

## QUANTITATIVE ASSESSMENT OF BACHELOR MECHANICAL ENGINEERING PROGRAMS BY SENIOR EXIT SURVEYS AT UNIVERSITI MALAYSIA PAHANG

M.S.M.Sani, A.Senawi, M.M.Noor, M.M.Rahman, M.Y.Taib, A.Sulaiman, K.Kadirgama,  
S.H.Tomadi, R.Daud, M.R.M.Rejab

Faculty of Mechanical Engineering, Universiti Malaysia Pahang, 26300 UMP, Kuantan, Pahang, Malaysia

E-mail: [mshahrir@ump.edu.my](mailto:mshahrir@ump.edu.my), [muhamad@ump.edu.my](mailto:muhamad@ump.edu.my)

### ABSTRACT

*Continuous program improvement is an important role to ensure the producing the high quality graduates of the engineering programs. This paper explores the assessment of continuous program improvement of mechanical engineering programs at Universiti Malaysia Pahang. Rapid change in the job market demands made it vital for the engineering education providers to adopt a strategy of continuous quality improvement (CQI) of their academic programs. The exit survey was utilized as a tool to assess the graduate students of Faculty of Mechanical Engineering (FKM), Universiti Malaysia Pahang. The exit survey was covered the student's impressions towards teaching and learning, skills and knowledge related to Program Outcomes (PO's), student ratings for lecturer's contributions, student opinions towards academic resources and overall graduate preparation by FKM. The outcome of assessment processes and how it can be facilitate to improve the mechanical engineering program was also investigated. The survey was conducted during last academic semester (first semester of the year 2008/2009). It is observed that all program outcomes have at least 70% student rating towards skills and knowledge preparation related to the program outcomes. This is confirmed outcome based education strategies when the entire curriculum should mapping to the program outcomes. Based on this survey, approximately more that 76.8% of the respondents are agreed that the mechanical engineering program are suitable and recommended of study to community.*

**Keywords:** *Continuous quality improvement, exit survey, skills, knowledge, program outcomes.*

### INTRODUCTION

Universiti Malaysia Pahang (UMP) was established on 16<sup>th</sup> February, 2002. It was established under Section 20 of the University and University College Act 1971 (Act 30) under the Orders of Universiti Malaysia Pahang (Incorporated) 2002 [1]. However, faculty of mechanical engineering at Universiti Malaysia Pahang (UMP) is one of the faculties that only have been established since April 2003. Currently, the faculty has four undergraduate programs; one is Bachelor of Mechanical Engineering (BMM).

The accreditation is granted by the Board of Engineers Malaysia, in full accordance to the procedures underlined by the Registration of Engineers Act 1967 (Revised 2006) [2]. Accreditation ensures that the courses offered by the department are recognized and accepted worldwide [3]. Engineering Accreditation Council (EAC) of Malaysia has been directed that Outcome-Based Education (OBE) learning approach is to be adopted in engineering academic programs in Malaysia. Higher Learning Institutions from developed country sat together and came up with the Washington Accord where every signatory member recognized engineering graduates from the other member nations [4,5]. Malaysia as a developing country is trying to move towards this direction of being a signatory of Washington Accord (WA). It would be an international recognition that the quality of graduates produced is at same level to that of developed nations. In the modern world where the supply of graduates seems to outpace the demand of the industry, the industry has more choices [6,7]. This is probably one of the reasons why the Outcome Based Education (OBE) was formulated. The successful implementation of OBE is the main criterion to be a new member of WA. OBE is a method of curriculum design and teaching that focuses on what students can actually do after they are taught [6]. The underlying belief that drives OBE is the conviction that all students can learn, regardless of ability, race, ethnicity, socioeconomic status, and gender [7]. OBE also urges schools to generate "exit outcomes" based on the challenges and opportunities that students will face after graduation, and then to "design down" from the outcomes for all other aspects of educational delivery [8]. Transformation and developing engineering programs has been taken is a major concern that has been dealt

by many universities. There have been rapid changes in the technologies and consequently the needs and expectations of the industrial sectors of graduates from engineering university.

