



Kongres Pengajaran dan Pembelajaran UKM, 2010

## Assessment of Programme Outcomes Through Exit Survey of Chemical/Biochemical Engineering Students

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### Abstract

Questionnaire of prospective university graduates have been identified as one of the effective methods for the strength and weakness assessment of the program curriculum. It is based on student feedbacks regarding on their performance and satisfaction in Department of Chemical & Process Engineering (JKKP) in order to determine the effectiveness of the Chemical and Biochemical Engineering Program at Faculty of Engineering and Built Environment, UKM. The questionnaire include a general information of future graduates, information on program outcomes over 4 years and acquiring skills, career preparation and student-lecturer relationship. The results of the evaluation process and recommendations for improving the curriculum were also studied. The study was conducted over two sessions (semester 2009/2010 and 2010/2011) for two batches of students. Overall, mostly all the prospective graduates are satisfied with the current system of teaching and learning in JKKP as well as also willing to involve into the working environment. Achievement of the 12 program outcomes indicates a satisfactory performance with an average of more than 70% and 57% for respective Chemical and Biochemical Engineering Program. Based on this study, approximately more than 27% graduate in Chemical Engineering believes that the theoretical-practical and technical oriented projects should be adopted, while 19% of Biochemical Engineering graduates thinks that the project design should be separated and should be more focused to the field of biochemical engineering area.

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### 1. Introduction

Questionnaire is an effective method of assessment to measure the strengths and weaknesses of a curriculum program based on students' feedback regarding on the performance and student satisfaction after their graduation. The Department of Chemical and Process Engineering (JKKP) University Kebangsaan Malaysia is always trying to get opinions and feedbacks from the graduates regarding the program, teaching and learning system that graduates get and achieve along their study as an undergraduate student and before they enter the real working environment. These feedbacks are very important to improve the quality and standards of teaching and learning in the JKKP. This

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study is based on the questionnaires given to the students at the end of final year semester. This type of questionnaire study has been conducted since 2006 in which its mission to measure the effective of Chemical and Biochemical Engineering Program. Career choice is an important aspect in an individual life since the chosen career will determine the pattern of work that will be played by individuals in the community later (IPPTN, 2003). Career choice is an important process individual life when a person starts thinking about involving in the real world of working environment (Sidek Mohd Noah, 2002) and it is one of the biggest problems faced by graduate students.

The objective of this study was to obtain the basic information about the career choices of graduates and the respondents' assessment of teaching and learning in JKPP. In particular, this study will also determine the level of graduate's preparation into the working environment, industry area options, and to measure the achievement level and program outcomes of graduates over four years in JKPP. The measurement of program outcomes was determined through a graduate survey of Chemical and Biochemical Engineering graduate based on the 12 program outcomes (PO), which has been outlined by the Faculty of Engineering and Built Environment as shown in Table 1.

Table 1 Program outcome (PO) of Department of Chemical & Process Engineering

No.	Learning Outcome
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 chemical engineering.
PO4	Ability to undertake problem identification, formulation and solution.
PO5	Ability to utilize 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	Recognizing 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 analyze 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.

## 2. Research Methodology

This study used questionnaire type survey to collect a basic quantitative information relating to the teaching and learning assessment in JKPP. About 106 graduates of the 76 respondents from Chemical Engineering program, while 30 respondents of Biochemical Engineering students for the batch 2009 and 2010 participated in this study. The questionnaire includes general information of future graduates, including information on the program outcomes over 4 years, their performance during four year period in JKPP and preparation to face a career world and the relationship between the students and the lecturers. Prospective graduate survey was conducted into two batches of JKPP graduate students, which graduated in the last two sessions of April 2009 and April 2010. Based on the collected information and objectives of the study, data analysis was limited to the basic descriptive analysis based on the index number, percentage and charts. A questionnaire was developed specifically to gather the information. The questionnaire was measured by using a likert scale of 1 (low) to 5 (excellent) scales. This questionnaire consists of four sections, namely:

- a. Part A (General Information of Respondents)
- b. Part B (Information of Teaching and Learning) which consists of four sub-sections (i) program outcomes over 4 years in JKPP (ii) achievement of performance over 4 years in the UKM (iii) preparation to face a career world and (iv) Lecturer-student relationship

