The Development of Employability Skills’ Diploma 3 Mechanical Engineering Students, Faculty of Engineering, Medan State University

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Abstract

Graduates of Diploma 3 (D3) program in Mechanical Engineering, Faculty of Engineering, Medan State University (Unimed) as labor forces face quantitative and qualitative matching problems. The qualitative matching problem that must be known and addressed immediately is employability skills. The purpose of this study is to obtain a description of the development of employability skills' D3 Mechanical Engineering students. The subjects of this study were D3 Mechanical Engineering students enrolled in 2017/2018 academic year (62 students). This research is a cross sectional study. To collect data, the employability skills self-inventory instrument was used. Statistical analysis to describe: (a) differences in employability skills between classes used Analysis of Variance, and (b) further analysis to find out sub components of employability skills (technological skills, fundamental skills, personal management skills, and team work skills) between classes used Multivariate Analysis of Variance. The research findings: (a) there are differences between inter-class employability skills, (b) 2017 technological skills are significantly lower than class of 2016, 2015, and 2014 at α = 5%; 2017 fundamental skills are lower, significantly from the 2016 and 2015 classes at α = 10%; (c) Personal management skills and team work skills are not different from all classes.

1. Introduction

In the process of developing human resources (HR) in Faculty of Engineering (FT) Unimed it must go through three phases, namely: (1) the preparation phase by educational institutions, (2) utilization (the transition from educational institutions to the world of work/industry), and (3) the increase in the world of work/industry. In the utilization phase, vocational education institutions face quantitative and qualitative matching problems. The quantitative matching problem is an imbalance between the number of jobs that exist or that can be provided by the labor market with the amount of education output of job seekers. In this condition the number of requests is always smaller than the number of graduates of educational institutions, resulting in unemployment. Whereas the qualitative problem is the incompatibility of the qualifications or competencies produced by educational institutions with those demanded by the business/industry. In situations like this even though there are many job opportunities and few job seekers, unemployment will still occur.

Because of technological developments are rapidly changing that result in qualitative inequalities and broad orientations of various national and international organizations, which finally demands labor is also rapidly changing, transferable skills are needed. Employability skills are transferable core skill groups that represent essential functional and enabling knowledge, skills, and attitudes required by the 21st century workplace. They are necessary for career success at all levels of employment.
and for all levels of education. Workers who have employability skills will easily enter, stay and do the job well [1].

Responding to the above conditions, FT Unimed as a supplier of intermediate labor in the field of technology and engineering must be able to equip graduates with employability skills that are appropriate and commensurate with the demands of the world of work. To achieve this, learning is needed that is able to equip/enhance the employability skills of D3 Mechanical Engineering students. Next to find out whether the employability skills of D3 students in Mechanical Engineering develop significantly or not, it is necessary to do research that can measure employability skills in each semester (cross sectional study).

1. Research Questions

1.1 Does employability skills possessed by D3 Mechanical Engineering students get higher as they are in higher semester?

1.2 Does the sub component of employability skills (technological skills, fundamental skills, personal management skills, and teamwork skills) possessed by D3 Mechanical Engineering students get higher as they are in higher semester?

2. Literature Review

2.1. Employability Skills

Employability skills are the capacity as well as the willingness to be and to remain attractive in the labor market, by anticipating on changes in tasks and work environment and pro-acting on these changes [2]. If employability skills are seen as an integral part of student learning experiences in school, employability must be recognized and assessed so that students can develop abilities, link them to opportunities, reflect and articulate their experiences and abilities [3]. Employability skills not only involve hard competencies that emphasize how to follow procedures, but also about soft competencies that emphasize reasoning or logic skills, interpersonal and communication skills, leadership, management, and entrepreneurial skills [4].

According to the Conference Board of Canada (2000) employability skills consist of: (1) fundamental skills, namely the skills needed as a basis for further development. These skills consist of communication skills, ability to manage information, and use numbers. (2) Personal management skills, namely personal skills, attitudes, and behaviors that encourage a person's potential to grow. These skills consist of the ability to demonstrate positive attitudes and behavior, possess a sense of responsibility, able to adapt, desire to learn continuously, work carefully, think and solve problems. (3) Teamwork skills, namely the skills and attributes needed to increase productivity. These skills consist of the ability to cooperate with others, and be able to participate in tasks. Graduates of Diploma 3 (D3) program in Mechanical Engineering, Faculty of Engineering as labor forces must have abilities to operate technological devices (technological skills).

2.2. Development Theory of Employability Skills

There are three basic assumptions or concepts about the nature of students that underlie vocational education and vocational education [5]. The first view that states that students do not like formal learning activities and wherever possible avoid them. According to these assumptions students must be forced, motivated even if they need to be given a threat so they want to learn. Observing this assumption, thus D3 mechanical engineering students have commensurate employability skills as needed, it is necessary to create a learning environment and rules so that students are conditioned to learn.