Program assessment should be done continuously to ensure the quality of higher education. Continuous program improvement is an important factor in ensuring the high quality of the graduates. Shuman et.al [9] was identified twelve methodologies that could be used for program assessment. The twelve methodologies are: authentic assessment, physical portfolios, electronic portfolios, student journals, competency measurements, intellectual development, concept maps, verbal protocols, student surveys, student interviews, focus groups and alumni survey. Assessment of the engineering programs by the various parties is an essential activity in the process of continuous program development [10,11]. The assessment of the programs by senior students immediately prior to their graduation, by means of senior exit surveys, is one of the key tools for the development process [12].

Previous exit survey questions are based on the mechanical engineering eleven program outcomes for the first and second intake [13]. Program outcomes are specific statements of graduates' knowledge, skills and attitudes that are evidences in the program objective achievements [14]. The program outcomes spell out the types of graduates that we are going to produce [15]. This eleven program outcome was developed by faculty on first accreditation process [2,13]. The outcomes for the program must be stated before any implementation of the OBE. The outcomes must take into account the needs of all the stakeholders include top management of university, faculty management, lecturer, student, parents, expert from various industries, alumni representative and representative from ministry of education office. The first draft was started based on the Programme Outcomes (PO) as stated in the ABET requirement and EAC manual [2,16]. After two batches completed this Bachelor of Mechanical Engineering Program, faculty academic faculty decided to review PO's and do some amendment based on comments from last two batch accreditation audit sessions [17].

The survey is particularly useful for valuing the graduating students input on the quality education, determining that the areas that need improvement in mechanical engineering programs. This paper present the results of a final year student exit survey conducted for mechanical engineering programs towards the end of first semester of the year 2008/2009, before the students do the industrial training at the final semester. The questionnaires based on student impression on teaching and learning at FKM, students responds on skills or knowledge related to PO's, student ratings for lecturer contributions, student opinion towards academic resources, overall services from FKM and recommendation program of study. This assessment strategy aligned with cycle of "develop-implement-review" (Figure 1) in order to improve the quality of program.

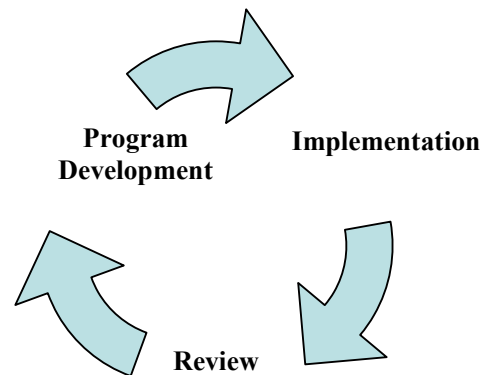


Figure 1: Program Continuous Improvement Cycle

## METHODOLOGY

The methodology was used to determine the students' assessment of the engineering programs. The final year student was filled-up the exit survey questionnaires. For this survey, a total of 98 students were received from graduating students in academic year 2005-2009. The questions were evaluating based on the six following categories:

- a) Teaching and learning at FKM, Universiti Malaysia Pahang
- b) Skills or knowledge related to Program Outcomes

- c) Lecturer and academic advisor contributions
- d) Academic Resources
- e) Overall program preparation by FKM, UMP
- f) Recommendation program of study

All data collected from the survey are analyzed using statistical analysis.

## RESULTS AND DISCUSSION

For the purpose of analysis, the response from the final year students was analyzed based on the following six criteria:

- a) Responds on the teaching and learning activities at FKM
  - b) Responds on the skills and knowledge related to PO's
  - c) Student Ratings for Lecturers/Academic Advisor Contributions
  - d) Student opinions toward academic resources
  - e) Student opinions toward overall preparation by FKM
  - f) Student opinions toward recommendation program of study and UMP as choice of institution.
- a) Responds on the teaching and learning activities at FKM

The analysis results based on responds towards the student impression regarding the overall quality of educational experience received and quality of learning at FKM, UMP are summarized in Table 1. It can be seen from the results tabulated in Table 1 that 70.7% of the respondents agreed that the overall quality of educational experience received at UMP has been in good and excellent level. This is also analogous with UMP education strategies to provide students with technical knowledge, skills as well as soft skills. Furthermore, the results also indicate that 69.9% of the respondents rated at good and excellent level towards the overall quality of teaching received at FKM. Based on the results obtained from Table 2, 70.7% are agreed that better quality improvement of teaching and learning has been practiced at FKM. However, 29.3% of respondents not agreed to quality improvement of teaching and learning at FKM because of majority of educators are young lecturers and lag of enough experience in teaching and learning at higher level institutions. On other hand, academic services and development center (ASDC), UMP has taken action to improve the teaching skills and facilitating skills in order to improve quality of teaching. Beside of that, since 2005, FKM has been sent more 20 academic staff pursuing PhD in various field of mechanical engineering. These initiatives are embark the teaching and learning activities with high knowledge of educators.