## 3. Results and Discussion

### 3.1 General Information of Respondent

General information section in this exit survey focuses on valuable information after graduation day, the field of career choice and job offer before graduation. The analysis will be reported according to the item or group of being

studied for both graduates in 2009 and 2010, where the percentage of respondents planning to work after graduation was very high. Figure 1 shows more than 90% of respondents planned to work after graduation, the tendency of respondents for further studies is between 3-9% only, while for other choices are about 2%. Figure 2 shows the industry preference after graduation. Majority of respondents had chosen to work in the manufacturing sector. The percentage of respondents employed by sectors for the two graduation year were manufacture industry 36-64%, services and consultancy respectively about 3-12%, government bodies 9-16%, universities and colleges 4-6%, entrepreneurs 8-13% and others 7%. From the aspects of starting a career, less than 10% of respondents were able to obtain an employment after graduation. Figure 3 shows the job offered to respondent before completing their final year study.

Overall, the planning of JKKP graduates is mostly based on the job market situation nowadays. About 89% and 97% of respondents had an enthusiasm to participate in the job market right after graduation. This situation indicates that graduates are ready to face with the working environment based on their knowledge and skills they acquired during study in JKKP. It also gives a good competitive environment among the graduates in the job market and shows employers' confidence in their capabilities to contribute to the firm in future. The second option after graduation is to pursue to higher level of education which is at low with only about 10% of respondents are planning to pursue a higher level of education or attending the training/courses to enhance at the higher level of capability and skills. While, 2% of respondents chose neither to participate in the job market nor pursue higher level of education. The graduates might have plans to involve and joint venture into the businesses area or others. The involvement of graduates into the job market was consistent with the mission of program objectives in the JKKP to produce a professional level and good quality of graduates that can contribute towards the development of the country. Graduates have an opportunity to involve in several areas such as manufacturing, services, consultation, universities or colleges, entrepreneurs, government bodies and others. The manufacturing sector became the predominant sector by the respondents at 36% and 64% for year 2009 and 2010 respectively. This situation is reliable with the orientation of teaching and learning that aims to produce higher quality of engineers in that sector and also proves that the graduates of UKM relevant to the needs of the manufacturing industry.

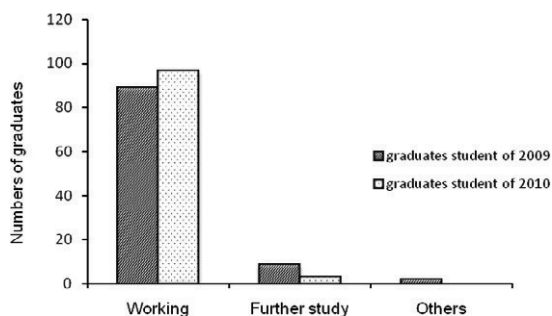


Figure 1 Comparison of career plans after graduation for respondent 2009 and 2010

