



Evaluating Programme Learning Outcome for Diploma in Mechanical Engineering from Students' Perception

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Abstract

Higher education curriculum need to be revised periodically to make sure that the students produced meet the human capital requirement in globalization era and the aspiration of the ministry of higher education. Diploma in Mechanical Engineering (DKM) program curriculum has been designed to ensure the graduates produced are qualified to become parts of human resources that are able to challenge the globalization era in the employment sector. With regard to that, DKM curriculum is not only emphasizing on the knowledge and practical skills aspects but also soft skills that are applied in Program Learning Outcome (PLO). Soft skills include communication skills, problem solving and critical thinking skills, social and responsibilities skills, information management and continuous learning skills, entrepreneurship and management skills, professionalism, ethics and moral, and leadership and team work skills. The objective of this research is to study the DKM students' perception on their achievement of PLO and to compare the level of achievement through the students' perceptions with the actual students' achievement through the examination results. The questionnaire form consists of 43 items distributed to 156 of final semester DKM students in December 2016 session representing the sample of study. Data analysis was performed using the IBM SPSS Statistics 20. Data analysis methods conducted for this research are descriptive statistics (frequency and score mean) which the reliability value (Cronbach's alpha), $\alpha = 0.97$. Result of the analysis showed that respondents gave positive perceptions on the research questions. From the study, it was found that the average mean of 11 PLO studied from the students' perceptions was 4.06 while the average mean obtained from the students' examination result was 3.78.

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Keywords: Curriculum, Programme Learning Outcome (PLO)

1. Introduction

Higher education becomes a part of globalization process which includes supply and demand across the boundary (Zha Qiang, 2003). Because of that, higher education curriculum needs to be revised and updated to meet the human capital requirement in globalization era and to aspiration of the ministry of higher education. Polytechnic curriculum has been designed to produce the graduates who are qualified to become parts of human resources that are able to face the challenges of globalization era in the employment sector. Diploma in Mechanical Engineering in Polytechnic is a program developed to produce graduates who manage to fulfill all the characteristics. These students have been equipped with knowledge and skills in their respective fields effectively and systematically. In addition, generic skills are integrated into the polytechnic curriculum where students are equipped with the aspects of soft skills, entrepreneurship skills and information technology to ensure that the human capital produced by polytechnics is excellent not only in academics but also with good personality.

The objective of this study were to

1. evaluating the PLO achievement of DKM students in Department of Mechanical Engineering (DME), Politeknik Sultan Haji Ahmad Shah (POLISAS)
2. compare the level of achievement through students' perceptions with actual students, achievement

Achievement of PLOs should be evaluated for continuous quality improvements process for the curriculum document. This type of study can be used as a tools to determine whether students have achieved the knowledge, practical skills and soft skills integrated in the curriculum from students' perceptions.

Generally this assessment study can be divided into two components which are the achievement of the students' perceptions and the comparison of the achievement of the students' perceptions with the actual final semester students' achievement through the final examination results. The results of the PLOs assessment are part of the continuous quality improvement (CQI) feedback loop obtained by JKM that can be used to improve the curriculum as well as the teaching and learning of the students as recommended by the Malaysian Qualification Agency (MQA).

PLO is specific program statement. It explains the things that need to be known, implemented and achieved by students at the end of their study period in polytechnics. PLO defined in Programme Overview Diploma In Mechanical Engineering, Curriculum document June 2014 as shown in Table 1.

