Outcome Based Education (OBE) Curriculum Assessment for Industrial Training Program: Based on Students' Perception

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Abstract: - The implementation of outcome-based education (OBE) curriculum in the university syllabus nowadays plays an important role in producing quality graduates students. Assurance to the effectiveness of OBE, a steady and continuous assessment must be carried out through each course as well as the industrial training program. This paper discussed the perceptions of the undergraduate students from Civil and Structural Engineering Department who have undergone their industrial training program. Questionnaires were prepared and summarized into three main aspects i.e. 'personal attitude', 'communication' and 'work attitude' of the students before and after the training program. The results show that the overall student's performance before the training averaging from 48% to 63% for these three main aspects. Interestingly the percentage has tremendously increased to 89% - 95% after completion of the training program. This proved that the OBE implementation in university syllabus is beneficial for improvement to the engineering education and engineering profession in general.

Key-Words: - Industrial training, program outcomes (PO), course outcomes (CO), attitude, work attitude, communication.

1 Introduction

The increasing numbers of development in infrastructure and building projects throughout Malaysia nowadays has made the university constantly produce graduate students every year. This is in line with the Malaysia visions to become a fully developed country by year 2020. For this aspiration to be realized, Malaysia expects to have approximately 200,000 of engineers to serve and develop the country (Mustafa et al., 2008). Excellent qualification, dedicated, responsible and well trained are amongst the key factor to become successful engineers. Furthermore, most of the companies nowadays are expected to hire graduates with skills, quality and market ready. Thus automatically their operating cost can be greatly reduced. As to fulfil those criteria specified by the companies, the industrial training program is being made a compulsory course for every student in the faculty. By having this industrial training, students are exposed to the responsibility of an engineer and the engineering profession, communication skills that include daily interaction within the real working environment and as well as technical writing. Furthermore, the needs to include the industrial training as part of the university curricula are also under requirements of Board of Engineers Malaysia (BEM) through Malaysian Engineering Accreditation Council (EAC, 2006).

Apart of that, starting from 2004 all the engineering programs in Malaysia have been instructed to adopt OBE based curriculum by the EAC as a part of the requirement for BEM to be a full member of the Washington Accord (WA). This is to ensure that the engineering degree produced by the Malaysian Universities would be recognized by the fellow WA member, such as United States, United Kingdom, Australia, South Africa, and etc (Shahrir et al. 2008). The implementations of OBE curriculum in all engineering courses, which also include industrial training, have given a positive implication for the graduates. Most of the existing courses have been reviewed and modified as well as the industrial training courses where the companies' requirement and input have been taken into consideration. As a result, every program that runs in the faculty or department have its own outcomes whilst, every course that offered in the department

also needs to have its own outcomes. At the moment there are twelve program outcomes (PO) have been formulated for each course and the list of POs are as follows:

PO1 – Ability to acquire and apply knowledge of basic science and engineering fundamentals,
PO2 – Ability to communicate effectively, not only with engineers but also with the community at large,
PO3 – Having in-depth technical competence in a specific engineering discipline,
PO4 – Ability to undertake problem identification, formulation and solution,
PO5 – Ability to utilise a systems approach to design and evaluate operational performance,
PO6 – Ability to function effectively as an individual and in a group with the capacity to be a leader or manager as well as an effective team member,
PO7 – Having the understanding of the social, cultural, global and environmental responsibilities and ethics of a professional engineer and the need for sustainable development,
PO8 – Recognising the need to undertake lifelong learning, and possessing/acquiring the capacity to do so,
PO9 – Ability to design and conduct experiments, as well as to analyse and interpret data,
PO10 – Ability to function on multi-disciplinary teams,
PO11 – Having the knowledge of contemporary issues,
PO12 – Ability to use the techniques, skills, and engineering tools necessary for engineering practice.