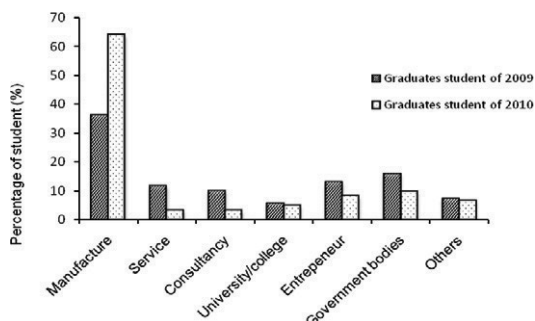


Figure 2 Comparison of the Respondent Choice of the Industry in 2009 and 2010

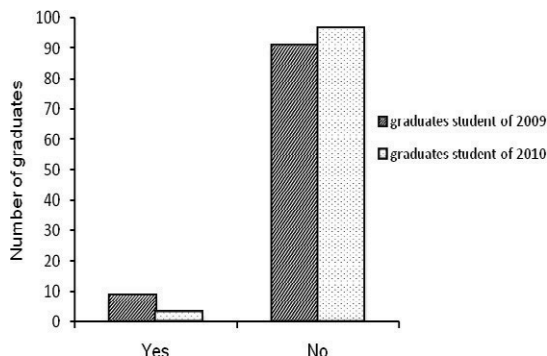


Figure 3 Job Offered to the respondents Before Graduation in 2009 and 2010

### 3.2 Teaching and Learning Outcomes

Figure 4 and 5 show the performance results on the program outcomes achievement for graduate student in year 2009 and 2010 during their fourth year of study at JKPP. Meanwhile, Figure 6 shows the comparison between graduates 2009 and 2010 who gave an excellent and very good response on the program outcomes achievement of JKPP. The results found that all the respondents showed their confidence in teaching and learning of JKPP. This confidence is measured by the average percentage of respondents achieving outcomes over 4 years in JKPP which the average percentage for both years was about 70%. Higher level of confidence in the system and quality of education in JKPP had been developed through the teaching and learning experience in the following aspects: curriculum, assessment system, quality of lecturers, facilities, career guidance services, knowledge and skills acquired, and the impact of programs on the development of professionalism and skill themselves. Graduates of JKPP also had applied with the enhancement of professionalism through the efforts of lifelong learning. It is driven by the higher competition in the job market from various universities in Malaysia and abroad. They had to compete with each other in a professional group, and also with others graduates who have a master’s degree and qualified in various professional fields.

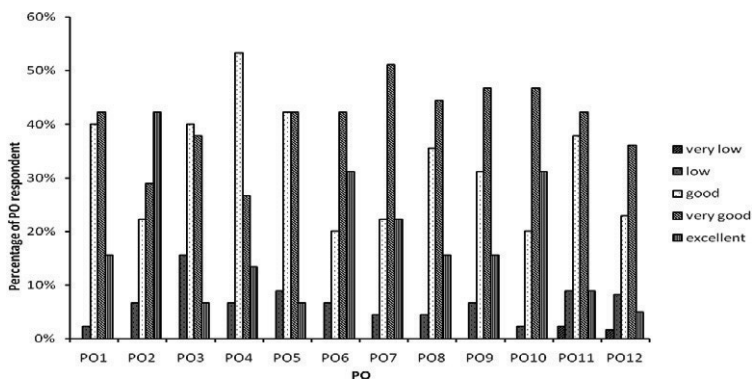


Figure 4 Achievement of Program outcomes over 4 years in JKPP for graduates 2009

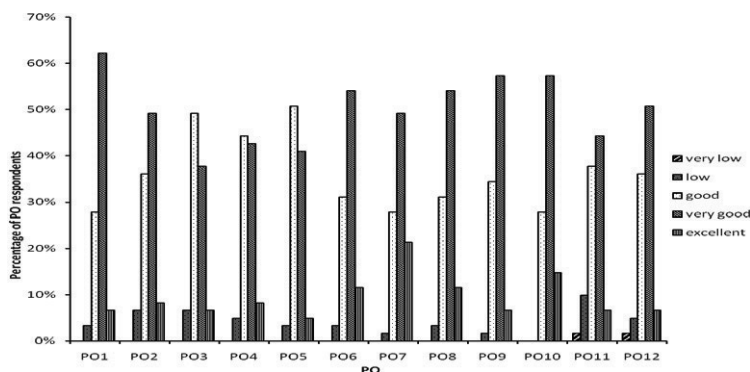


Figure 5 Achievement of Program outcomes over 4 years in JKPP for graduates 2010

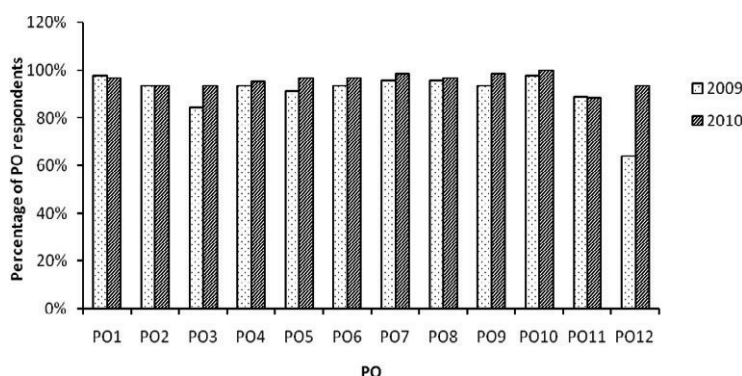


Figure 6 Comparison of Achievement of Program outcomes over 4 years in JKPP for graduates 2009 and 2010

Table 2 lists down the statement in the questionnaire asking the performance of learning for fourth year study in UKM. The graduate performance during their study in JKPP is shown in Figure 7 and 8 for the respondents in year 2009 and 2010. In addition, Figure 9 shows a comparison of 2009 and 2010 respondents who stated an excellent and very good on their performance over 4 years in JKPP. Generally, the performances of the graduates for the past 4 years in JKPP was at very satisfactory level with an average percentage are 70% for both years. This finding indicates that the impact of programs on development of professional and personal skills had received the highest rating by the respondents. Overall, the respondents were satisfied with the scope of knowledge or skills that they had obtained.