Table 1: Overall student impression towards teaching and learning at FKM, UMP

Students impression towards:	Marginal	Fair	Satisfactory	Good	Excellent
Overall quality of educational experience received at UMP	0%	2.2%	27.1%	57.9%	12.8 %
Overall quality of teaching received at FKM	0%	3.8%	26.3%	62.4%	7.5%

Table 2: Overall student impression towards quality improvement of teaching and learning at FKM

Students impression towards:	No Change	Somewhat Better	Much Better
Overall quality improvement of teaching and learning at FKM	29.3%	57.9%	12.8%

- b) Responds on the skills and knowledge related to PO's

Table 3 shows the student ratings for importance of skills and knowledge of student performance to PO's. Nine out of eleven program outcomes contributes 80% above score regarding for the importance skills and knowledge to the student performance. The highest percentage, 84% belong to program outcome number three which is an ability to design a system, component, and process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability. This result shows the strong relationship between student performance and program outcomes. Besides of that, Table 4 shows the skills and knowledge preparation related to program outcomes. It is observed that all program outcomes have at least 70% student rating towards skills and knowledge preparation related to the program

outcomes. This is confirmed outcome based education strategies when the entire curriculum should mapping to the program outcomes.

Table 3: Student ratings for the importance of skills and knowledge to student performance related to PO's

No.	Program Outcome	Average Score (1-5)	Percentage Score (%)
1	An ability to apply knowledge of mathematics, science, and engineering	3.88	77.6
2	An ability to design and conduct experiments, as well as to analyze and interpret data	4.12	82.4
3	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	4.20	84
4	An ability to function on multi-disciplinary teams	4.11	82.2
5	An ability to identify, formulate, and solve engineering problems	4.10	82
6	An understanding of professional and ethical responsibility	4.05	81
7	An ability to communicate effectively	4.10	82
8	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	3.95	79
9	A recognition of the need for, and an ability to engage in life-long learning	4.11	82.2
10	A knowledge of contemporary issues	4.02	80.4
11	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	4.05	81

Table 4: Student ratings for student skills and knowledge preparation related to PO's

No.	Program Outcome	Average Score (1-5)	Percentage Score (%)
1	An ability to apply knowledge of mathematics, science, and engineering	3.57	71.4
2	An ability to design and conduct experiments, as well as to analyze and interpret data	3.73	74.6
3	An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability	3.73	74.6
4	An ability to function on multi-disciplinary teams	3.71	74.2
5	An ability to identify, formulate, and solve engineering problems	3.73	74.6
6	An understanding of professional and ethical responsibility	3.62	72.4
7	An ability to communicate effectively	3.74	74.8
8	The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context	3.56	71.2
9	A recognition of the need for, and an ability to engage in life-long learning	3.79	75.8
10	A knowledge of contemporary issues	3.62	72.4
11	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	3.63	72.6

c) Student Ratings for Lecturers/Academic Advisor Contributions

Responses from students towards the academic advisor contributions are summarized in Table 5. It can be seen that the most of students who believes the contributions were average, good or excellent. Majority of the students are agreed that the lecturers/academic advisor contributions for all items are satisfactory and more than 50% of respondents are agreed to rating good.

Table 5: Student ratings for lecturers/academic advisor contributions

Criteria	Average	Good	Excellent
Set high expectations for learning	40.2%	53.7%	6.1%
Encourage student to be active learner	49.4%	46.9%	3.7%
Exhibit proficiency in the field of instruction	39.7%	51.8%	8.5%
Show concern for student learning	45.1%	50%	4.9%
Provide feedback frequently and promptly	39.0%	55.1%	5.9%
Communicate critical concepts and ideas effectively	41.5%	46.3%	12.2%
Encourage student and to devote sufficient time and energy to course work	37.2%	54.3%	8.5%
Incorporate teamwork as part of the learning process	32.9%	52.5%	14.6%
Proficiency in the area of instruction	35.4%	51.2%	13.4%
Overall teaching ability	33.0%	58.5%	8.5%
Responsibilities to quality and problem resolution	32.9%	57.3%	9.8%

d) Student opinions toward academic resources

i) Response on academic advising of their major

Table 6 summarized the student opinion on academic advising of their major attained during their study related to students' impressions of their academic resources. The numbers in the second column of the table are response averages, based on responses with range from 1 (meaning don't know) to 5 (meaning excellent). The minimum and maximum score found to be 3.49 and 3.70, which implied that the most of the students are satisfy their academic advising during their study. Figure 1 shows the satisfactory rating on their academic advising. It can be seen that the average rating are 3.61.