For the industrial training program/course, six course outcomes (CO) have been designed as follows:

CO1 – Expose student to work, responsibility of an engineer and the ethics of engineer
CO2 – Ability to communicate effectively within the working environment
CO3 – Expose students to general and specific procedure of engineering field which related to industry
CO4 – Expose student to engineering practice which is specific to his/her specialization
CO5 – Ability to prepare technical report for the industrial training
CO6 – Ability to use the theoretical knowledge for solving the industry problem

All of six COs need to be mapped with the 12 POs as shown in Table 1 according to the Undergraduates Studies Guidelines Session of Engineering Faculty (2007-2008). Based on that table only PO2, PO6 and PO7 were identified to be fully measured and marked as 3 (PO with fully measurement) and the rest of others POs were marked as 2 (PO with partial measurement) and 1 (PO with no measurement) in this industrial training program.

Table 1 Mapping of course outcomes (CO) with programme outcomes (PO)

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1							3			2	2	
CO2		3		1		3						
CO3						1	1			1		
CO4						1			1	2	2	
CO5		3							2			
CO6	2			1	1		1		2			

1 - PO with no measurement
2 - PO with partial measurement
3 - PO with fully measurement

These POs (PO2, PO6, and PO7) need to be measured in order to assess the effectiveness of OBE curriculum as well as the benefits of industrial training to the students. For the purpose of these measurements and assessments, a series of questionnaires have been prepared to suit with the three POs. These questionnaires were carried out to all civil engineering students in order to assess and compare their performance before and after the industrial training program. All 17 questionnaires were prepared and classified to 3 main aspects namely personal attitude, communication and work attitude. These 3 main aspects will be used to measure the 3POs where 'personal attitude' represents PO7, communication for PO2 and work attitude is for PO6. Hence, this paper will discuss on the three main aspects that contribute to the program outcomes for students in Civil and Structural Engineering Department based on their perceptions. In addition, these results also proved that students have gained benefits in terms of providing and upgrading their skills.

2 Research Methodology

Every year students in the Department of Civil & Structural Engineering from the Faculty of Engineering & Built Environment, Universiti Kebangsaan Malaysia (UKM) must undergo their industrial training program for at least 2 months. Normally the industrial training program will be carried out in the third semester for third year students who have successfully completed their six semester studies.

In 2008, a total of 105 civil engineering students have had their training program from 5th Mei 2008 to 4th July 2008 (Omar et al., 2008). 17 questions were asked and evaluated based on 1-5 Likert scale. This Likert scale was used to measure the extent and represent the perception of student's views (Likert, 1967). The choice of Likert scale were ranging from not satisfactory at all given as 1, not satisfactory as 2, neutral as 3, satisfactory as 4 and most satisfactory is given as 5. All questionnaires were prepared to meet the outcomes target and simultaneously can be used to investigate the students evaluation on the industrial training program which were includes of:

a) Students profile
b) Place of industrial training
c) Students perception before undergo the industrial training programme
d) Students perception after undergo the industrial training programme
e) Students perception on the benefits of industrial training programme and
f) Placement method for the industrial training programme through online application

The questionnaires were given to the students once they have completed the industrial training program.

3 Results and Discussion

Results from the questionnaires are discussed and divided accordingly as follow.

3.1 Student's Profile

The total numbers of 105 students in the third year of Civil and Structural Engineering Department can be divided to 34% (36 person) of female and 66% (69 person) of male as shown in Figure 1 (Osman et al., 2008). Percentage of the students was Malay (50%), Chinese (40%), Indian (1%) and others (9%). The students' entry level to UKM can be divided into 4 sources where 50% of them came from Matriculation colleges, 37% from Malaysian Certification Higher School holder (or STPM), 10% were from diploma holders with any university and 3% were from others qualification. Figure 2 shows the distribution of students' percentage entry level to the department.

