

Full Length Research Paper

Implementation of mechanical engineering curriculum in school and industry in the 3 and 4 years vocational high school programs (VHS) for the improvement of the quality of graduates to meet the requirement of ASEAN economic community

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In field application, there are various models of Vocational High School (VHS) education based on the period of study, education design in school or industry and competence design. There are 3 year VHS programme, 4 year VHS programme and community college. Vocational education in Indonesia challenges the Asean Economic Community. The appropriate vocational education curriculum either 3 year or 4 year VHS program is outcome-based. Regulation of The Ministry of Education and Culture, No 70/ 2013 on Basis Sketch and Curriculum of Sewer Structures of VHS endorsed the 3 and 4 years VHS programmes. This research, a descriptive research, makes comparison between two independent samples: implementation of the curriculum of mechanical engineering in the 3 and 4 years VHS programmes in school and industry to improve the quality of graduates who major in mechanical engineering at VHS Negeri in Makassar. Most graduates who do 3 years and 4 years VHS programmes lack expertise and are poor in the field, and cannot adapt to the development of science and technology. From the result of this work, it is concluded that there are differences in the implementation of the curriculum of mechanical engineering between in the 3 years and 4 years VHS programmes at school and industry; there are also differences from the students' outcomes in both programmes. So graduates of 4 year VHS program challenge AEC more than the 3-year VHS program graduates.

Key words: Curriculum, 3-year VHS, 4-year VHS, graduate, Asean Economic Community (AEC).

INTRODUCTION

The Ministry of National Education System (MNES) in Indonesia has a unique classification of technological education and training (vocational education and training/VET) that differs from other states. Vocational High School program in Indonesia is run for a period of 4

years instead of 3 years as run by most other nations. There are very few 4 years VHS program in Indonesia, and ideally its study design and competence is different from the 3-year VHS program.

Technological Education and Training (TET) or

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vocational education (VE) is meant to prepare students to be enlisted in the work force. At the basic and mid part of education, VE covers both Vocational High School (VHS) and Vocational Aliyah Madrasah Aliyah (VAM) in Indonesia.

According to the types of government regulation education in Indonesia, the UU No. 20/2003 on National Education System (NES), Section 15 says: "types of education include public education, vocational, academy, professional, special, and religious education". The definition of vocational education implies that participants have to participate actively to be able to fit into the corporate world and industry based on their expertise. The current development in market economics indicates that vocational education and human resource capacity expansion have become a priority in national strategy, politics advancement strategy, and economy and technology. Along with labor market requirement and demand and public request, there has been an increased interest in vocational education and training. 3-year VHS and 4-year VHS are expected to challenge or stand up to meet the standard of the Asean Economic Community (AEC), which started in January 1st 2016.

Jitgarun et al, (2003) expressed that, "the issue of vocational education is teaching things that are not related to the market and/or meeting the requirement of the market ..., and education must build the necessary skills needed for each position at work so that the corporate world and industry can place the right man in the right job ". According to Nurettin ISIK, et al-, 2004, "Vocational Technical Education (VTE) is a process of making an individual adopt to his/her work. A competency is the minimum skill which must be mastered prior to employment at the entry level at work". Vocational education (VE) is an institute that aims to solve this challenge between the industrial individuals and the work force. To do this, VE must motivate students to work in the world of industry.

Education policy written in the 2013 Regulation of the Government about Education National Standard no 32, section 4 expressed that "Competency is a set position, knowledge, and skill which must be owned and mastered by the educative participant after studying a course, ending a program, or finalizing a set of certain education". Regulation of The Ministry of Education and Culture of the Republic of Indonesia, no 70/2013 about bases frame and curriculum structure of Vocational High School (VHS) and Vocational Aliyah Madrasah (VAM) expressed that "2013 curriculum developed was theory "standard-based education" Curriculum based on competency is designed to provide wider learning experiences for students in developing their performance, knowledge, and skills".