Table 6: Student ratings on academic advising of their major

Satisfaction with:	Average Score (1-5)
Career advising	3.49
Access to advisors	3.60
Amount of time spent with advisors	3.60
Accuracy of information about the degree requirements and course sequencing	3.63
Assistance on major concentration and elective selection	3.65
Overall quality of advising	3.66

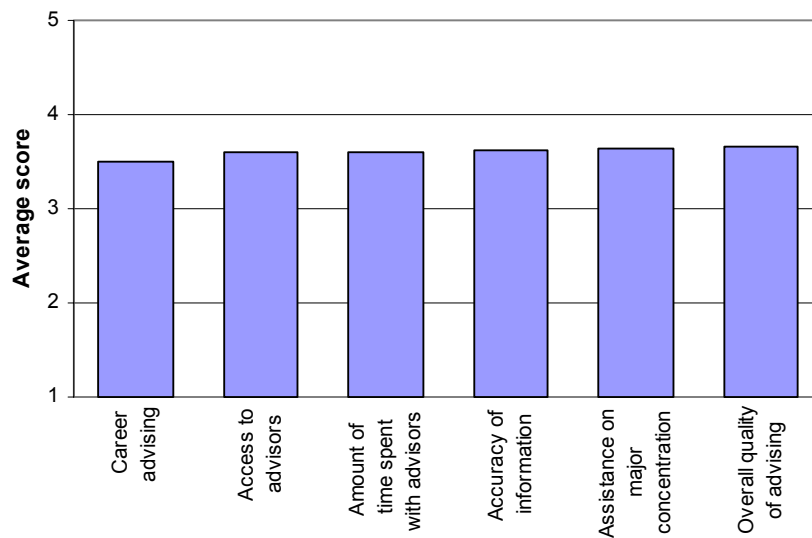


Figure 1: Satisfaction rating with academic advising of their major

ii) Response on Library Services

Table 7 are tabulated the students opinion on the library services provided related to students' impressions of their academic resources. The average scores are based on responses with range from 1 (meaning don't know) to 5 (meaning excellent). Figure 2 shows the satisfaction rating on the library services during their study period. It can be seen that the respondents rating are good and satisfactory level.

Table 7: Student ratings on library services

Satisfaction with:	Average Score (1-5)
Hours of operation	3.49
Access to databases and collections both physically and online	3.60
Staff responsiveness	3.60

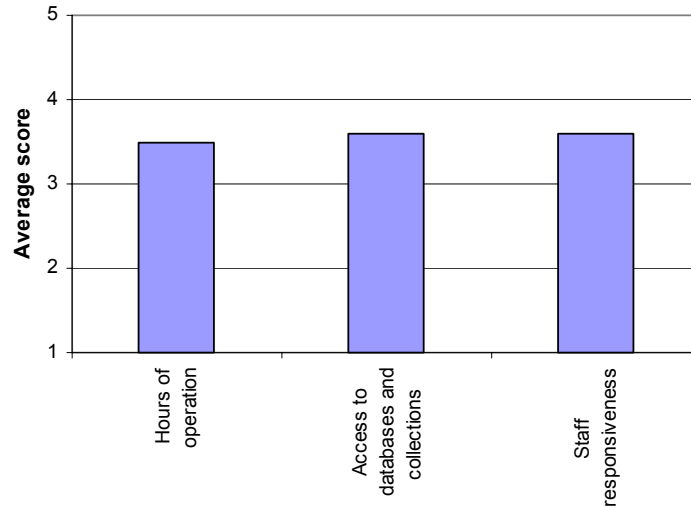


Figure 2: Satisfaction rating with library services

iii) Response on Information Technology/Computer Services Provided

Table 8 summarizes the student opinion on information technology/computer services provided related to students' impressions for their academic resources. The average scores are based on responses with range from 1 (meaning don't know) to 5 (meaning excellent). The minimum and maximum score are found of 3.19 and 3.67 for this criterion. Figure 3 shows the student rating on the service provided during their study period. It can be seen that the students are also satisfy their information technology and computer services throughout their study.

