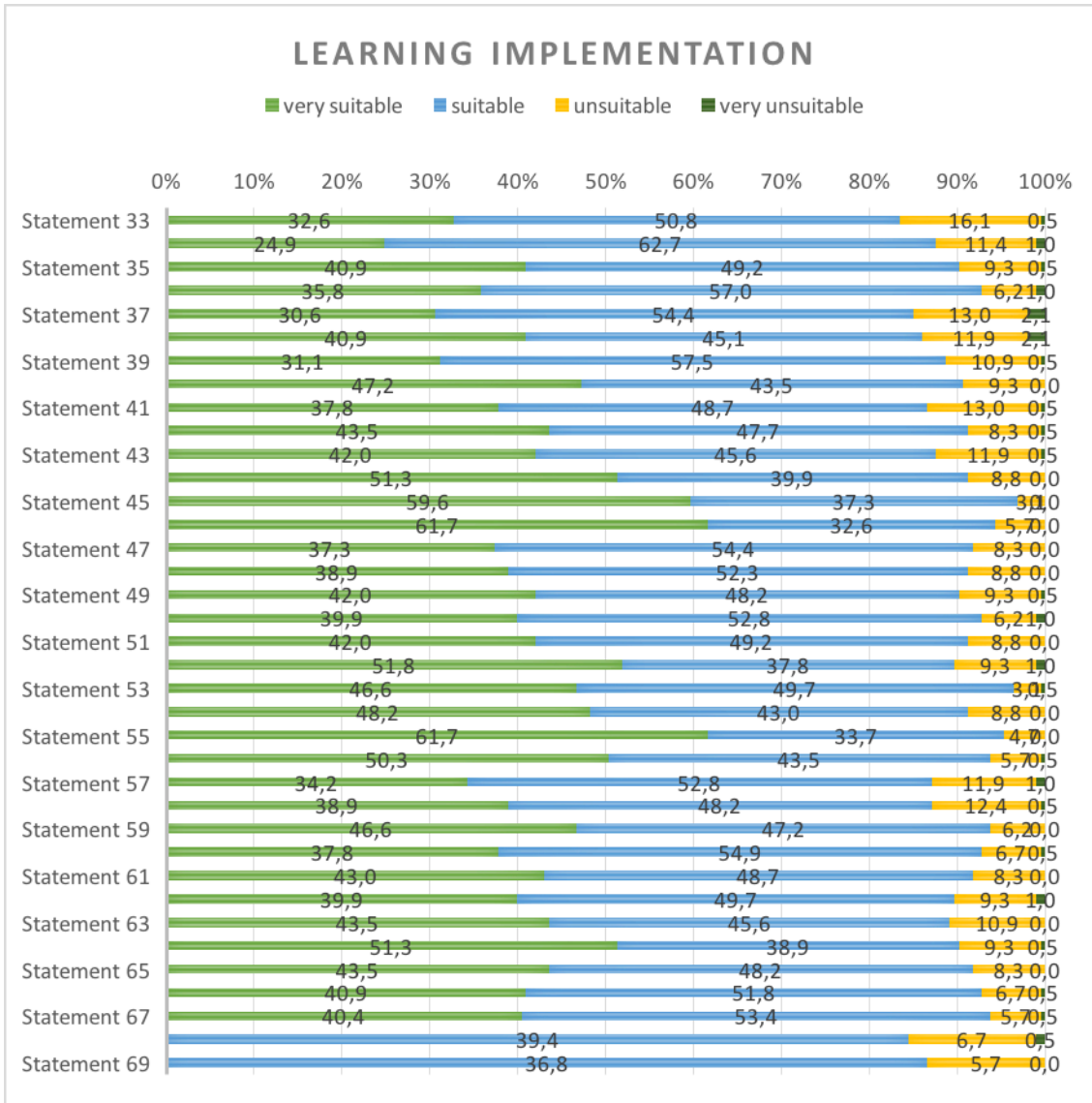The results of the data are captured through a questionnaire, as in Figure 4.