The Government Regulation No. 17/ 2010 on Organizer Education in Paragraph 2 of the Set of Education, section 78 of verse 3 expresses that "VHS and VAM consist of 3 class levels: class 10, class 11, and class 12 , or 4 that is

class 10, class 11 , class 12, and class 13, according to the demand of work world". It is interesting to know that the 2013 Regulation of The Ministry of Education and Culture of the Republic of Indonesia, no 70 on the curriculum of sewer structures consisted of 2 types of VHS/VAM: 3-year VHS/VAM and 4-year VHS/VAM. Based on the subjects taught, both types of VHS/VAM are the same, but the differentiating feature is that the 4-year VHS has extra 1 year, in which subjects are taught 48 hours per week. Studies can be completed either in an education setting and/or industry. The 3-year VHS programme is executed at class XII while the the 4-year VHS programme, at class XIII.

Vocational education in Indonesia is challenging; it has enough weight to face the free market challenge for the year 2020. For this purpose, vocational education must prepare competent labour that can compete with the labour market outside. This thing is the application consequence of Asean Free Labour Association (AFLA) and Asean Economic Community (AEC). The low level of interest, differences in interest in every area of specialization and relevance of graduation can be made reference to in evaluating and reflecting the level of competition and relevance of study, in the 3-year and 4-year VHS programmes. The most important skill needed by every student or an individual is to face the challenge of the rapid technological development.

The 2005 Regulation of the Government, no 19 about MNES amended into the 2013 Regulation of the Government, no 32, section 26 of article 3 expresses that "Competency standard created for graduates of mid vocational education aims to improve students' intelligence, knowledge, personality, good behavior, and skills; to be self-supportive and further education in their vocational field". Based on the regulation of the government, the conclusion drawn is that there are 3 important aspects of vocational education: work competence aspect (form of knowledge and skill), vocational character aspect (form of personality of work and harmonious balance life between humanities, environmental and religion) and development aspect of career through vocational education.

The right curriculum for good vocational education of the 3-year and 4-year VHS must be "outcomes-based curriculum". The curriculum should be expanded to attain its educational goals based on Graduate Competency Standard (GCS). Also the assessment result of learning and curriculum should be measured based on the attainment of competency (Ministry of Education and Culture December, 2012).

From the aspect of programme competency approach, the 4-year VHS programme ought to be efficient than the 3-year VHS programme because of the one year difference between them. Also the 4-year VHS programme has excellence in the area of practical work because this is done during the extra 1 year period. Duration of study has great effect; the students doing the

4-year VHS programme have more competency than those doing the 3 years programme.

They can even match up with diploma 1 students. So this research emphasizes the implementation of the mechanical engineering curriculum in the 3-year and 4-year VHS programmes at school and industry to improve the quality of graduates to meet up with the standard and demand of the Asean Economic Community (AEC) in Makassar - South Sulawesi. Based on this background, this work compares the two year periods (3 and 4 years) in which the curriculum of mechanical engineering was implanted at school and industry to improve the quality of graduates.

Theory frame

Vocational education is the education that prepares students for employment in the world of industry based on their qualifications and it gives students the opportunity to develop their self-potency. Vocational education enhances students' self-potency based on their area of interest. Thus, the purpose of the management of education in VHS is to increase students' skill, knowledge, prepare them as skillful middle floor labour, make them educated and professional, and develop them in science, technology and art. Djonegoro (1998) gives the importance of skilled manpower in goods production and service; it plays a major role in determining the level of quality, production cost, supports the growth of industrialization in state, and makes skillful labour excellent in global competition.

Vocational education curriculum

With uncountable opinions about the curriculum, it is theoretically more difficult to determine one opinion that can cover diverse opinions. But, having the fundamental understanding of the curriculum is very important. In the document of 2013 curriculum, Ministry of Education and Culture (2012:2) expresses that "conceptually, curriculum is education response to the requirement of the public and nation in building the rising generation of the nation". Riyanto (2009) in his study, on the expansion of curriculum, says:

"A curriculum is a plan for learning". He defined curriculum as *"All curricula, no matter their particular design, are composed of certain elements. A curriculum usually contains aims and specific objectives; it indicates some selection and organization of content; it either implies or manifests certain patterns of learning and teaching, whether because the objectives demand them or because the content organization requires them. Finally, it includes a program of evaluation of the outcomes"*. Finch and Crunkilton (1984 : 9) said "...

curriculum may be defined as the sum of the learning activities and experiences that a student has under the auspices or direction of the school".