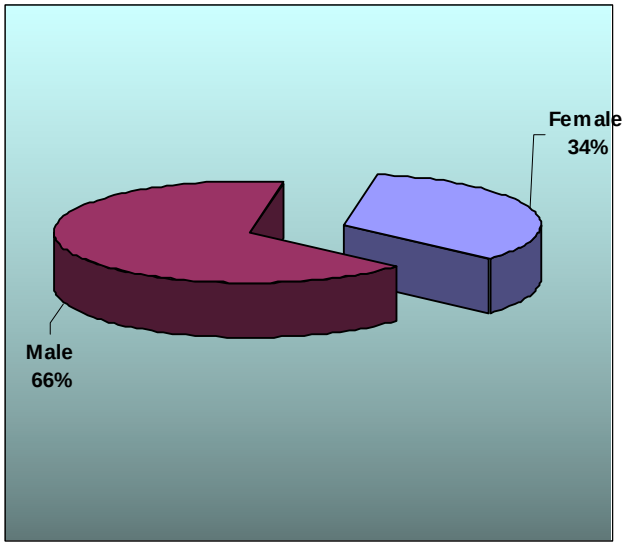

Fig. 1 Students percentage by gender

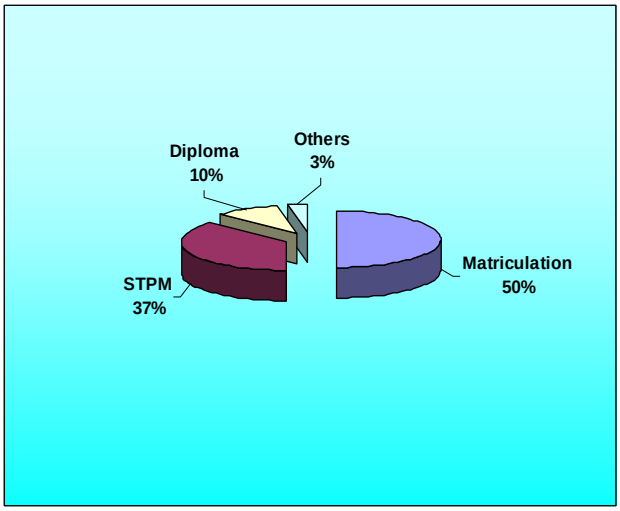

Fig. 2 Students percentage by entry level

3.2 Place of Industrial Training

Each year students from the department will have their training placement throughout Malaysia; however their placement (56%) were mostly concentrated in the urban area and in a town centre such as Kuala Lumpur. Table 2 shows the percentage of students' placement in various companies that available in Malaysia. As expected

most of the civil engineering students were interested to have their placement in Properties and Construction sector (37%) and followed by the Consultancy sector (34%). Normally female students were likening to have their industrial training placement in consultant design office whilst for male students they always preferred to be placed in construction sector.

In the aspect of specialization and scope of work for the companies as shown in Table 3, majority of the students (44%) were having their training in companies that involved in civil and structural engineering work and civil and environment work (21%). Some of them were also involved in mechanical (8%) and electrical engineering (8%) companies. Placements of students in the right companies which involve in the same field such as civil and structural would benefits the students, otherwise students may end up their training program without any knowledge and experience if they were placed in the unsuitable companies. Even though students were given full opportunity to choose the companies, but faculty did always monitored the suitability and capability of the companies in providing the training program.

Table 2 Students placement in various Companies

A . Types of Companies	**Percentage (%)**
Manufacturing Sector	2
Properties & Construction Development	37
Transportation	7
Agriculture & Food	1
Material Engineering	1
Energy & Natural Resources	2
Built Environment Sector	8
Consultancy	34
Others	9

Table 3 Students percentage according to Companies specialization

Companies specialization	**Percentage (%)**
Mechanical	8
Manufacturing	3
Civil and structural	44
Civil and environment	21
Biochemical	1
Microelectronics	2
Electrical	8
Communications	4
Computer	2
Architectural	5
Others	3