Figure 4. Alternative Graph of Respondents Answers for Public and Private
Vocational High School of Learning Implementation Criteria

### 3.3. Expected Learning Outcomes Assessment Criteria

The data measured and analyzed on the criteria for the Expected Learning Outcomes Assessment are taken through a questionnaire obtained from 2 (two) aspects, that is (1) Assessment based on the specified performance indicators, and (2) Graduates have achieved the expected learning outcomes. These two aspects include 3 (three) statement items. The results obtained are as in Figure 5.
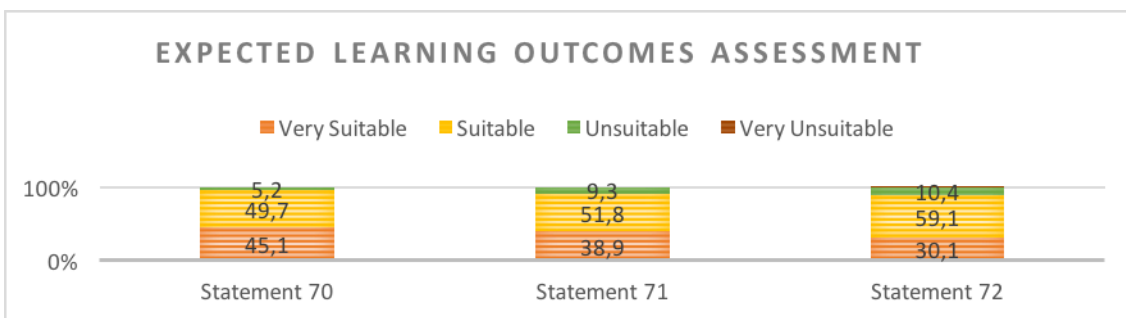


Figure 5.  Alternative Graph of Respondents Answers for Public and Private

Vocational High School of Expected Learning Outcomes Assessment Criteria

### 3.4. Continuous Improvement Criteria

For Data measured and analyzed on the Continuous Improvement criteria were captured through a questionnaire consisting of 2 (two) aspects, that is (1) the program was improved based on the results of the evaluation, and (2) the program was developed based on documented data. This criterion includes 3 (three) statement items. Data obtained as in Figure 6.
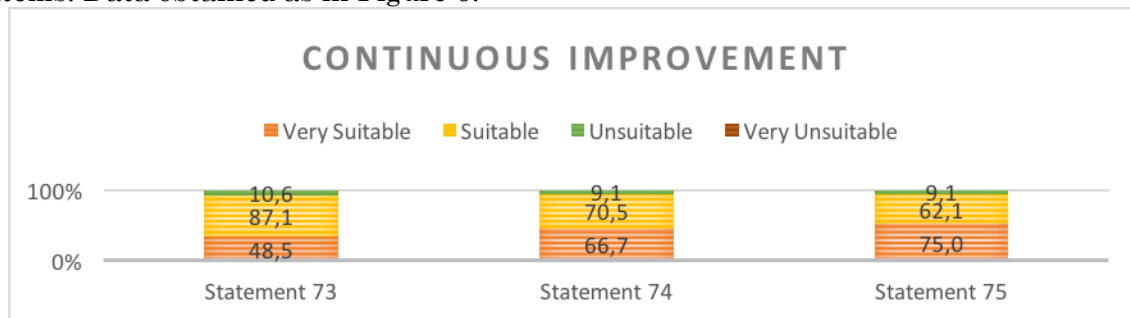


Figure 6. Alternative Graph of Respondents Answers for Public and Private
Vocational High School of Continuous Improvement Criteria

## 4. Discussion

Research which is a form of evaluation of teaching and learning process, is there a conformity with the concept of the outcomes based education (OBE) model, so that this research can establish a learning approach to the curriculum currently used, whether it can still be continued or corrected, revised or restructured the curriculum.

By using 4 (four) criteria that is (1) Graduate Competency Orientation, (2) Learning Implementation, (3) Expected Learning Outcomes Assessment, and (4) Continuous Improvement, the data collection results can be described as follows:

*4.1. Graduate Orientation Competency Criteria*

The number of items in the questionnaire consisted of 32 statements with 4 (four) alternative answers with a score range of 1 (one) to 4 (four). With category restrictions, the results of the study can be described as shown in Figure 7.
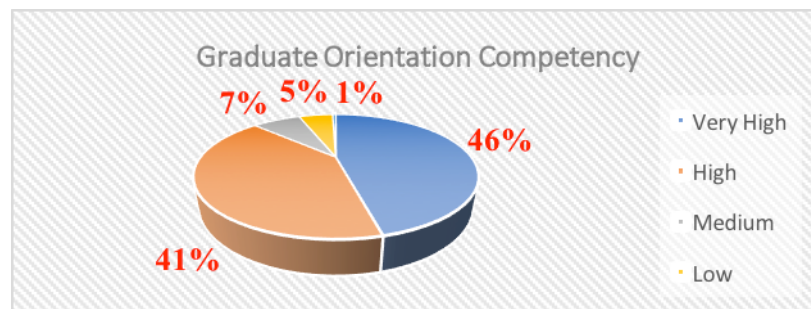