In the 2013 Regulation of The Ministry of Education and Culture of the Republic of Indonesia no 70 about based frame curriculum structures VHS/VAM, section 1 verse 2 expresses that "High School Curriculum Structures VHS/VAM is an organization of core interest, subject, learning, and fundamental competence in each VHS/VAM" curriculum developed with the purpose to produce graduates who can work for world industry, and can apply science and technology in their place of work. Finch and Crunkilton (1984) say that:

"The ultimate success of a vocational and technical curriculum is not measured merely through students' educational achievement but through the result of that achievement based on their performance at work".

Vocational education curriculum is designed to produce graduates that can be employed in the corporate world or those that can do well on their own in life. In the theoretical anvil of the 2013 Regulation, The Ministry of Education and Culture of Republic of Indonesia no 70 expressed that "2013 curriculum developed is theory-education based, and the curriculum theory is based on competency (competency-based curriculum). 2013 curriculum about based competency VHS (2013) expressed that "Graduate Competency Standard (GCS) formulated for a set of education of VHS be utilized to formulate basis competency needed to reach it. GCS still must be attained at the end of VHS/VAM which lasts for either 3 or 4 years. 2013 curriculum did not specifically elaborate every expertise programme in mechanical engineering. But marginally, it has been arranged in the Regulation of The Ministry of Education and Culture of the Republic of Indonesia no 70/2013 about basic frame curriculum structures in VHS/VAM (Tables 1 and 2).

Contents of curriculum

Curriculum planning having anvil philosophic approach is selected with confidence to constitute the curriculum. Curriculum designers need to believe that the purpose of curriculum will be achieved in the students after they graduate from school. The curriculum of all school must be broad and comprehensive". Sukanto (1988:91) said, "the contents of the curriculum should be based on performances, teach students how to adapt to their work environment, overcome problem of work mobility, and have good human relation skill. The determined contents of curriculum for the 4-year VHS programme are very difficult compared to the 3-year VHS programme. The content of the curriculum as a whole is a system of

Table 1. Curriculum of public structures in VHS/VAM (3 years Programme).

Subject	Study time allocation per week		
	X	XI	XII
Group A (compulsory)			
Religion Education	3	3	3
Civic	2	2	2
Indonesian Language	4	4	4
Mathematics	4	4	4
Indonesia History	2	2	2
English Language	2	2	2
Group B (compulsory)			
Cultural art*	2	2	2
Physical, sport and health education	3	3	3
Creative Task and Entrepreneurship	2	2	2
Total of subject hour of Group A and B per week	24	24	24
Group C (Interest)			
Vocational subject academic enthusiast (VHS/VAM)	24	24	24
Total hour a subject must be done each-week	48	48	48

Table 2. Curriculum public structures of VHS/VAM (Programme 4 years).

Subject	Study time allocation per week			
	X	XI	XII	XIII
Group A (compulsory)				
Religion Education	3	3	3	3
Civic	2	2	2	2
Indonesian Language	4	4	4	4
Mathematics	4	4	4	4
Indonesia History	2	2	2	2
English Language	2	2	2	2
Group B (compulsory)				
Cultural art*	2	2	2	2
Physical, sport and health education	3	3	3	3
Creative Task and Entrepreneurship	2	2	2	2
Total of subject hour of Group A & B per week	24	24	24	24
Group C (Interest)				
Vocational subject academic enthusiast (VHS/VAM)	24	24	24	24
Total subject hour that must be done each week	48	48	48	48

instruction consciously applied in the training of students to develop their potency maximally.

Implementation of curriculum

Implementation of curriculum generally has become the

school responsibility of headmasters, teachers, and the public. Especially, teachers, the main instrument in the field, who draw up study activity must be supported by leaders, facilities and conditions required for the study to run as planned and expected. The creativity of teachers, supported by policy of constructive leaders with all the facilities required, will enhance the study process needed

Table 3. Difference in the outcomes of student in school and industry in the 3 and 4 year VHS programmes.