Table 1: Programme Learning Outcomes (PLO)

	Description
PLO 1	<i>Knowledge of mathematics, science, engineering fundamentals and social sciences to well-defined mechanical engineering procedures and practices.</i>
PLO 2	<i>Analyse well-defined mechanical engineering problems with respect to operation and maintenance, including troubleshooting</i>
PLO 3	<i>Conduct investigations and assist in the design of solutions for mechanical engineering systems</i>
PLO 4	<i>Apply appropriate techniques, resources, and engineering tools to well-defined mechanical engineering activities, with an awareness of the limitations</i>
PLO 5	<i>Demonstrate an awareness and consideration for societal, health, safety, legal and cultural issues and their consequent responsibilities</i>
PLO 6	<i>Communicate effectively with the engineering community and society at large.</i>
PLO 7	<i>function effectively as an individual and as a member in diverse technical teams</i>
PLO 8	<i>Demonstrate an understanding of professional ethics, responsibilities and norms of engineering practices</i>
PLO 9	<i>Demonstrate an awareness of management, business practices and entrepreneurship</i>
PLO 10	<i>Demonstrate an understanding of the impact of engineering practices, taking into account the needs for sustainable development</i>
PLO 11	<i>Recognise the needs for professional development and to engage in independent and lifelong learning</i>

(Source: Document of Curriculum, June 2014)

PLO assessment of lecturers is based on the assessment conducted by each lecturer directly through summative assessment that has been made throughout the learning process (Karami et al.,2004 in Seri Mastaza et al,2009). Data collected using Learning Domain (LD) instrument were analyzed and compared with the studies conducted on DKM students who completed their studies in POLISAS in December 2016 session. In addition, the comparative analysis results are also used as an indicator to determine the need to improve the implementation of a program in accordance with the continuous quality improvement (CQI).

Table 2: Learning Domain (LD)

	Description
LD 1	<i>Knowledge</i>
LD 2	<i>Practical Skills</i>
LD 3	<i>Communication Skills</i>
LD 4	<i>Critical Thinking and Problem Solving Skills</i>
LD 5	<i>Social Skills and Responsibilities</i>
LD 6	<i>Continuous Learning and Information Management Skills</i>
LD 7	<i>Management and Entrepreneurship Skills</i>
LD 8	<i>Professionalism, Ethics and Moral</i>
LD 9	<i>Leadership and Teamwork Skills</i>

(Source: Document of Curriculum, June 2014)

2. Literature review

The Diploma in Mechanical Engineering curriculum is a learning experience plan for learning and to produce competent, professional and integrated human beings. The curriculum features provided for the DKM program are intended to produce knowledgeable and competent human capital in Mechanical Engineering. The PLO comprises of 8 domains of learning outcomes emphasized in the Malaysian Qualification Framework (MQF). Learning outcomes are statements about what students are required to know, understand and can do after completing a study (KKM, 2011). Therefore an assessment is needed to measure how far the PLO is achieved after following the DKM curriculum provided by the Department of Polytechnic Education. This is because evaluations represent the process of visualizing, acquiring and providing descriptive court information on the strengths and weaknesses of goals, designs, implementation and impacts to help make decisions, requirements for accountability and to help understand phenomena that occur (Stufflebeam and Shinkflied, 2007)

With reference to various definitions and concepts related to the assessment and evaluation of the program, it can be concluded that evaluation is a systematic study of information about programs/projects, procedures, curriculum, courses, management, educational software, teaching materials or a policy. The assessment aims to identify the effectiveness of the strengths and weaknesses of a program and also identify the various factors that are related to the percentage of success of the program (*Ahamad Shabudin Yahaya, Azizi Yahaya & Kartini Abdul Mutalib, 2010*). As a result, the information obtained from the assessment of a program can help provide feedback to the organizer / planner of the decision-making program ie whether the program is to be continued, modified through improvements or terminated. Program evaluation can be implemented using appropriate assessment model depending on the purpose of the assessment (Stufflebeam, 2000). According to Ahamad Shabudin Yahaya (2010), there are three main features that must be taken into account by reseachers conducting a program evaluation study ie firstly, program evaluation is a systematic inquiry that contributes information to designers or policy makers. The information obtained from the assessment will be used as a guide in the formulation of a program, policy or program policy. Secondly, program evaluation must also be value-oriented. Value is important because it can prove the success or failure of a program and thirdly is the time to do a program evaluation. No specific time has been set for evaluating a program. Assessment can be done at any time ie either in the initial, mid or end of the program depending on the types of assessment to be implemented.