The second view or assumption views that human beings are born in a state of knowledge or empty heads, their souls are clean like a sheet of white paper, which is then gradually filled with experience. Schools and environments where students are able to write blank and clean sheets with things that are expected to benefit the lives of students. Besides that according to the social context of
vocational and vocational education there are three main sub-components, namely: human, society and technology [5]. This component explains that the condition of a person/learner is influenced and shaped by forces from outside who are sometimes foreign. This second assumption and the social context of vocational and vocational education explains that communication skills, self-regulation, cooperation, and other social relations are not only obtained by D3 Mechanical Engineering students in the campus environment as long as they study, but also they can be off campus (other social environments). A good social environment will make them have social skills that are also not good.

The third assumption is that students are basically creatures full of curiosity, love to read, and have a desire to learn. In addition, children also have social, moral, intellectual and physical potential. This assumption explains that the development of these potentials is highly dependent on the quality and the amount of experience gained and lived by the students. This experience can be obtained through formal education or from other social environments (family and peers). This experience must be planned, both by the students themselves, by schools, parents, and the environment in which students are located.

The three assumptions above show that the ability/potential/employability skills possessed by children (students) can develop and are strongly influenced by their environment. This development is very dependent on the quality of experience and the amount of experience gained and experienced. The first assumption shows that for D3 students to have employability skills that are commensurate with the needs of the business / industry, the study program must have design rules and learning activities so that D3 students have high motivation, feel threatened if they do not have the minimum employability skills needed to work, and there are design activities that force students to carry out activities that can improve employability skills.

This second assumption can be used to understand the development of previous employability skills and how they relate to the development of employability skills in the following years. D3 students who come from schools and from an environment that provides experience in the ability of employability skills will become the basic capital for developing employability skills when they become D3 Mechanical Engineering students. For example, schools that have engineering facilities and teach them well will provide graduates with technological skills. Schools and the environment teach and apply discipline and rules that must be adhered to by their students to instill the personal management skills of their students. Schools and environments that teach how students work together will instill teamwork skills with their students. Classroom learning such as learning mathematics, Indonesian, and English will teach basic abilities, such as counting, communication skills, in addition to providing the ability of personal management skills and team work skills.

The third assumption explains that D3 student employability skills can develop well if curiosity, desire to learn, social potential, moral potential, and physical potential are facilitated well. This development is very dependent on the quality of experience and the amount gained. This experience must be planned, both by the lecturer and by the students themselves. According to Stewart (there is rather general agreement today that conditions for learning are much more favorable when the learner experiences a feeling of need for the subject matter, and when the mastery of the subject matter results in personal satisfaction [6].

The core aspects of the development program include employability skills: experimental action learning: using and understanding the value of skills rather than simply acquiring knowledge, work experience: preferably through work placements, but otherwise in classroom activity that simulates workplace characteristics; reflection and integration: preparing to put the employability skills into practice within different environments [6].

In this study the sub-components of employability skills are grouped into four groups, namely: technological skills, fundamental skills, personal management skills, and team work skills. The high and low level of employability skills students have depends on the quality and the amount of experience gained and lived by students (D3 students in Mechanical Engineering)).

Sub components of technological skills and fundamental skills are generally obtained from educational institutions (schools or colleges), although it does not rule out the possibility of them
(students) getting experience outside of educational institutions, such as at home or other social environments. The D3 Mechanical Engineering students come from two different educational institutions, namely high school (SMA) and vocational high school (SMK). Students from vocational schools have experienced technological skills from school and at the time of their internship (industrial work practices), while students from high school (SMA) do not gain technological skills from school.

Lectures in the first semester, D3 Mechanical Engineering students have been given subjects related to technological skills, namely bench and welding work subjects. The higher the semester the tendency for more and more subjects related to the ability of technological skills, it can be assumed that the more semesters these students are in then the higher the technological skills that they possess.

Fundamental skills skills, such as mathematical abilities, the ability to use language to communicate is generally obtained by educational institutions. The implementation of lectures on D3 Mechanical Engineering students who tend to lead to subject matter and with student centered learning approaches will equip students with good mathematical skills and good communication skills. Thus it can be assumed that the higher the semester students are in, D3 students will also possess higher fundamental skills.

While still in school (SMA/SMK) and when they have become D3 Mechanical Engineering students, they are equipped with personal management skills and team work skills both in the form of hidden curriculum and in the form of real teaching in a learning design. Nevertheless this ability is formed and starts from the family environment and social environment where they are raised or formed by their environment. Thus it can be assumed that the higher the semester the student does not guarantee the higher the ability of personal management skills would possess and the ability of the team work skills.