Figure 7. Graph Based on the Range Scores of Graduate Orientation

Competency Criteria

Figure 7 can be explained that the highest frequency is in the category of "very high" with the acquisition of 89 respondents (46.1%), "high" obtained from 79 respondents (40.9%), "medium" obtained from 14 respondents (7.3 %), "low" category is obtained by 10 respondents (5.2%) and "very low" is obtained by 1 respondent (0.5%). Of the 193 responses obtained by the results of the categories "very high" and "high" that is 178 respondents (87%), which can be interpreted that the respondent believes that the Graduates Competency Orientation criteria meet the indicators of OBE model which is currently needed to fill in the formation of jobs in the machining and automotive industries at the Industrial 4.0.

*4.2. Learning Implementation Criteria*

The questionnaire for the Learning Implementation criteria consisted of 37 statements with 4 (four) alternative answers with a score of 1 to 4. With category restrictions, the results of the study can be described as shown in Figure 8
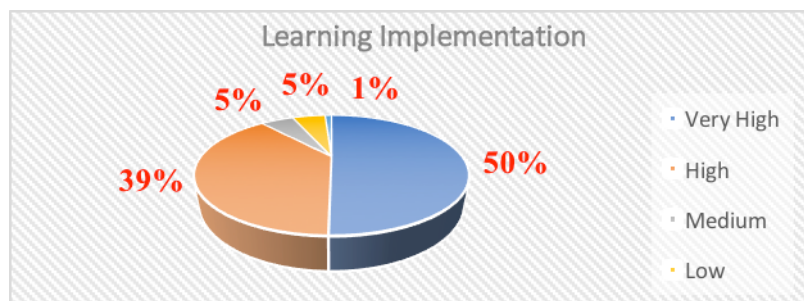


Figure 8. Graph Based on Range Scores of Learning Implementation Criteria

Figure 8, is described as follows: the highest frequency is the "very high" category with a frequency of 97 respondents (50.3%). "High" category with 74 respondents (38.3%). "Medium" category with a frequency of 10 respondents (5.2%), "low" category with a frequency of 10 respondents (5.2%) and "very low" with a frequency of 2 respondents (1.0%). Aggregat of Learning implementation criteria including the category "very high". This means that 171 of 193 respondents stated that the learning implementation had met the OBE indicators with assessments that were categorized as "very high" and "high". There are 6 (six) statements that received "very low" responses by 193 respondents, that is (1) The teacher understood well the curriculum structure and the interrelationships between subjects; (2) The teacher makes a learning plan in accordance with the applicable curriculum; (3) The learning plan is used by the teacher as a guide in the teaching and learning process; (4) Schools implement learning assessments that guarantee the competency of students in accordance with learning achievements; (5) Schools have a network of collaboration with graduate user institutions; and (6) Schools are developed in collaboration with the industrial world. This shows that the Teacher implemented the VHS Curriculum 2013 in accordance with the curriculum implementation guidelines that is by understanding the applicable curriculum, preparing the Learning Program Plan, using the Learning Program Plan as a guide to implementing the learning process and evaluating the learning process to monitor the absorption of learning and competencies possessed students as planned. The school also established a network of cooperation with the business world and the industrial world for the implementation of industrial practice programs, and the school built networking in preparing its graduates to directly enter the workforce.