3. Methodology

This study used a pilot study design which is a survey to study the achievement of PLO. The sample of the study is composed of final semester DKM students in JKM, POLISAS. The researcher chose the students to study the PLO achievement level of the DKM students at JKM, POLISAS. Reffering Krejcie & Morgan (1970), the DKM students population for the cohort studied is 263, then the sample taken is 156.

The instruments in this study are descriptive. This research instrument is a questionnaire form based on a study on the PLO achievement level of the DKM students at POLISAS adapted from the exit survey used by Universiti Malaysia Pahang (UMP). The questionnaire used consists of two parts as follows:-

- a) Section A : Questions related to respondents' personal information
- b) Section B : Questions related to the achievement level of DKM students at JKM, POLISAS

Section A requires respondents to answer questions related to self-information using a nominal scale. Each respondent must mark (√) on every answer that they have chosen. While questions in section B use an interval scale of likert scale.

4. Result and Discussion

4.1 Data Analysis

The data processing and analysis in this study were conducted using the IBM SPSS Statistical 20 software. Data analysis conducted in this study comprises analysis on the three main parts, part A consisting of demographics of final semester students for DKM programme in JKM, POLISAS, part B is analysis about the level of PLO achievement of DKM students and part C, the comparison of PLO achievement by students' perceptions with achievement analyzed from final year students' exam results. Part A is analyzed to obtain respondents' distribution in terms of gender and race by using frequency and percentage calculations. Whereas for sections B and C, the data analyzed are based on the initial objectives of the study and to answer the questions of the predetermined study. The results of the study for Part A are presented in percentage format and analysis information. In analyzing sections B and C, descriptive statistics have been used. Both objectives are reported in the form of mean score. Analysis of the findings was done by putting the category very low, low, medium, high and very high according to the mean score interpretation table as in Table 3

Table 3: Mean Score Interpretation Table

Mean Score	Description
1.00-1.80	Very Low
1.81-2.60	Low
2.61-3.20	Medium
3.21-4.20	High
4.21-5.00	Very High

(Source: Moidunny, 2009)

4.1.1 Analysis of Part A - Student Demographic Information

In this section, respondents' background of gender and race was analyzed using the percentage method. This data is important to show the actual number of respondents involved in the study according to gender and race. The results showed that 84.1% of respondents were male and 15.9% were female. This is because the number of male students taking the DKM course was much higher than female students. According to the race's analysis, 98.1% of the respondents were Malays and 1.7% were Indians. This is because the number of Indian students who took this course was too small compared to Malay students.

4.1.2 Part B Analysis - PLO achievements level of DKM students

There were eleven PLOs to be examined in identifying the achievement level of DKM students. Students were asked to evaluate the extent to which the PLO was achieved at the end of the semester of their studies. Questionnaires containing 43 items of PLO were distributed to students. These items were used to evaluate specific PLO achievements according to the predetermined Learning Domain (LD). Table 4 shows that the PLO has been applied in the DKM curriculum and LD which was considered to represent the PLO to be assessed and analysis of the findings obtained. Some items have been used to assess LD achievement levels for each PLO. The min score was obtained by taking into account each item representing each LD that contributed to the PLO.

Table 4: Min Score and Standard Deviation for DKM student achievement of the DKM session in December 2016

Learning Domain (LD)	Programme Learning Outcome	Mean Score	Description
LD 1	PLO1/PLO2	4.00	High
LD 2	PLO4	4.02	High
LD 3	PLO6	4.07	High
LD 4	PLO3	4.06	High
LD 5	PLO5/PLO10	4.06	High
LD 6	PLO11	4.08	High
LD 7	PLO9	4.08	High
LD 8	PLO8	4.08	High
LD 9	PLO7	4.07	High
Average Mean		4.06	High