Table 8: Student ratings on information technology/computer services provided

Satisfaction with:	Average Score (1-5)
Access to the internet	3.27
Networking functioning	3.23
Quality of computer labs in the faculty	3.63
Helpfulness of labs personnel	3.20
Overall staff responsiveness	3.19
Quality of classroom	3.35
Quality of laboratories	3.67
Standard of technology available in classrooms	3.63

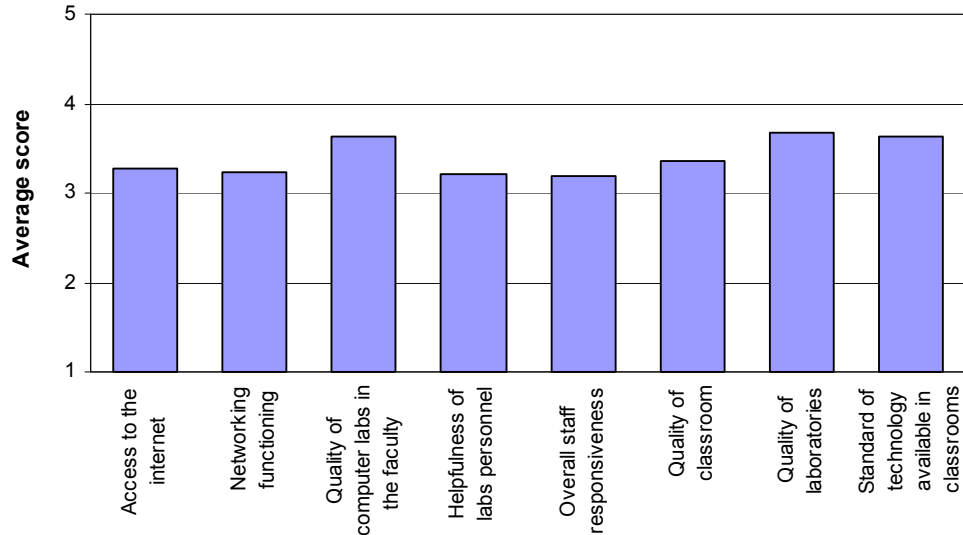


Figure 3: Satisfaction rating with information technology/computer services provided

e) Student opinions toward overall preparation by FKM

Figure 4 shows the satisfaction rating with FKM preparation for career training, graduate study, personal and intellectual growth. Based on Figure 4, it can be concluded that more than 80% of the respondents are agreed to all criteria including career training, graduate study, personal and intellectual growth. All these criteria are adequate and suitable level for program.

f) Student opinions toward recommendation program of study and UMP as choice of institution

Figure 5 shows the willingness to recommend program of study and UMP as choice of institution to community. Based on Figure 5, it can be concluded that:

- Respondents agreed and willingly to recommend program of study to community are 76.8%.
- Respondents agreed and willingly to recommend UMP as choice of institution to community are 71.0%.