*4.3. Expected Learning Outcomes Assessment Criteria*

The Expected Learning Outcomes Assessment Questionnaire consists of 3 statements with 4 (four) alternative answers with a score of 1 to 4. Referring to the category, the research data can be explained by Figure 9
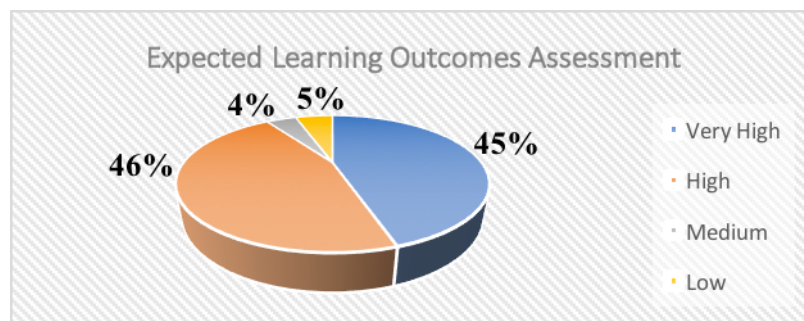


Figure 9. Graph Based on Range Scores of Expected Learning Outcomes Assessment Criteria

Figure 9 can be illustrated as follows: the category of "very high" with a frequency of 98 respondents (45.1%). "High" category with 88 respondents (45.6%). "Medium" category with a frequency of 8 respondents (4.1%), "low" category with a frequency of 10 respondents (5.2%) and none of the respondents chose "very low". The category of the Expected Learning Outcomes Assessment criteria as a whole was "very high". This means that of 193 respondents stated that the implementation of learning has met the indicators of outcome base education. There are 3 (three) statements that received "very appropriate" responses by 193 respondents, that is (1) Assessment of student learning outcomes based on established performance indicators. (2) Student performance appraisal uses methods that are appropriate with the assessment instruments in the industrial world. (3) Graduates are guaranteed in accordance with specified learning outcomes.

*4.4. Continuous Improvement Criteria*

The number of items in the questionnaire on the Continuous Improvement criteria consists of 3 (three) questions with 4 (four) alternative answers with a score range of 1 (one) to 4 (four). With category restrictions, the results of the study can be illustrated as shown in Figure 10.
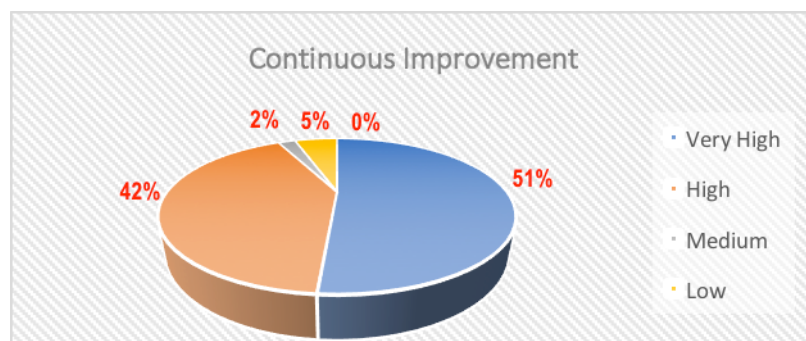
Figure 10. Graph Based on Range Scores of Continuous Improvement Criteria

The data obtained illustrates that the highest frequency is in the category of "very high" with the acquisition of 99 respondents (51.3%), "high" obtained by 80 respondents (41.5%), and "medium" obtained from 4 respondents (2.1 %). The "low" category was obtained by 10 respondents (5.2%), and "very low" none of the respondents voted. Achievement in terms of the criteria for Continuous Improvement can be concluded that the sustainability of the current VHS system is in accordance with the OBE concept and can continue to change due to the development of the industrial and business world at the Industry 4.0 era.

*4.5. Aggregat Criteria*

In total, 4 criteria consisted of 75 statements with 4 (four) alternative answers with a score range of 1 to 4. With category restrictions, the results of the study can be described as shown in Figure 11.
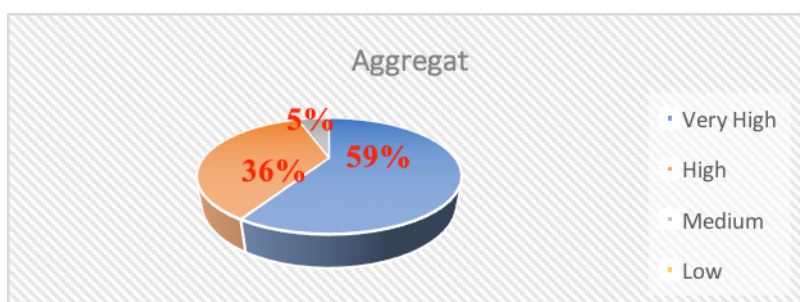


Figure 11. Graph Based on the Range Scores of Aggregat Criteria

The data obtained in Figure 11 illustrates that the highest frequency is in the "very high" category with the acquisition of 113 respondents (58.5%), "high" obtained by 70 respondents (36.3%), and "medium" obtained by 10 respondents (5 , 2%), "low" and "very

low" none of the respondents voted. It can be concluded that the aggregate criteria stated that the VHS curriculum 2013 was in accordance the OBE indicators and the Industry 4.0 indicators for VHS in Indonesia.

