Technical Skills and Employability Skills of Mechanical Engineering Student in 4-Year And 3-Year Program in Indonesian Vocational High School

Amiruddin Amiruddin[1,*], Aminuddin Aminuddin[1], Muhammad Hasim[1], Wirawan Setialaksana[2]

[1] *Mechanical Engineering Education, Universitas Negeri Makassar, Makassar, Indonesia*
[2] *Informatics and Computer Education, Universitas Negeri Makassar, Makassar, Indonesia*
[*]*Email: amiruddin@unm.ac.id*

ABSTRACT
This research aims to depict level of domination of technical skills and employability skills student at 4-year and 3-year program in Indonesian Vocational High School (VHS) expertise package of mechanical engineering. Research applies quantitative approach of non-experiment with survey method applies questionnaire as a means of data collector. Research population is last year students on both program expertise in mechanical engineering at VHS in Makassar and Surabaya consisted of 290 students. One hundred and fifty-eight students are randomly chosen as research participants. The participants fill employability skills questionnaire. They are also observed in their workshop to investigate their technical skills. The research data is analysed using descriptive statistics. The results shows that technical skills and employability skills of mechanical engineering students at 4-year program is higher than those of 3-year program. The level of technical skills of the students of 3-year program is at low category while those of 4-year program gives higher category. The employability skills student at 3-year program VHS categorizes as low while student at 4-year program categorizes as high.

Keywords: *Technical Skills, Employability Skills, 4-Year VHS, 3-Year VHS.*

1. INTRODUCTION

The existence of the 4-year Vocational High School (SMK) program is a different profile from most SMK programs with a 3-year study period. In its implementation in the field, there are various SMK programs developed based on the study period, dual education system (PSG) patterns, and competencies, such as 3-year and 4-year SMKs and community colleges (3+1-year SMKs). However, there is no measurable difference between the graduates of 3-year and 4-year SMKs in terms of student achievement, competencies, graduate absorption, career advancement, equivalence in higher education, and school effectiveness [1].

The National Education Minister Regulation of Indonesia Number 22 Year 2006 on content standards in vocational education curriculum structure mentioned that the duration of SMK/MAK education is three years, with a maximum of four years according to the demands of expertise programs [2]. Meanwhile, the National Education Minister Regulation of Indonesia Number 17 Year 2010 on the management of education provision in Article 78 Paragraph 3 states that SMK and MAK can consist of 3 (three) levels of classes or 4 (four) levels of classes in accordance with the demands of the working world [3].

The 3-year and 4-year SMK programs each have advantages and disadvantages, both in terms of technical skill and employability skills competencies, study period, and experience in the business and industrial world. The advantage of the 4-year SMK is its ability to improve graduates' professional competencies to be better prepared to enter the workforce, more mature, independent, have technical skill and employability skills

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standards required by the industry, and have an entrepreneurial spirit. Developing employability skills for SMK graduates can be done through the implementation of project-based learning. This result is expected to be an input for all SMK stakeholders to improve the quality of learning so that graduates have employability skills according to industry demand [4].

The biggest challenge in the Indonesian education system today is to produce graduates with balanced academic skills, technical skills, and employability skills [5]. Vocational high schools as education institutions oriented towards the workforce through the mastery of technical skills and employability skills are essential to support knowledge-based economic development [6].

The employability skills of SMK graduates are becoming increasingly important due to changes in the job market demands, changes in education orientation, and the expectations of students, employers, parents, and the government. On a broader scope, the employability skills of SMK graduates have an impact on improving the competitiveness of graduates in the job market, which will have implications for improving the competitiveness of the nation [7].

Overtoom (2000) explained that employability skills as a core skill group can be transferred and describe the primary function of knowledge, skills, and attitudes needed in the workplace [8]. Robinson (2006) revealed that employability skills consist of three groups of skills, namely (1) basic academic skills, (2) higher-order thinking skills, and (3) personal qualities [9]. Employability skills are skills relevant to various fields of work and professions [10]. Employability skills can also be defined as the ability to adapt to a particular job, enabling one to survive and succeed in the workplace [11].

The Conference Board of Canada (CBC, 2000) defines employability skills as the skills and qualities desired by employers in new hires to start work [12]. Employability skills consist of three main skills, namely (1) fundamental skills, including: communication skills, information management skills, math skills, and problem-solving skills; (2) personal management skills, including: positive behavior skills, responsibility skills, adaptability skills, continuous learning skills, and safe work skills; and (3) teamwork skills, including: working with others in a team and participating in a project or task.

The Secretary's Commission on Achieving Necessary Skills (SCANS) states that employability skills are "workplace know-how" that includes workplace competencies and foundation skills. Workplace competencies consist of five competencies that can be effectively used by workers to enhance productivity, including: (1) resources; (2) interpersonal skills; (3) information; (4) systems; and (5) technology. Meanwhile, foundation skills are required to improve workers' performance, including: (1) basic skills; (2) thinking skills; and (3) personal qualities [13].