Based on Malaysia Small Medium Industries Development (SMIDEC) definition, the available companies in civil engineering sector can be classified into three types of sizes; large company with numbers of employees more than 250, medium size company with employees around 100 to 250 and small size company with the employees below 100 (SMIDEC, 2007). Figure 3 shows the highest percentages (47%) of the students were having their placement training in small size company whilst the lowest percentages with 23% of the students were placed in medium size company. From these data it proved that majority companies involved in civil engineering sector were from consultant office and small contractor. Even though these companies were considered small but their capabilities in providing more opportunities, training coverage, management skills were much better when compared with large companies (Connor and Shaw, 2008).

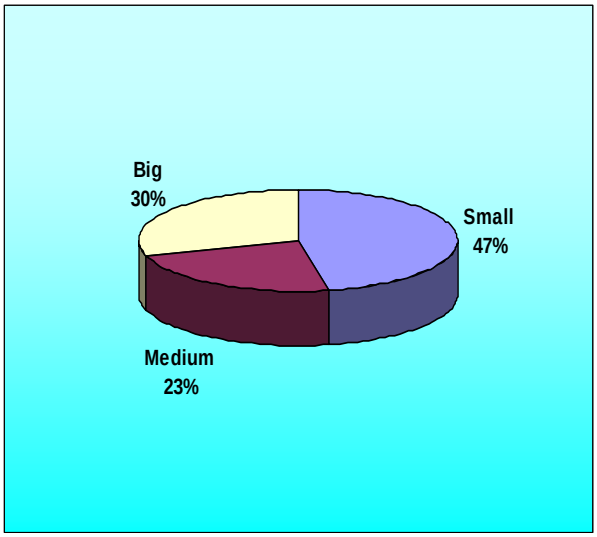

Fig. 3 Percentage of students' placement in company

3.3 Students' Perception before Industrial Training

As mentioned before all the 17 questionnaires can be classified into three main aspects and were prepared by considering the POs and COs as shown in Table 3 (Osman et al. 2008). These aspects were assessing the students' perception before the industrial training. Based on these questionnaires (as shown in Figure 4), 66% of the students agreed that they have good personal attitude (PO7) and 63% of them have an ability to perform good work attitude (PO6) before the training. This indicates that even before the training starts the students are confidence on their ability to posses' good attitude and in delivering good works as an trainee engineer. The confidence level of the students may be achieved because of the OBE curriculum where students have been exposed to ethic of engineering courses and they also involved with the real design project during their studies. For example in structural design course of steel and reinforced concrete, the application of real project is much important in order for the students to have real picture of the design concept. So their preparation in completing the design project which involves drawing, calculation, simulation and written report has prepared them prior having their training. However for the communication aspect (PO2), only 48% of the students are confidence in their communication skills and the rest have problem with communication. Even though students have been exposed to do presentation since in the 1st year of their studies but their confidence level in communication skills is still low.

Table 3 Questionnaires classification

Aspects	**Questionnaires**
Personal Attitude	Good self esteem
	Good self & time management
	Self confidence
	Punctuality
	Curiosity
	Presentable self appearance
Communication	Oral presentation skills
	Written communication
	Interaction skills
Work attitude	Ability to work independently
	Adaptable with environment
	Teamwork
	Ability to work under pressure
	Leadership
	Problem solving skills
	Subject knowledge