Table 4 shows the average mean score for the achievement of DKM students in POLISAS for final semester students in December 2016 was 4.06 which can be interpreted as High. Overall, all the items studied have reached a High interpretation of the mean. However, the highest mean score was achieved by LD6, LD7 and LD8 which was 4.08 and the lowest mean score was LD 1 which was 4.00. This finding showed that DKM students felt that they achieve highest level of continuous learning and information management skills (LD6), Management and entrepreneurial skills (LD7) and Professional, Ethical and Moral (LD8). However, students felt that their achievement in LD1 which is knowledge was lower. This is followed by a mean score achieved by students for Practical Skills (LD2) which was 4.02. The score of the mean score achieved for Critical Thinking Skills and Problem Solving (LD4) and Social and Responsible Skills (LD5) was 4.06. Hence, the mean score for communication skills (LD3) and leadership and teamwork skills (LD9) was 4.07. Average value for mean was 4.06 which shown a high level of interpretation. In conclusion, the achievement level of PLO for DKM students in POLISAS has achieved the level of interpretation which is high and this means that the respondents feel that they have achieved all the PLOs that are applied in the curriculum through items that have been submitted.

4.2 Comparison of the mean score of the students' PLO achievement score from the survey with actual achievement.

This comparison is made to answer the objectives of the second study. In this section, the mean score for each PLO will be compared to the actual PLO achievement in which the student was assessed during the course of the study by the lecturer. Actual PLO achievement data was obtained through the Polytechnic Informatics Management System (SPMP) for December 2016 session. Table 5 shows PLOs achievements from their actual survey and achievement through examination results.

Table 5: Comparison of PLOs' achievements from students' surveys and achievements through examination results.

LD	Mean of PLOs' achievements from students' perceptions	Mean of achievements through examination results
1	4.00	3.28
2	4.02	3.75
3	4.07	3.60
4	4.06	3.40
5	4.06	4.08
6	4.08	4.00
7	4.08	3.80
8	4.08	3.95
9	4.07	4.15
Average	4.06	3.78

Table 5 showed that mean achieved from students' perceptions is higher than mean score from the student's actual achievement for LD1, LD2, LD3, LD4, LD6, LD7 and LD8. Only for LD 5 and LD9 the examination results showed the higher mean than the survey. The mean score of the students' perceptions for knowledge, LD1 was 4.00 and mean from actual results is lower which was 3.28. While mean score for LD2 which is practical skills was 4.02 from the students's perception and 3.75 from their results. For Communication Skills, LD3, students felt that they achieved mean score of 4.07 but their examination results showed that they only achieved mean score of 3.60. For LD4 which is Critical Thinking and Problem Solving Skills, mean score of the students' perceptions was 4.06 compared to 3.40 from the examination results. Hence, for Social Skills and Responsibilities, LD5, the mean score of the students' perceptions was 4.06 and the score mean from examination results was 4.08. For LD6 which is Continuous Learning and Information Management Skills, the mean score of the students' perceptions was 4.08 and the mean score from the examination results was 4.00. While for LD7, Management and Entrepreneurship Skills, the mean score of the students' perceptions was 4.08 and the mean score from the examination results was only 3.80. The mean score of the students' perceptions for LD8 which is Professionalism, Ethics and Moral was 4.06 compared to the score mean from the examination results which was 3.95. Finally for LD9 which is Leadership and Teamwork Skills, the mean score from students' perceptions was 4.07 while from the examination results was 4.15. The results showed that although mean obtained from the examination results was lower than mean from the survey, but all the items studied achieved the High interpretation of mean as shown in Table 3.

5. Conclusion

The results showed that the achievement of PLO for DKM students in POLISAS from the students' perception of the shows a high mean score of 4.06. This finding is consistent with Kesavan et al (2015) findings that summarize the level of employer satisfaction on the technical level and technical knowledge of POLISAS students. Results from the comparison of data with actual results showed that the mean score was found to be in the same category except for all the LDs. This shows that DKM students at POLISAS agree that they have achieved all the PLOs applied in the curriculum throughout their studies. This is approved by the comparison made with their actual examination results.

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