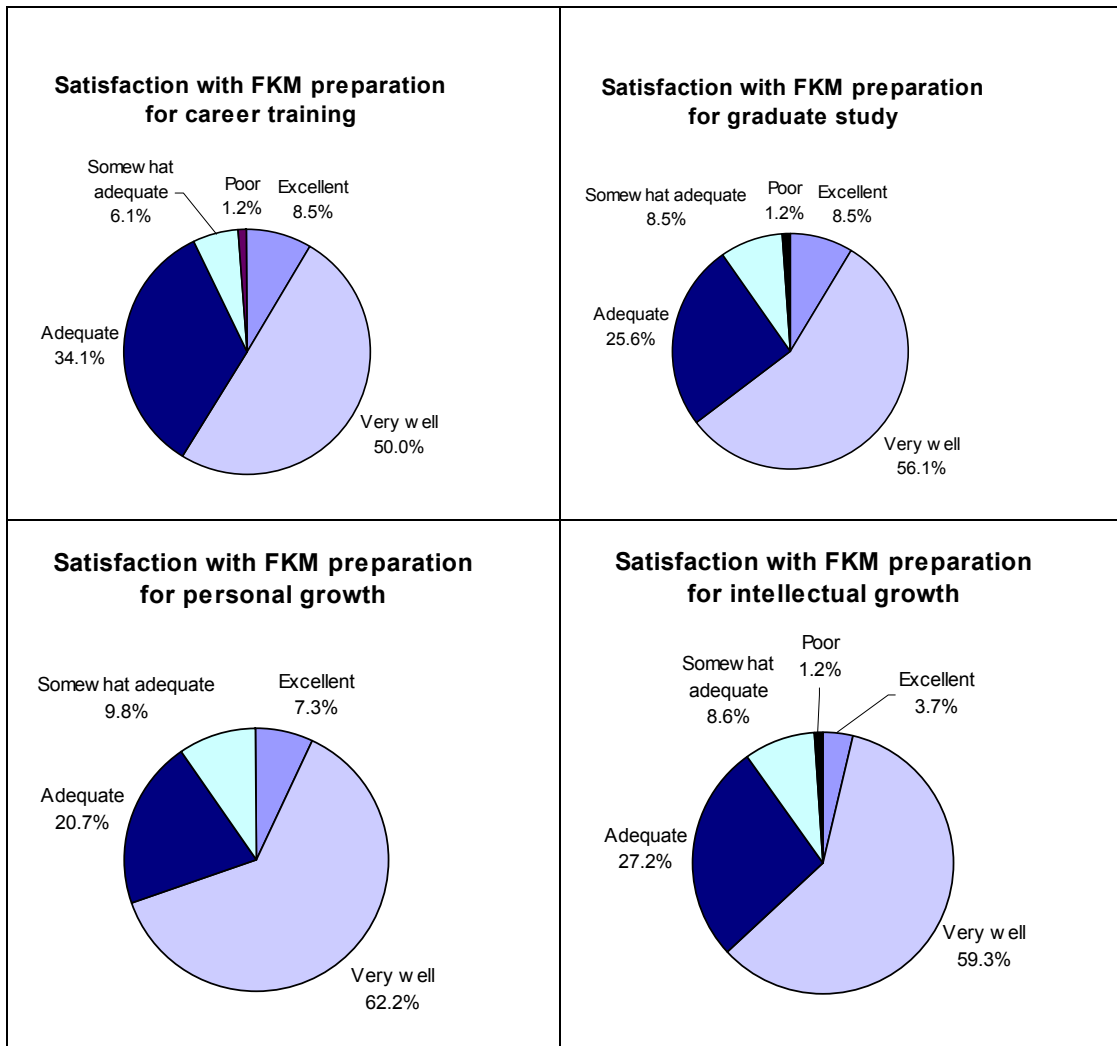


Figure 4: Satisfaction rating with FKM preparation for career training, graduate study, personal and intellectual growth.

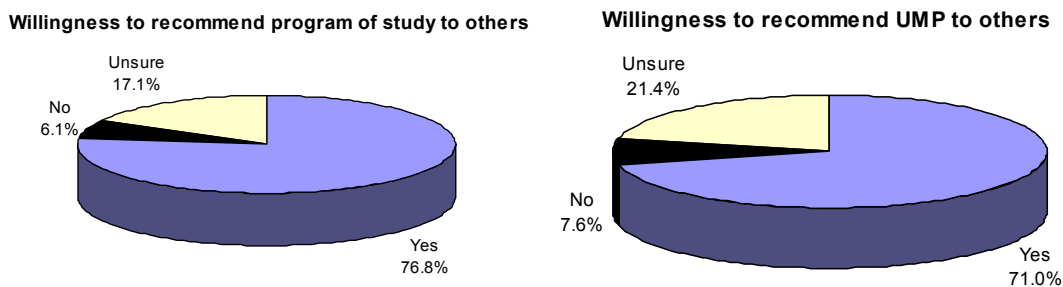


Figure 5: Response of willingness to recommend program of study and UMP as choice of institution.

## CONCLUSION

It is concluded from the assessment that quality of education and the level of preparation of Mechanical Engineering program are appropriate and at satisfactory level. Majority of the PO's strongly related and positive trends on quality and improvement of program. At least 70% of respondents rated are good and excellent rating



on this exit survey. As whole, the exit survey found to be an essential tool that can be improvement of the quality continuously.