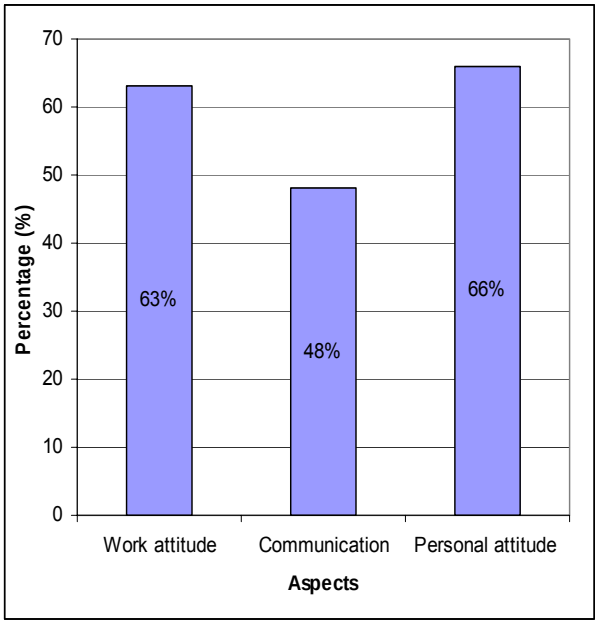

Fig. 4 Students' perception before industrial training

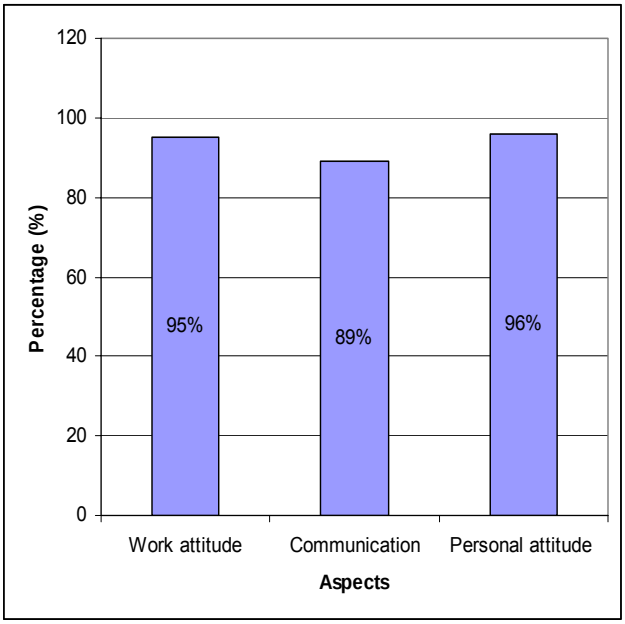

Fig. 5 Students' perception after industrial training

3.4 Students' Perception after Industrial Training

After completed the industrial training, the students' perception were also evaluated from the three aspects mentioned earlier. The percentage of three main aspects has now improved as shown in Figure 5 of which work attitude (PO6) and personal attitude (PO7) had increased up to 95% and 96%. The increment around 30% to 32% of these two aspects showed that the exposure to the industrial training had made the students improved their personal attitude and work attitude. It also means that the students can adapt themselves with the working environment and had gain confidence in delivering their works.

In communication aspect (PO2), the percentage has now increased up to 89% as shown in Figure 5. Most of the students agreed that after having their industrial training, they are more confident to express their work verbally and in writing skills. Interaction with office colleagues at all levels had also improved their daily communication and this has been proven by the increment of 41% compared with that of before the industrial training. This finding is in line with the study of Connor & Shaw (2008), which stressed that communication skills can be improved through industrial training experience.

As listed in Table 3, every aspects of work attitude, communication and personal attitude that been assessed have its own criteria. These criteria were prepared according to POs and COs and the students need to answer questionnaires based on their perceptions according to the Likert scale. From the answers gathered, POs of these three aspects can be fully measured and simultaneously the achievement of these course outcomes such as CO1, CO2 and CO5 can be determined. These measurements are important to be carried out yearly in order to monitor the effectiveness of OBE and also for continual review of the program.

The improvements in these three aspects (PO2, PO6 and PO7) have shown that the students are capable to be a good trainee engineer and through this program students can also be trained to become a responsible and good professional civil engineer. This aspect is very important as mentioned by Harris et al. (2005), where as an engineer they are responsible to the human safety, health and people welfare.