Variable	Test value = 0					
	t	Df	Sig. (2-tailed)	Mean difference	95% confidence interval of the difference	
					Lower	Upper
Students' outcome in the 4 years VHS programme	73.605	19	0.000	97.95000	95.1647	100.7353
Students' outcome in the 3 years VHS programme	88.530	20	0.000	99.19048	96.8533	101.5276

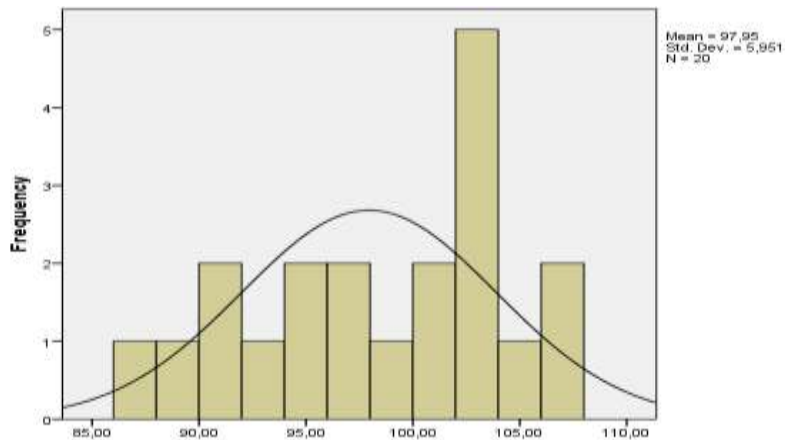


Figure 1. Outcome of student in industry and school doing the 4 years VHS programme.

to achieve the purpose expected. The curriculum is expected to make the students have optimal learning at vocational and technological school to be able to work in the corporate world. After passing through the vocational school they are not expected to be socially awkward at work. The students must have skills which will be of benefit to them later in life. Vocational schools need to make students useful to themselves and their family members.

METHODOLOGY

This research, a descriptive research, makes comparison between two independent samples: 3 and 4 years VHS programmes in which the curriculum of mechanical engineering was implemented at school and industry to improve the quality of graduates who majored in mechanical engineering at VHS Negeri in Makassar. Data were collected from the mechanical engineering students using questionnaire. The questionnaire consisting of questions were administered to the study respondents.

RESULTS

The data obtained were analysed descriptively. The average score got from each aspect is calculated based on the assessment criterion specified for all. Then the

data are presented in tables. In Table 3, the level of value of significance is 0,000, with df of 19 and 20. Significance value is 0.05. Significance value is lesser than 0.05, hence there are differences (Santoso, 2014:79) in the result of t-test outcome of the students doing the 4-year and 3-year VHS programmes (Figure 1 and 2). In Table 4, the level of value of significance is 0,000, with df of 13 and 3. Significant value is 0.05. The significance value is lesser than 0,05, hence there are difference (Santoso, 2014:79) in the result of the t-test of the study process used by teachers in the 4 year VHS and 3 year VHS programmes (Figures 3 and 4).

DISCUSSION

Based on the result of the research in every aspect there is significant difference; there are differences in the education design of multiple system (DMS) between the states running 4-year VHS and those running 3-year VHS. In this research VHS 5 in Makassar State represented the 4-year VHS because in South Sulawesi, the city of Makassar runs a period of 4 years VHS study. While, VHS 2 in Makassar State represented the 3-year VHS because VHS 2 in Makassar runs the DMS schedule, and the place of the DMS is also the same