## 5. Conclusions

### 5.1. Conclusion

The results of the research and discussion that have been presented, can be concluded as follows:

1.    Graduate Competency Orientation Criteria, the data illustrates that the highest frequency in the "very high" category comes from 89 respondents (46.1%), "high from 79 respondents (40.9%), "medium" from 14 respondents (7.3%), the "low" category of 10 respondents (5.2%) and "very low" of 1 respondent (0.5%). This means that 87% of respondents think that the competency of VHS using the  VHS Curriculum 2013 is of the opinion that they are "very high" and "high" in accordance with the indicators of the OBE models that are currently needed to fill the formation of jobs in the machining and automotive industries at the Industrial 4.0.

2.    Learning Implementation Criteria describe the results as follows: the category of "very high" with a frequency of 97 respondents (50.3%). "High" category with 74 respondents (38.3%). "Medium" category with a frequency of 10 respondents (5.2%), "low" category with a frequency of 10 respondents (5.2%) and "very low" with a frequency of 2 respondents (1.0%). It means that 88.6% (171 of 193 respondents) stated that the Learning Implementation criteria had met the OBE model indicator.

3.    Expected Learning Outcomes Assessment Criteria are illustrated as follows: the "very high" category with a frequency of 98 respondents (45.1%). "High" category with 88 respondents (45.6%). "Medium" category with a frequency of 8 respondents (4.1%), "low" category with a frequency of 10 respondents (5.2%) and one of the respondents chose "very low". It means that 90.7% (186 of 193 respondents) stated that the expected learning outcomes evaluation criteria had met the OBE model indicator.

4.    Continuous Improvement Criteria, the results of the study illustrate that the highest frequency is in the "very high" category with the acquisition of 99 respondents (51.3%), "high" 80 respondents (41.5%), and "medium" obtained from 4 respondents (2.1%). The "low" category was obtained by 10 respondents (5.2%), and "very low" none of the respondents voted. This means that 92.8% (179 of 193 respondents) are of the opinion that the criteria for improvement in the sustainability of the current vocational education system are in accordance with the OBE model and can continue to change due to the development of the industrial and business world at the Industrial 4.0.

5.    Aggregat criteria, the outcomes based education (OBE) model obtained a description that the highest frequency is in the category of "very high" with the acquisition of 113 respondents (58.5%), "high" obtained by 70 respondents (36.3%), and "Medium" gained 10 respondents (5.2%), "low" and "very low" none of the respondents voted. The results of this study can be concluded that the VHS Curriculum 2013 is in accordance with the indicators of the OBE models and Industrial 4.0 for VHS in Indonesia.

### 5.2. Suggestions

1.    Research on vocational high school curriculum 2013, this only covers the field of machining and automotive expertise, not as a whole vocational curriculum and not all elements of subjects. Therefore it is necessary to conduct a comprehensive review of the components contained in the curriculum and broader fields not only in the field of Engineering Technology.

2.    Research which includes descriptive correlational research internal to this school, needs to be developed into research involving elements of users of vocational high school graduates who use the VHS Curriculum 2013.

3.    The research area in urban areas, does not include other areas far from the location of the industrial world and the business world, so it is necessary to develop a wider and varied research area.

4.    Ideally this research covers the entire population of types of skills and regions, both those managed by the government (State Vocational High Schools) and those managed by the public (Private Vocational High Schools) so that the relevance of curriculum implementation will be seen, conformity with current needs (Industry 4.0) and educational sustainability relevant (sustainability).

### 5.3. Limitations

This research has been tried as much as possible, but of course there are limitations in this study, that is:

1.    The data sources of this study are teachers in machining and automotive. Not all teachers who teach participate. The limitations of the respondents certainly become part of the limitations of this study.

2.    Time limitations and respondents who cannot be netted as much as possible

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