Bektiarso (2015) defines competency as the ability or skill possessed by students in the form of knowledge, skills, and attitudes that can be applied in daily life [14]. Meanwhile, according to Susilo (2007), competency is a combination of experience, skills, values, and attitudes reflected in habits of thinking and acting [15]. Technical competency or technical skills are the knowledge, skills, and attitudes related to a specific job, and must be achieved by students in learning as a preparation for working in their field of expertise.

The technical competency of mechanical engineering in vocational schools based on the 2013 curriculum consists of several competencies, including: (1) performing work with a lathe machine; (2) performing work with a milling machine; (3) performing work with a grinding machine; (4) performing work with a complex lathe machine; (5) performing work with a complex milling machine; (6) grinding cutting tools; (6) setting up machines and NC/CNC machine programs; (7) programming basic NC/CNC machines; and (8) operating basic NC/CNC machines [16].

Based on the above description, the purpose of this study is to describe the level of technical skills and employability skills mastery of students in 4- and 3-year vocational programs in mechanical engineering in Indonesia.

2. RESEARCH METHOD

This study uses a non-experimental quantitative approach [17] and is ex-post facto in nature [18]. The research was conducted using a survey method with a questionnaire as the data collection tool. The population of the study was 290 students in grade XII of the Machining Engineering Program at vocational high schools in Makassar and Surabaya, with a sample size of 158 students. The sampling technique used was proportional random sampling [19], where the research sample was allocated proportionally to each school that was the population in the study.

The data collection instruments include employability skills questionnaires and observation sheets of technical skills performance. The employability skills instrument was developed from ten indicators, namely: (1) communication skills; (2) teamwork skills; (3) problem-solving skills; (4) initiative and effort-taking skills; (5) planning and organizing skills; (6) self-management skills; (7) learning skills; (8) technology skills; (9) health and safety at work; and (10) personal quality (Sunardi, et al., 2016). Meanwhile, the mastery of technical skills is measured by eight indicators, namely: (1) operating a lathe machine; (2) operating a milling machine; (3) operating a grinding machine; (4) operating a complex lathe machine; (5) operating a complex

Technical Skills Indicator	Mean	Standard Deviation	Score Percentage (%)
Operating a lathe machine	7.49	1.02	74.92
Operating a milling machine	6.72	0.91	67.19
Operating a grinding machine	7.38	1.01	73.83
Operating a complex lathe machine	7.04	0.96	70.42
Operating a complex milling machine	6.87	0.93	68.71
Setting up basic NC/CNC machine and program	6.86	0.93	68.61
Programming basic NC/CNC machine	6.37	0.87	63.69
Operating a basic NC/CNC machine.	6.52	0.89	65.16
Grand Mean	**7.49**	**1.02**	**74.92**

milling machine; (6) setting up basic NC/CNC machine and program; (7) programming basic NC/CNC machine; and (8) operating a basic NC/CNC machine [16].

The validity test results of the employability skills questionnaire showed that five questions did not meet the valid criteria. Thus, there were forty valid questions and reliable with Pearson product moment correlation coefficients ranging from 0.403 (lowest) to 0.857 (highest), and Cronbach's Alpha reliability value of 0.954.

The research data were analyzed quantitatively using descriptive analysis. Quantitative descriptive analysis was used to describe the level of mastery of technical skills of machining engineering students. Quantitative descriptive analysis was also intended to determine the level of employability skills of machining engineering.

3. RESULTS

3.1. Descriptive Statistics of Technical Skills Student 3-year VHS

The research results show that the minimum score for the level of technical skills mastery of vocational high school students in the 3-year machining engineering program is 36.69; the maximum score is 75.18; the mean is 55.25; the median is 54.94; the mode is 59.41; and the standard deviation is 7.52. A more detailed description of the level of technical skills proficiency can be seen from the average score, standard deviation, and percentage score of each indicator that makes up the technical skills construct of vocational high school students in the 3-year machining engineering program, as presented in Table 1.

Table 1. Descriptive Statistics of Technical Skills Student 3-year VHS.

Based on Table 1 above, it can be concluded that out of the eight indicators of technical skills mastery of vocational high school students in the 3-year machining engineering program, the first indicator, which is working with a lathe machine, has the highest percentage achievement score at 74.92%, while the seventh indicator, which is programming basic NC/CNC machines, has the lowest percentage achievement score at 63.69%. The average percentage achievement score for all eight indicators is 74.92%, indicating a low level of technical skills mastery among the students. Therefore, it is crucial to improve the percentage achievement score for each technical skills indicator for the students in the 3-year machining engineering program.