3. Research Method

3.1. Research Sample

This ex post facto study was done with the approach of cross sectional study. The population of this study is all D3 Mechanical Engineering students in total of 71 students. The number of sub-populations and samples from each meter are presented in Table 1 below.

In postal school-leaver surveys, the use of self-report to measure competences is almost inevitable [7]. Based on this opinion, the employability skills instrument used to collect data is a self-report. This instrument was adopted from the employability skills instrument for industrial technology vocational high school students (SMKTI) and SMKTI graduate workers developed by [6]. Adoption is done by adding and subtracting items that are less relevant to the condition of students. The addition and subtraction is based on the theory and analysis of the workforce of D3 graduates in Mechanical Engineering in the field of machinery.

| No. | Class (Semester) | Sub Population | Sample |
|-----|-----------------|----------------|--------|
| 1   | 2017 (1st)      | 27             | 23     |
| 2   | 2016 (3rd)      | 16             | 13     |
| 3   | 2015 (5th)      | 12             | 11     |
| 4   | 2014 (7th)      | 16             | 15     |
| Total |                 | 71             | 62     |

The instrument of employability skills consists of: technological skills, fundamental skills, personal management skills, and team work skills sub components. Sub component of technological skills consists of seven items, fundamental skills sub-component consists of seven items, sub-component of personal management skills consists of seven items, and sub-component of team work skills consists of six items.
3.2. Data Analysis

To find out the development of inter-group employability skills it was analyzed using one-way analysis of variance (one way ANOVA) with four groups, namely class 2017, class 2016, class 2015, and class 2014. With this analysis an overview of differences in employability skills between class. Whereas to find out the development of employability skills sub-components (technological skills, fundamental skills, personal management skills, and work skills teams) between class it was analyzed using multivariate analysis of variance (MANOVA). All analyzes were carried out using SPSS software.

4. Research Results

The development of employability skills and sub component of employability skills’ D3 Mechanical Engineering students are presented in Figure 1a and 1b. It indicates that: (1) there is a tendency the higher the semester the higher the employability skills.(2) from the four sub components of employability skills, technological skills are the components that develop best, then fundamental skills. Personal skills experienced a decline in the 2014 class, while the team work skills experienced a decline in the 2015 class, then went up on the 2014 class.

One-way ANOVA results (Table 2) showed that the four class had a significance of 0.033 (<0.05). This probability it means the test of the difference between the four class groups (class 2017, 2016, 2015, and 2014) is not the same (there are differences).

|                | Sum of Squares | Df | Mean Square | F      | Sig.  |
|----------------|----------------|----|------------|--------|-------|
| Between Groups | 1797,858       | 3  | 599,286    | 3,106  | .033  |
| Within Groups  | 11190,530      | 58 | 192,940    |        |       |
| Total          | 12988,387      | 61 |            |        |       |

Tukey's test results (Table 3) show that there are differences in positive and significant employability skills between 2017 class students and 2014 class, where the 2014 class employability skills are higher compared to class 2017 students. While 2017 class student employability skills are no different from 2016 class students and 2015 class students. However, if viewed from the average difference, it can be stated that the 2016 class student employability skills and 2015 class students are higher than the 2017 class students.
Table 3. Tukey Test Employability Skills

| (I) CLASS | (J) CLASS | Mean Difference (I-J) | Std. Error | Sig. | 95% Confidence Interval |
|-----------|-----------|-----------------------|------------|------|------------------------|
| CLASS 2017 | CLASS 2016 | -9,334 | 4,820 | 0.224 | -22.08 to 3.41 |
| CLASS 2015 | CLASS 2016 | -9,632 | 4,610 | 0.169 | -21.83 to 2.56 |
| CLASS 2014 | CLASS 2016 | -13,747* | 5,092 | 0.044 | -27.22 to -0.28 |
| CLASS 2017 | CLASS 2016 | 9,334 | 4,820 | 0.224 | -3.41 to 22.08 |
| CLASS 2015 | CLASS 2016 | 2,97 | 5,263 | 1,000 | -14.22 to 13.63 |
| CLASS 2014 | CLASS 2016 | -4,115 | 5,514 | 0.878 | -19.46 to 10.64 |
| CLASS 2017 | CLASS 2016 | 13,747* | 5,092 | 0.044 | -2.56 to 21.83 |
| CLASS 2015 | CLASS 2016 | 2,97 | 5,263 | 1,000 | -13.63 to 14.22 |
| CLASS 2014 | CLASS 2016 | -4,115 | 5,514 | 0.878 | -10.64 to 19.46 |
| CLASS 2017 | CLASS 2016 | 13,747* | 5,092 | 0.044 | -2.56 to 21.83 |
| CLASS 2015 | CLASS 2016 | 2,97 | 5,263 | 1,000 | -13.63 to 14.22 |
| CLASS 2014 | CLASS 2016 | -4,115 | 5,514 | 0.878 | -10.64 to 19.46 |
| CLASS 2017 | CLASS 2016 | 13,747* | 5,092 | 0.044 | -2.56 to 21.83 |

* The mean difference is significant at the 0.05 level.