The comparison of details criteria for the three aspects before and after the industrial training is shown in Figure 6 – Figure 8. These criteria represent the same questionnaires that have been prepared as in Table 3. Figure 6 shows the comparison of personal attitude (PO7) before and after the industrial training for each criterion. Whilst for communication aspect (PO2), the comparison before and after the industrial training is shown in

Figure 7 and for work attitude aspect (PO6) is presented in Figure 8. Obviously every criterion of these three aspects (POs) have shown an increment and this proved that both students and companies were benefited from this training in terms of experience, load works and etc (Oyebisi et al., 1996).

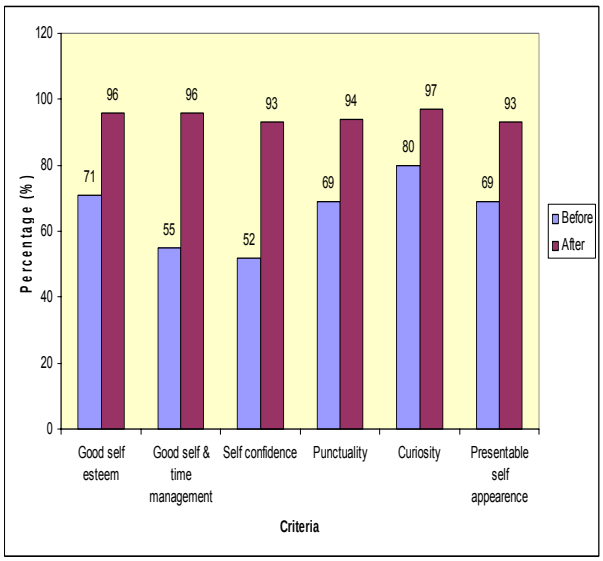

Fig. 6 Comparison of students' perception before and after undergoing industrial training based on criteria of 'personal attitude'

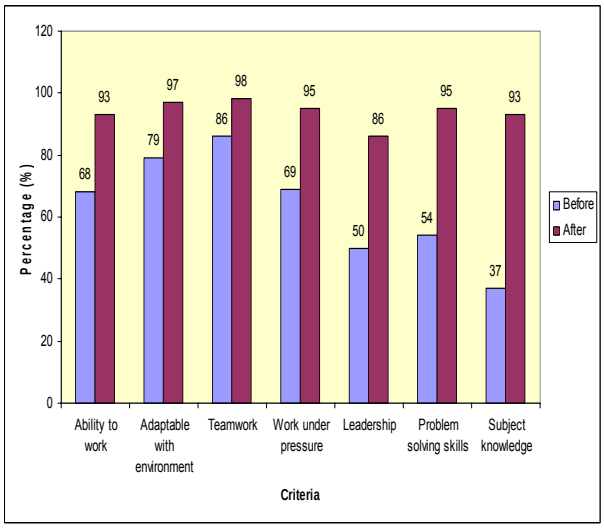

Fig. 7 Comparison of students' perception before and after undergoing industrial training based on criteria of 'communication'

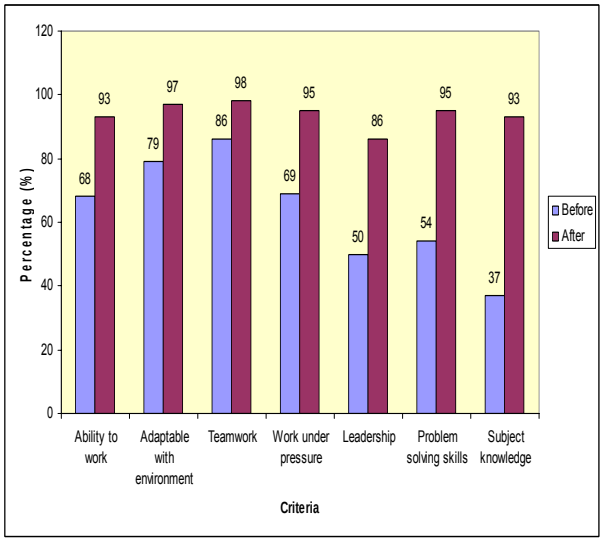

Fig. 8 Comparison of students' perception before and after undergoing industrial training based on criteria of 'work attitude'