## **ACKNOWLEDGEMENT**

The authors would like to express their deep gratitude to Universiti Malaysia Pahang for provided the financial support.

## **REFERENCES**

- [1] The Faculty of Mechanical Engineering Academic Guidebook Session 2008/2009 (2008)
- [2] Engineering Programme Accreditation Manual (2007), Engineering Accreditation Council (EAC).
- [3] Shajahan, M., Hamzah, H. & Taufik (2007), "Curriculum Structure Of Degree Programme offered by the Department of Manufacturing Design Universiti Teknikal Malaysia Melaka, Regional Conference Engineering Education (RCEE 2007), Johor, Malaysia.
- [4] Blust, A. (1995), The Debate Over Outcome Based Education, News & Views.
- [5] Malan, SPT (2000), "The 'new paradigm' of outcome-based education in perspective", *Tydskrif vir Gesinsekologie en Verbruikerswetenskappe*, 28, 22-28.
- [6] Acharya, C. (2003), "Outcome-based Education (OBE): A New Paradigm for Learning", Centre for Development of Teaching and Learning (Singapore), Vol. 7, No. 3
- [7] McNeir, G. (1993), "Outcome-Based Education", ERIC Digest 85, University of Oregon, Nov.
- [8] Spady, William G. (1998), "Organizing for Results: The Basis of Authentic Restructuring and Reform.", *Educational Leadership* 46, pp. 4-8
- [9] Larry Shuman, Mary E. Besterfield-Sacre, Harvey Wolfe, Cynthia J. Atman, Jack McGourty, Ronald L. Miller, Barbara M. Olds and Gloria M. Rogers (2000), "Matching Assessment Method to Outcomes: Definitions and Research Questions, ASSE Annual Conference, Session 3530. St. Louis, Missouri.
- [10] Leonard, M.S., Nault, E.W. (2004), "An Integrated Approach to Evaluation of Program Educational Objectives and Assessment of Program Outcomes using ABET Criteria for Accreditation of Engineering Programs", ASEE Annual Conference Proceedings: Engineering Education Researches New Heights, pp. 7543-7553.
- [11] Doepker, P.E (1999), "The Development and Implementation of a Assessment Plan for Engineering Programs: A Model for Continuous Improvement", ASEE Annual Conference Proceedings: Engineering Education to Serve the World, pp. 4905-4914.
- [12] Nader Al-Bastaki. (2005), "Assessment of the Engineering Programs by Senior Exit Surveys at University of Bahrain", Regional Conference on Engineering Education, December, Johor, Malaysia, pp. 343-347.
- [13] Sani, M.S.M., Noor, M.M., Senawi, A., Sulaiman, A.S. & Rejab, M.R.M. (2008). "Assessment of the Mechanical Engineering Programs by Exit Surveys at University Malaysia Pahang", 4<sup>th</sup> International Conference on University Learning and Teaching, Shah Alam, pp 317~322.
- [14] Noor, M.M., Kadirgama, K., Rejab, M.R.M., Sani, M.S.M., Sulaiman, A., Rahman, M.M., Rose, A.N.M., Bakar, R.A. & Ibrahim, Abdullah "Quality Management System in the Implementation of OBE at Faculty of Mechanical Engineering, Universiti Malaysia Pahang", 4<sup>th</sup> International Conference on University Learning and Teaching, Concorde Hotel, Shah Alam, 20-21 October 2008, 277~285.
- [15] Rejab, M.R.M, Noor, M.M, Rahman, M.M., Kadirgama, K., Sulaiman, A., Sani, M.S.M., Rose, A.N.M. , Zahid, M.N.O. & Bakar, R.A., "Implementation of Outcome-Based Education in the Faculty of Mechanical Engineering, Universiti Malaysia Pahang: An Experience", 4<sup>th</sup> International Conference on University Learning and Teaching, Concorde Hotel, Shah Alam, 20-21 October 2008, 311~316.
- [16] Felder, R.M. and Brent, R. (2003), "Designing and Teaching Courses to Satisfy the ABET Engineering Criteria", *Journal of Engineering Education*, 92 (1), pp. 7-25.
- [17] Self Assessment Report for Bachelor of Mechanical Engineering Program, Faculty of Mechanical Engineering, Universiti Malaysia Pahang (2009).