Table 2. Statement on performance of learning for fourth year study in UKM

Item	Aspect
3.1	Technical content of programs (courses of engineering and other scientific and technical courses).
3.2	Experience in designing and operating the laboratory experiments, including data analysis and discussion.
3.3	The ability of applying engineering principles, the problem of chemical/ biochemical engineering and system design
3.4	Participation in teamwork to solve a problem.
3.5	Training to identify and formulate the problem and solve the methods.
3.6	Understanding on issues of professionalism and ethics in engineering and how to use it.
3.7	Oral communication and effective writing.
3.8	The quality of others courses of the engineering field (such as management, co-curriculum, and ethics) and the extent to which courses can help make you to become the global engineer.
3.9	Ability to use of common software (MSWord, Excel) as well as professional software (like AutoCAD, Matlab, HYSIS, iCON, SuperPro).
3.10	Overall quality of the learning experience at the Department of Chemical and Process Engineering, UKM
3.11	Confidence to work as a chemical/ biochemical engineer.

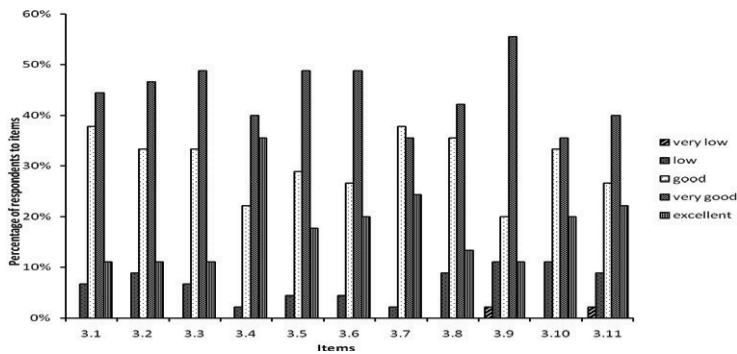


Figure 7 Performance of 4 years in JKPP for 2009

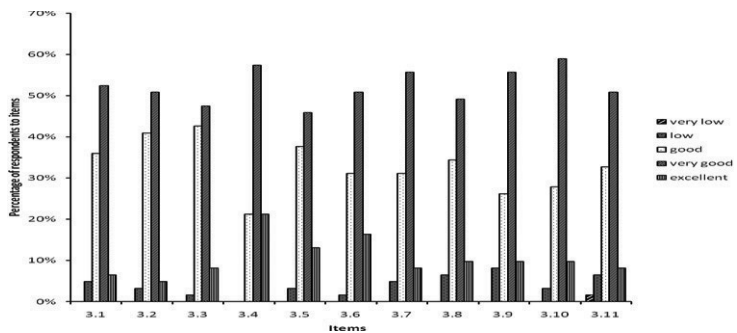


Figure 8 Performance of 4 years in JKPP for 2010

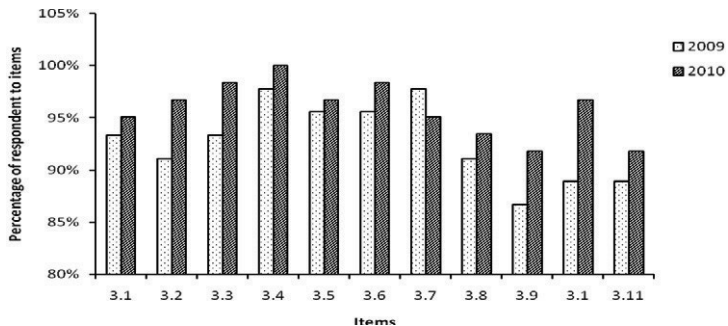


Figure 9 Comparative performances of 4 years in JKPP for both groups of students

Table 3 lists down the statement in the questionnaire asking the preparation of respondent for starting the career. Figure 10 and 11 show the percentage ready graduates to enter the working environment for graduates in year 2009 and 2010. Whereas, Figure 12 shows the comparison between 2009 and 2010 groups of graduates who achieve an excellent and very good level of readiness to enter the world of working. It show 72% of both years graduates expressed higher desire to enter the working world. This result is consistent with the expectations of JKPP to produce the professional graduates to support the development and improvement of industrial competitiveness in the era of economy and contribute their expertise in the national socioeconomic development. This proves that the teaching and learning experience in the JKPP can achieve the human capital development as required which not only depends on the quality of human capital, but also the intellectual and characteristic workers. In the same time, JKPP always trying to improve the quality of education not just the quantity but the quality of graduates.