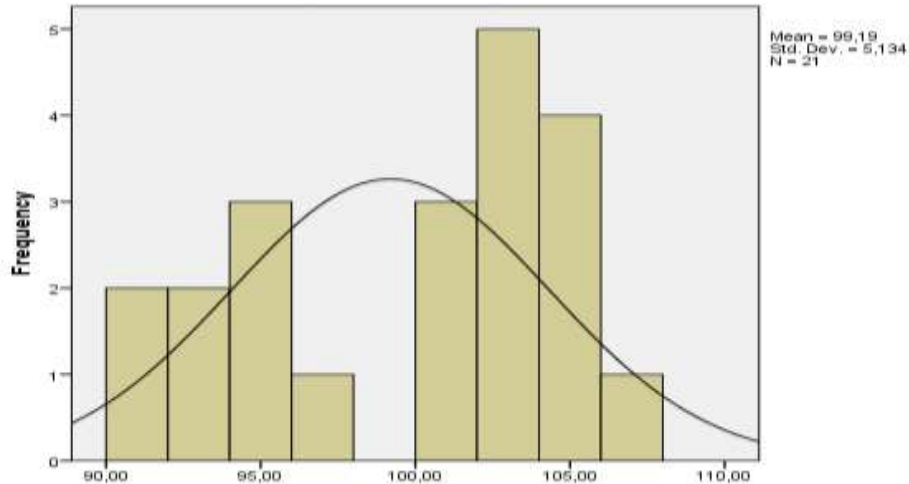


Figure 2. Outcome of student in industry and school doing the 3 years VHS programme.

Table 4. Different study process used by teacher in the 3-year VHS and the 4-year VHS.

Variable	Test value = 0					
	t	df	Sig. (2-tailed)	Mean difference	95% Confidence Interval of the difference	
					Lower	Upper
Learning process by teacher in the 4 years VHS	50.585	13	0.000	113.57143	108.7210	118.4218
Learning process by teacher in the 3 years VHS	23.730	3	0.000	126.50000	109.5352	143.4648

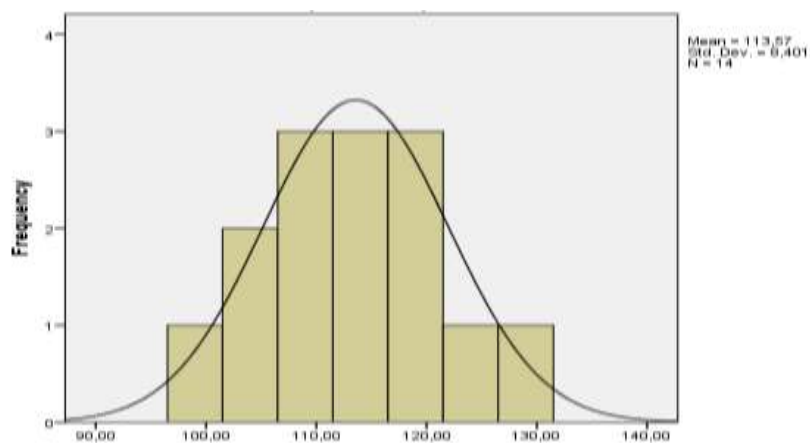


Figure 3. Study process used by teacher in VHS 4 years.

with VHS 5 in Makassar.

The result shows that there is improvement in the quality of graduates prepared for the Asean Economic Community (AEC) from VHS 5 in Makassar State. The education program from the beginning to the end is planned and assessed jointly by the vocational schools

and industries. Class 4 students did practical training in industries during the beginning of the odd semester for 7 months. A student can inform his teacher or major chief of the industry he wants for the training. Then the school sends letter to the company to receive the said student to undergo the industrial training. But some students do not

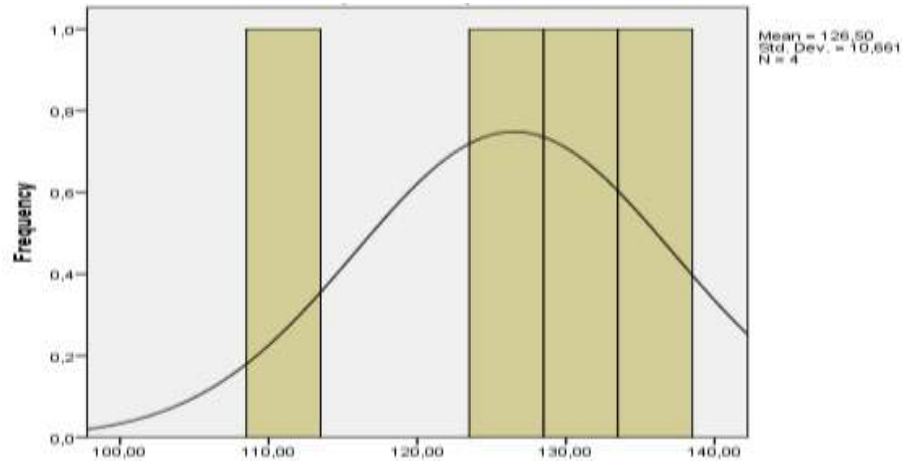


Figure 4. Study process used by teacher at VHS 3 years.

choose by themselves; the schools assigns them to any industry. Not all the students of class 4 can could go for the industrial training because there are clauses which must be fulfilled: the students must finalize their payment arrears and pass all their courses. Students' score got from the assessment in the industry and score from their teacher make up their report.