3.5 Students' Perception on the Benefits of Industrial Training

Besides of these three aspects (PO7, Po2 and PO6), the questionnaires were also prepared to collect students' perception on the benefits of industrial training. As a result, from Figure 9 most of them (94%) agreed that the industrial training can increased their job prospect and 92% feel that it also provides more confidence in terms of job qualification. Whilst, 97% of them agreed that by doing the industrial training can provide more knowledge and guidance in choosing the job after graduated.

With high percentage for all aspects which almost 92% and above it is also proved that most of the students are satisfied with the industrial training and it is significant in helping them to plan for their future prospect and career. In addition by doing the industrial training, students can relate the fundamental theory that they have learnt in the university. Even though the students are now have been exposed to the OBE curriculum, but to apply the fundamental theory learnt in the university during industrial training may produce better trainee engineers and simultaneously students are well prepared when entering the workforce. According to Fallows and Steven (2000), fresh graduate students are immediately required to perform well with sufficient knowledge and background by the employer hence, by having the industrial training it is one of the options to equip them with such

experiences. Furthermore by having the industrial training program students will be more aware on the scope of works as a civil engineer and interestingly they will gain more knowledge especially the specialisation field in civil engineering profession. Some of the students may also have their ideas to choose and proceed their interest to work and prepare for their final year dissertation (thesis) based on what they have learnt during the industrial training program.

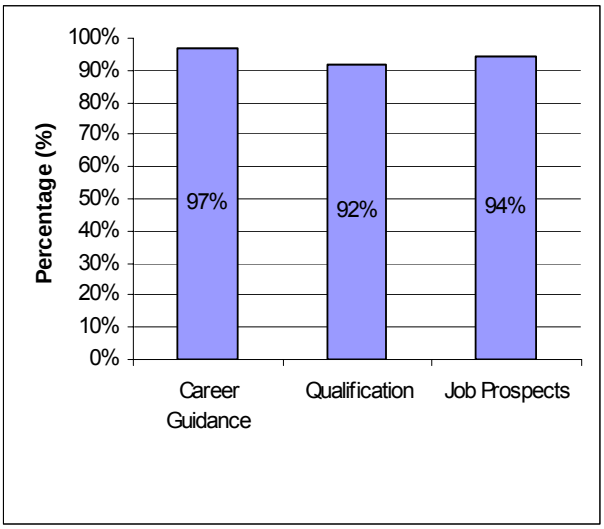

Fig. 9 Students' perception on the benefits of industrial training

3.6 Method of Placement for Industrial Training

Beginning from 2008, a new application method for industrial training which is known as SMPLAI has been introduced to all students in the Engineering Faculty. Students are compulsory to use the SMPLAI method. By using this SMPLAI method via online system, students can minimize their time and cost for the placement process. Furthermore through this process, the students' application letter can be monitored and well prepared by the faculty management. From the questionnaires results as shown in Figure 10, 80% of the students were successfully obtained their industrial training placement through this process and only 20% managed to get their placements using the other method. Those 20% who managed to get their placement may have sent their application letter, email or phoned directly to the companies which are not listed in the SMPLAI database.