Table 3 Statement on the preparation of respondent for starting the career

Item	Aspect
4.1	Preparation of the technical aspects in the engineering profession.
4.2	The ability to manage technical projects.
4.3	Preparation of research and engineering development.
4.4	Preparation to pursue their studies at a higher level of education.
4.5	Get job opportunities through the dissemination of information by UKM.
4.6	Experience through the industrial training

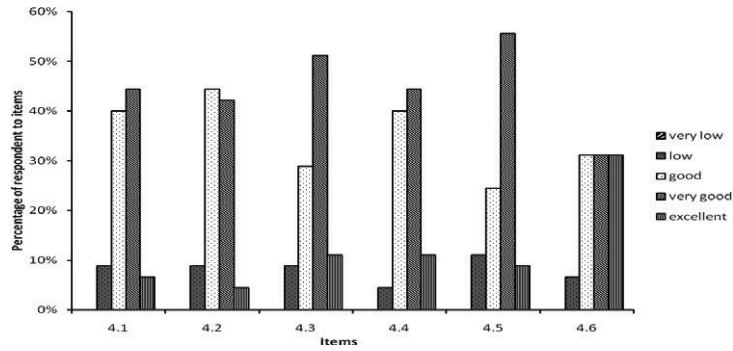


Figure 10 Agreement of statement for the preparation of graduates to enter working environment in 2009

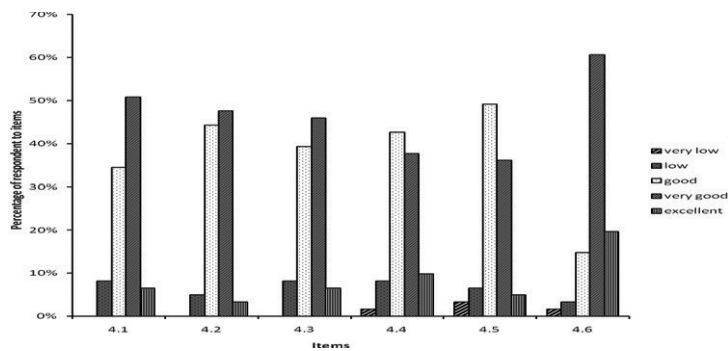


Figure 11 Agreement of statement for the preparation of graduates to enter working environment in 2010

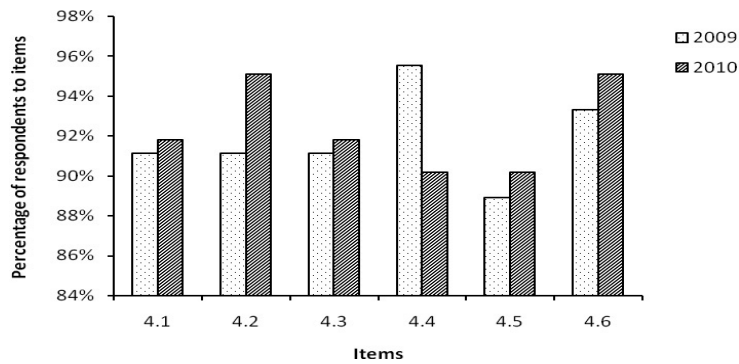


Figure 12 Agreement of statement for the preparation of graduates to enter working environment for both groups of students

This is also due to continuous efforts of JKPP to cooperate with a diversity of industrial firms/companies in the industrial training programs for final year graduates. This industry training provides the valuable experience and benefits; especially for graduates students to apply their theoretical knowledge that had learned in lecture and laboratory to the real application. Through industrial training as well, graduates are able to strengthen and enrich the various competencies built over a period of learning before and given an opportunity to perform based on the level of field study and familiarize with the current issues and latest developments in the fields that they will be pursue after graduation in future.