3.2. Descriptive Statistics of Employability Skills Student 3-year VHS

The research results show that the minimum score for the level of employability skills of vocational high school students in the 3-year machining engineering program is 55.00; the maximum score is 119.00; the mean is 90.89; the median is 91.00; the mode is 94.00; and the standard deviation is 10.94. A more detailed description of the level of employability skills can be seen from the average score, standard deviation, and percentage score of each indicator that makes up the employability skills construct of vocational high school students in the 3-year machining engineering program, as presented in Table 2.

Table 2. Descriptive Statistics of Employability Skills of Students in 3-year VHS.

Employability Skills Indicator	Mean	Stand. Deviation	Score Percentage (%)
Communication skills	8.52	1.42	71.04
Teamwork skills	9.32	1.55	77.69
Problem-solving skills	8.82	1.68	73.52
Initiative and effort-taking skills	8.84	1.53	73.68
Planning and organizing skills	8.86	1.61	73.84
Self-management skills	8.75	1.77	73.00
Learning skills	8.91	1.59	74.26
Technology skills	9.01	1.68	75.16
Health and safety at work	9.83	1.71	81.91
Personal quality.	10.01	1.57	83.39
Grand Mean	**9.09**	**1.61**	**75.75**

Based on Table 2 above, it can be concluded that out of the ten indicators of employability skills of students in

SMK 3-year program of machining engineering, the tenth indicator, which is individual quality, has the highest percentage of achievement with a score of 83.39%, while the first indicator, which is communication skills, has the lowest percentage of achievement with a score of 71.04%. The average percentage achievement for all ten indicators is 75.75%, indicating a low level of employability skills by students. Therefore, the percentage of achievement for each employability skills indicator of students in SMK 3-year program of machining engineering needs to be improved.

3.3. Descriptive Statistics of Technical Skills Student 4-year VHS

The research results show that the minimum score for the level of proficiency in technical skills of students in SMK 4-year program of machining engineering is 54.69; the maximum score is 93.18; the mean score is 73.25; the median is 72.94; the mode is 77.41; and the standard deviation is 7.40. A more detailed description of the level of mastery of technical skills can be seen from the mean score, standard deviation, and percentage score of each indicator that makes up the technical skills construct of students in SMK 4-year program of machining engineering, as presented in Table 3.

Table 3. Statistics Descriptive of Technical Skills of Students in 4-year VHS.

Indikator Technical Skills	Mean	Standar Deviasi	Persentase Skor (%)
Operating a lathe machine	9.19	1.02	89.92
Operating a milling machine	8.42	0.91	82.19
Operating a grinding machine	9.08	1.01	88.83
Operating a complex lathe machine	8.74	0.96	85.42
Operating a complex milling machine	8.57	0.93	83.71
Setting up basic NC/CNC machine and program	8.56	0.93	83.61
Programming basic NC/CNC machine	8.07	0.87	78.69
Operating a basic NC/CNC machine.	8.22	0.89	80.16
Grand Mean	8.61	**0.94**	**84.07**

Based on Table 3 above, it can be concluded that out of the eight indicators of technical skills mastery for vocational high school students in the 4-year machining engineering program, the first indicator, which is working with a lathe machine, has the highest percentage of achievement with a score of 89.92%, while the seventh indicator, which is programming basic NC/CNC machines, has the lowest percentage of achievement with a score of 78.68%. The average percentage of achievement for all eight indicators is 84.07%, indicating a high level of technical skills mastery among the students. However, there is still room for improvement in the percentage of achievement for each technical skills indicator for students in the 4-year machining engineering program.

3.4. Statistics Descriptive of Employability Skills Student 4-year VHS

The description of the employability skills of vocational high school students in the 4-year machining engineering program can be seen in Table 4, which presents the mean score, standard deviation, and percentage of scores for each indicator that makes up the employability skills construct. The research findings show that the minimum score for employability skills is 65.00, the maximum score is 120.00, the mean score is 100.08, the median score is 101.00, the mode is 91.00, and the standard deviation is 10.17.

Table 4. Statistics Descriptive of Employability Skills of Students in 4-year VHS.

Employability Skills Indicator	Mean	Standar Deviasi	Persentase Skor (%)
Communication skills	9.51	1.39	79.27
Teamwork skills	10.26	1.45	85.50
Problem-solving skills	9.77	1.59	81.38
Initiative and effort-taking skills	9.82	1.48	81.80
Planning and organizing skills	9.82	1.55	81.86
Self-management skills	9.69	1.66	80.75
Learning skills	9.86	1.50	82.17
Technology skills	9.96	1.58	82.96
Health and safety at work	10.61	1.47	88.45
Personal quality.	10.78	1.31	89.82
Grand Mean	**10.01**	**1.50**	**83.40**

Based on Table 4 above, it can be concluded that out of the ten indicators of employability skills for vocational high school students in the 4-year machining engineering program, the tenth indicator, which is individual quality, has the highest percentage of achievement with a score of 89.82%, while the first indicator, which is communication skills, has the lowest percentage of achievement with a score of 79.27%. The average percentage of achievement for all ten indicators is 83.40%, indicating a high level of employability skills among the students. However, there is still room for improvement in the percentage of achievement for each employability skills indicator for students in the 4-year machining engineering program.