The 2016 class student's employability skills are not significantly different from the 2015 class students. However, when viewed from the average difference, it can be stated that the 2015 class student employability skills and 2014 class students are higher than the 2016 class students. The 2015 class employability skills is not significantly different from the 2016 class students. However, when viewed from the average difference, it can be stated that the 2015 class student employability skills are higher than the 2016 class students.

The results of calculation Manova against sub component of employability skills among class, showed that on class effects: Pillai’s Trace = 0.010, Wilks’ Lambda = 0.006, Lawley-Hotelling Trace = 0.003, and Roy’s = 0.00. These results indicate that the probability of all four test statistics is <0.05. With this probability, the multivariate test as a whole shows that not all the mean vectors of the four groups of sticks are different. To find out the differences in technological skills, fundamental skills, personal management skills and team work skills among the four class groups, it was conducted by looking at the effect test analysis between subjects (the test of the between-subjects effects). The effect test results between subjects showed that the class source showed 0.000 on technological skills, 0.101 on fundamental skills, 0.253 on personal management skills and 0.771 on team work skills. These results indicate that there is a significant difference in the level of technological skills between class groups with α = 5%; there is a significant difference between fundamental skills between class groups with α = 10%. While for personal management skills, and team work skills, there is no difference between the four groups of classes (Table 4).

Table 4. Tests of Between-Subjects Effects

| Source | Type III Sum of Squares | df | Mean Square | F | Sig. |
|--------|------------------------|----|-------------|---|-----|
| Class  | TECHNOLOGICAL SKILLS   | 462,103 | 3 | 154,034 | 8.742 | 0.000 |
|        | FUNDAMENTAL SKILLS      | 108,099 | 3 | 36,033 | 2.360 | 0.101 |
|        | PERSONAL MANAG SKIL     | 16,702 | 3 | 5,567 | 1.396 | 0.253 |
|        | TEAM WORK SKILLS        | 24,971 | 3 | 8,324 | 0.376 | 0.771 |
|        | TECHNOLOGICAL SKILLS   | 255,594,000 | 62 | | | |
|        | FUNDAMENTAL SKILLS      | 242,180,000 | 62 | | | |
|        | PERSONAL MANAG SKIL     | 316,180,000 | 62 | | | |
|        | TEAM WORK SKILLS        | 264,000,000 | 62 | | | |
| Total  | TECHNOLOGICAL SKILLS   | 255,594,000 | 62 | | | |
|        | FUNDAMENTAL SKILLS      | 242,180,000 | 62 | | | |
|        | PERSONAL MANAG SKIL     | 316,180,000 | 62 | | | |
|        | TEAM WORK SKILLS        | 264,000,000 | 62 | | | |
5. Conclusions

According to result of Tukey test on Anova and the results of multiple comparison analysis calculations with the Post Hoc test (advanced test on Manova) with Tukey test are concluded that:

5.1 Employability skills possessed by D3 Mechanical Engineering students; the higher the semester the higher the employability skills.

5.2 In the sub-components of technological skills show that:

5.2.1 there are significant differences in technological skills between 2017 class with class 2016, 2015, and 2014;
5.2.2 there is no difference in 2016 class technology skills with class 2015, and class 2014, there is no difference in technological skills class 2015 with class 2014.

5.3 In the sub-component of fundamental skills shows that: there is no difference in fundamental skills class 2017 with 2016 class, 2015 class; but there is difference in fundamental skills class 2017 with 2014 class. \( \alpha = 10\% \).

5.4 In the sub-component of personal management skills, it shows that there is no difference between all class groups. Similar to the sub-component of personal management skills, in the sub-component of team work skills, there is no difference between the class groups.

6. References

[1] Overtoom C. 2000. Employability skills: An update (ERIC Clearinghouse)
[2] Sanders J and de Grip A. 2003. Training, task flexibility and low skilled workers’ employability
[3] Ball L. 2003. Future directions for employability research in the creative industries ADM (The High. Educ. Acad. Subj. Cent. Arts, Des. Media). York High. Educ. Acad.
[4] Hale J. 2002. Performance-based evaluation: Tools and techniques to measure the impact of training (Jossey-Bass)
[5] Djohar A. 2007. Pendidikan Teknologi dan Kejuruan Dalam Ilmu dan Apl. Pendidikan. Bandung Pedagog. Press. Hal 1285
[6] Sukamto R A. 2008. Konversi Sistem, Kriteria, Pengujian dan Kualitas Perangkat Lunak
[7] Van Loo J and Semeijn J. 2004. Defining and measuring competences: an application to graduate surveys Qual. Quant. 38 331–49