Table 4 lists down the statement of student-lecturer relationship. Besides that, the perception of student-lecturer relationship quality can be seen in Figure 13 and 14 which the percentage of the relationship between student and lecturer at the JKPP is very encouraging for both groups of students. Meanwhile, Figure 15 shows the comparison of year 2009 and 2010, who gave an excellent and very good relationship between lecturers and students. Overall, the respondents were satisfied with the quality of the lecturers in the process of teaching and learning which more than 70% of respondents expressed satisfaction in both studies.

Table 4 Statement of student-lecturer relationship

Item	Aspect
5.1	Quality and benefits of mentor-mentee system.
5.2	Willingness of the lectures to answer questions in the classroom and help students understands the course content.
5.3	Opportunity to meet with lecturers outside of class time for general advice or things related to the course.
5.4	Overall quality of the relationship between the student / lecturer.
5.5	Overall quality of the relationship between students / staff of the laboratory and the General Office.

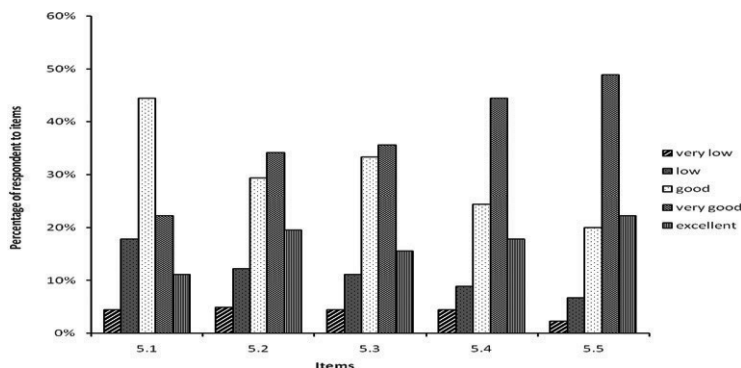


Figure 13 Agreement of statement on student-lecturer relationship for 2009 graduates

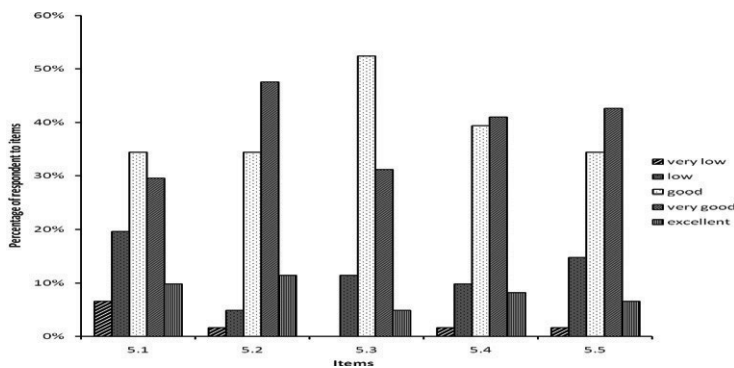


Figure 14 Agreement of statement on student-lecturer relationship for 2010 graduates



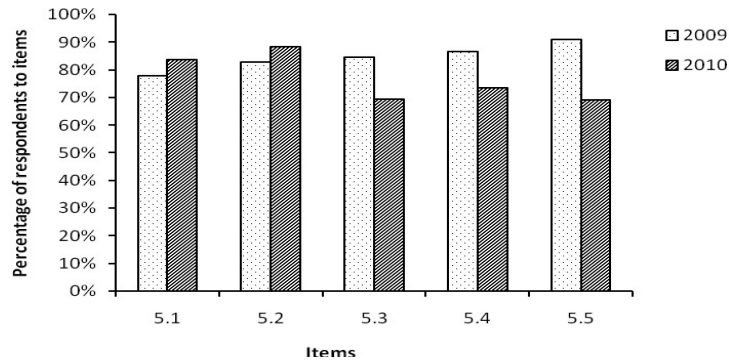


Figure 15 Agreement of statement on student-lecturer relationship for both groups of students

#### 4. Suggestion For Improvement

There were a number of suggestions and recommendations given by the student to improve the quality and effectiveness of teaching and learning in JKPP. These recommendations and improvements are shown in Appendix I for the Chemical and Biochemical Engineering Program for year 2009 and 2010 respectively. For Chemical Engineering Program respondents in year 2009 indicated that the Chemical Engineering program should be more focused to the practical and technical oriented to provide a better understanding of the concepts and theoretical learned in class. In addition, others respondents suggest that the addition of the extra time of lectures should be given more attention to the difficult subject or courses such as computer programming, process control and design software such as ICON. While, for Biochemical Engineering programs, a few of respondents think that more group presentation oriented project should be added to enhance the communication skills and some of respondents felt that the project design should be separated and more focused to the Biochemical field area. In addition, others respondents stated that the others activities should be improved, such as industrial visits and programs that can give an exposure to the real working area and industry environment. A total of 21 recommendations were given by respondents in Chemical and Biochemical Engineering for 2009, while 20 recommendations were put forward and to be noted.