4. DISCUSSION

The results of quantitative descriptive analysis showed that the level of technical skills proficiency in 3-year vocational high school (SMK) students in the field of machining had a mean of 55.25, with an average achievement percentage for its indicators of 74.92% in the low category. Meanwhile, the level of technical skills proficiency in 4-year SMK students had a mean of 73.25, with an average achievement percentage for its indicators of 84.07% in the high category. If compared, the level of technical skills proficiency in SMK 4-year students is better than that of SMK 3-year students. This research is consistent with Amiruddin's (2017) study that 4-year SMK students are more competent and effective in meeting the skills needed by the industry. The effectiveness of 4-year SMK in improving student learning achievements lies in preparing skilled graduates who are ready to work in the industry.

This research is supported by Sunardi's (2016) study, which revealed that, in general, the vocational competency mastery of SMK students in the machining engineering program was in the moderate category [16]. 4.07% of students had a low level of vocational competency mastery, 61.99% had a moderate level, 33.48% had a high level, and 0.45% had a very high level. Currently, the industry demands SMK graduates who have high competence, which refers to graduates with technical skills or hard skills and employability skills [20]. The candidates needed by the industry today are those with comprehensive competencies, which are a combination of hard and soft skills or employability skills.

The results of quantitative descriptive analysis showed that the level of employability skills proficiency in 3-year vocational high school (SMK) students in the field of machining had a mean of 90.89, with an average achievement percentage for its indicators of 75.75% in the low category. Meanwhile, the level of employability skills mastery of 4-year SMK students had a mean of 100.08, with an average achievement percentage for its indicators of 83.40% in the high category. If compared, the level of employability skills mastery of SMK 4-year students is better than that of SMK 3-year students. This research is consistent with Amiruddin's (2017) study that 4-year SMK students are more competent with higher work attitude mastery, more mature work experience, and better industrial experience [21].

This research is also consistent with Sunardi's (2016) study, which revealed that, in general, the employability skills mastery of SMK machining engineering program students was in the high category [16]. The individual quality indicator had the highest score achievement percentage at 82.7%, and the communication skills indicator had the lowest score achievement percentage at 72.3%. Another study that supports this research is Robinson's (2006) study, which found that over 81% of respondents stated that employability skills, such as communication, information management, problem-solving, responsibility, adaptability, and teamwork, are very important to be able to work [9]. It is further stated that employability skills have been identified as a skill that must be mastered by workers to compete in the job market.

Employability skills can be defined as the skills needed not only to obtain a job but also to make progress in the workplace and contribute to the goals of the company [22]. Therefore, 4-year vocational high school students will be more desirable to industries in the recruitment of employees because their employability skills are higher compared to 3-year vocational high school students. Industries are still more interested in 4-year vocational high school graduates because they are more mature in their practical thinking and more prepared for work. This can be seen from the effectiveness of 4-year vocational high schools in improving student learning achievement, with a job absorption rate in the industry reaching 80%-90%, and only about 10% continuing to higher education [21].

The current job market is concerned with rapid changes in technology and highly competitive industries. As a result, industries are now more enthusiastic about hiring employees who are suitable not only with technical skills but also have employability skills to adjust to the rapid changes in the industry [23], [24]. Industries demand employability skills as the main capital to achieve satisfactory work performance.

5. CONCLUSION

Based on the results of the research and discussion, it can be concluded that the technical skills and employability skills of machining engineering students in 4-year vocational high schools are better compared to students in 3-year vocational high schools in Indonesia. The level of mastery of technical skills for students in 3-year vocational high schools had a mean score of 55.25 with an average achievement percentage of 74.92% for the measurement indicators, categorized as low. Meanwhile, the level of mastery of technical skills for students in 4-year vocational high schools had a mean score of 73.25 with an average achievement percentage of 84.07% for the measurement indicators, categorized as high. On the other hand, the level of employability skills for students in 3-year vocational high schools had a mean score of 90.89 with an average achievement percentage of 75.75% for the measurement indicators, categorized as low. Meanwhile, the level of employability skills for students in 4-year vocational high schools had a mean score of 100.08 with an average achievement percentage of 83.40% for the measurement indicators, categorized as high.

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