In VHS 2 in Makassar State, class 3 students went for the industrial training during the odd semester. The students that went must have passed all their subjects. Then teacher sent a letter to the industry to accept them. A teacher councillor always co-ordinates and watches them in the industry. The training lasts for 3 months. Students' score got from the assessment in the work place and from their teacher make up their report.

In the different aspects of the students both in the 3 and 4-year VHS programmes, the students can be motivated by their teachers to learn. The learning method used for the students at school, and the education of mechanical engineering is not that different between the 4-year VHS State and 3-year VHS State. However, in the case of practicals the 4-year VHS State students particularly VHS State 5 Makassar are best compared to the 3-year VHS students from VHS State 2 Makassar. This is because mechanical engineering is taught more in VHS State 5 Makassar and their students spend more time at the workshop to finalize job given by their teachers.

In the aspect of how teachers in the 3 and 4-year VHS programmes teach students about the fundamentals of mechanical engineering, they inculcate knowledge in the students at school before they go for their industrial training. The students must fulfill certain things before leaving for the training; they are taught to be always discipline and take care in doing any job given to them. In this case, there is not much difference in the studies given to the students doing 4 years and 3 years VHS programmes; hence conclusively there is difference

between 4 years VHS and 3 years VHS in this aspect.

To be competent, knowledgeable and and acquire vocational skills, graduates must meet the vocational competence standard in the 2012 Regulation of The Ministry of Education and Culture of the Republic of Indonesia no 28 ,Section 1 of article 1 which says "Vocational competence standard of vocational high school (VHS/VAM) must be of national education standard complementing subject component standard as stated in National Ministry of Education no 22/ 2006 about content standard for middle education."

In line with the demand of Asean Economic Community (AEC), Graduate Competency Standard (GCS) is obtained from the requirement of the public and subject is obtained from the competence desired to be obtained. In line with that, VHS is a set of formal education which aims to prepare graduates to be excellent at work. In the curriculum of 2013 fundamental core competence was stated in the 2013 Regulation of The Ministry of Education and Culture of the Republic of Indonesia no 70 for 3 years VHS program, although that of VHS 4 years programme has not been written.

With technological advances and existing information, VHS needs to grow with them; it needs to adapt to the competence design especially 4 years VHS programme to be of relevance to industries. One of the policies of Culture and Education Department in the exploitation of Human Resource in VHS introduced in 1993/1994 is education of Link and match, that is education of VHS must have the character to link and match with good requirement; that is requirement of students and public work especially in the present era of Asean Economic Community (AEC).

The problems of the 3 and 4 years VHS programmes are related to competence especially competence in machinery technics in 2013 curriculum; hence graduates of these programmes must have expertise in the field of mechanical engineering which could be position

competence, knowledge and skill. It is seen that most vocational education graduates especially of 3 years and 4 years VHS programme do not apply their expertise and cannot adapt to the development of science and technology. This is also seen in the result of Guidance Directorate of VHS (2014: 135) that, there is difference between what is given in vocational school and the real requirement of the industry. The similarity between what is given in vocational school and required by industries around the world is about 60% and 80%; it is very big at big industries, with small difference in entrepreneurship activity.

CONCLUSION

From the result, it is inferred that there are differences in the implementation of mechanical engineering curriculum in the 3 years and 4 years VHS programs at school and industry based on the result of t-test outcome of students doing 4 3 years and 4 years VHS program. There are also differences in the study process t-test of teachers in the 4 years and 3 years VHS programmes. So the graduates of 4 years VHS program readily challenge the era of Asean Economic Community (AEC) more than those of 3 years VHS program.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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