#### 5. Conclusions

This survey was successfully conducted for Chemical and Biochemical Engineering graduate student in 2009 and 2010 sessions. This valuable information and recommendations derived from this survey will be used to further improve and enhance the quality and performance of learning and teaching JKPP in the future. Overall, mostly all the prospective graduates were satisfied with the current system of teaching and learning in JKPP as well as also ready to involve into the working environment. Achievement of the 12 program outcomes indicate a satisfactory performance with an average of more than 70% and 57% for Chemical and Biochemical Engineering Program, respectively. Based on this study, approximately more than 27% graduate in Chemical Engineering believes that the theoretical-practical and technical oriented projects should be adopted, while 19% of Biochemical Engineering graduates thinks that the project design should be separated and should be more focused to the field of biochemical engineering area.

#### Acknowledgement

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## Reference

Institut Penyelidikan Pendidikan Tinggi Negara (IPPTN) Pulau Pinang. 2003. *Kajian Masalah Pengangguran di Kalangan Siswazah*. Sidek Mohd. Noah. 2002. *Perkembangan Kerjaya: Teori dan Praktis*. Serdang: Penerbit Universiti Putra Malaysia.

## Appendix I

Table 5 Recommendations Improvement from the respondents 2009

No.	Recommendations Improvement
1	Add the period of industrial training (IT) / guide the student to find a place / make cooperation and joint venture with big companies.
2	Theoretical-Technical project oriented
3	The syllabus of the subjects should be improved (some subject should be taught earlier to avoid a clash with other subject)
4	Add more extra time to the difficult and important subject such as computer programming, process control and software design
5	Improve the delivery of work / associate with other subjects
6	Add the use of English language
7	Extend the period of project / plant design
8	Add other activities / site visit
9	Suitability and customize the thesis topic with the availability of the apparatus and equipments at the laboratory
10	Lecturer gives an example of industry exposure and share their experience
11	Upgrade the computers facility
12	Improve the system of mentor-mentee
13	Add more competition other than Chem-E-Car competition
14	More project presentations oriented to improve communication skills
15	Use of English language in a lecture / presentation
16	Extended period of industrial training
17	Separate courses and more detailed project designs for Biochemical students
18	More of lectures / seminars on GMP
19	More course Hysis software, SuperPro, Matlab, AutoCAD
20	Expose to the industry & career area
21	Kind services, such as chemical student

Table 6 Recommendations improvement from the respondents 2010

No.	Recommendations Improvement
1	Visits must be made in each semester and the related industry should be visited.
2	Individual project should be increased. Expose to UKM style writing
3	Implement the Programme in English language thoroughly.
4	During the project presentation, the lecturer had been expected to provide extra information for students to improve the project rather than just telling them mistakes.
5	The submitted project report should be returned to students as soon as possible for improvement.
6	Thesis projects and design projects should be separately.
7	IP is a good exposure for us as future chemical engineers.
8	Plan more industrial visits to expose to real industrial environment.
9	Make IP as a competition to increase the competitiveness among the students.
10	Adding a financial budget for equipment and chemicals for final year to conduct thesis experimental.
11	Make the CGPA result for industry training course.
12	Laboratory assistances be more helpful, friendly, hardworking, and respect students.
13	The resources to carry out the final year thesis should always be sufficient.
14	Programme to further study in oversea can be introduced like others department such as JKMB, JKAS and JKEES.
15	The quality of the workers and lecturers can not be considered as good and need to be Improved.
16	Should cut down the internship period back to 10 weeks. Final semester schedules are very pack due to the 5 months internship.
17	Improve the lab facilities and we are facing big problems for the thesis fund. Wasting time to get the chemicals due to no chemicals and some delay problems.
18	The research studies ought to be taken off from the compulsory subject listed for this course but more allocations whether creditable units and focuses should be placed on a final year project which is more related to our studies.
19	The creditable units allocated for laboratory subject should be increased.
20	The draft reports for final year project should be submitted in the form of softcopy which is more environmental friendly.