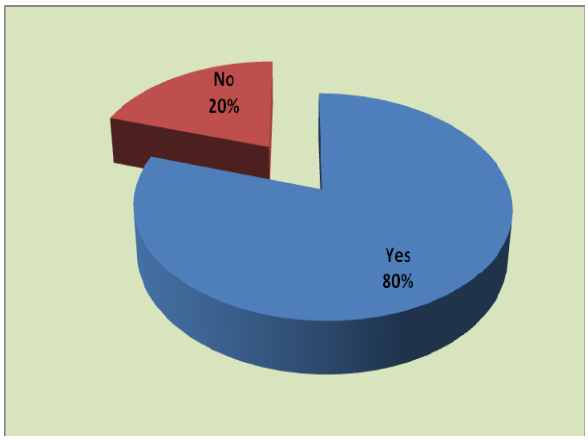

Fig. 10 Percentage of students' placement through SMPLAI

Students were also asked about their perceptions towards the SMPLAI method according to five aspects such as the application procedure and duration, the availability of the companies' data, informative and user friendly. Figure 11 shows that 45% of the students agreed that the SMPLAI method is informative in helping and providing the place. Students can save their time for searching the companies' availability and on top of that they can choose the companies which are nearest to their home town. From time to time the company profiles are always updated and the numbers of companies listed in the SMPLAI is also increasing. Meanwhile 72% of the students found that the SMPLAI method is user friendly and it shows that all the procedure and instruction in the method is properly arranged and easily to understand.

In terms of the application procedure and time that have been allocated for them in choosing the preferred place, only 62% and 65% of them were satisfied. The rest feel that they should have been given more time to choose their training places but for the faculty management the scheduled time table is important in order to ensure the application form can be processed in time. Delaying in processing the form would affect the students' preparation for the final examination as the industrial training program will start immediately after the exams. Only 38% of them have stated that the companies' data were sufficient in the SMPLAI. At the moment there are almost 2,000 numbers of companies' data that are available in the system and most of these companies are specialised in engineering fields of civil, mechanical, chemical and electrical. Based on these perceptions and feedbacks from the students, it shows that the SMPLAI method needs to be

improved in various aspects such as enhancing the method with complete and latest companies' database as to ensure the application process can be run smoothly. In addition, the system must also be updated with latest announcement with regards to the students' application status.

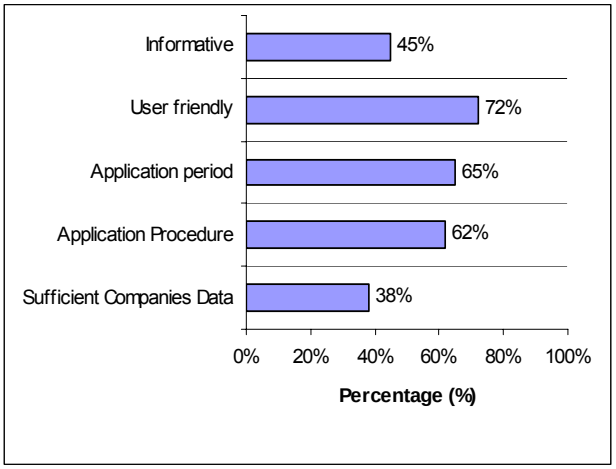

Fig.11 Students' perception towards SMPLAI

4 Conclusion

In conclusion, the purposes of this study have been achieved as all the students' perception data based on the three aspects (PO2, PO6 and PO7) were successfully obtained and assessed. From these data it shows that the percentage of personal attitude (PO7), communication (PO2) and work attitude (PO6) has significantly increased around 30% to 41% after they have completed the industrial training program. With these data it can also confirmed that the three COs from six COs that have been targeted (refer to Table 1) for this program were fully measured. These measurements show that the targeted CO is achievable and the effectiveness of OBE implementation through the training program can be evaluated.

Based on the POs and COs measurements, a continual improvement can also be carried out to enhance and strategize for a better industrial training program. A good cooperation and commitment from the companies in providing places for industrial training would also help the university to achieve the COs and POs. However, there are still rooms for improvement and review for the new SMPLAI method for students' placement. The feedbacks from the students were also proved that by undergoing the industrial training would give them opportunity to learn and experience the real world of working environment. Apart from that, with latest technology, knowledge and experiences that they have gathered during the training can also be used as an advantage for their future job prospects and guidance.

5 Acknowledgement

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