Case study for raising industry-oriented engineering students in southwestern Gyeonggi province

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Abstract

It is very important to understand the realistic requirements of prospective employer for training creative minded engineering students who can satisfy industry demand. In order to accomplish this goal, questionnaires were made for 6 departments (electronic, electronic materials, chemical, mechanical, civil engineering and computer science), and survey was conducted to undergraduates, graduates as well as industries where our graduates are currently employed. Questionnaire were consisted of educational conditions, satisfaction of general engineering education for undergraduates; job status, job preparation condition for graduates; and degree of recognition about our university and job condition for industries. Importance-Performance Analysis (IPA) method was utilized to evaluate the questionnaire results in terms of importance and satisfaction. Survey results indicated that for undergraduates and graduates, knowledge of their own majors and education for the general technical manpower was most important. However, for industry, the most important factor for a new employee was basic knowledge and creative mind that can solve real problems using their major skills. For graduates, they wanted to take more courses in design/experiments, major subjects (basic as well as advanced). In contrast, for the employers, they generally emphasized basic course reinforcement and engineering ethics, human relationship as well as job handling skill. Thus, in order to reduce these discrepancies between industries and graduating students, Innovation Center for Engineering Education(ICEE) at the University of Suwon started to offer industry oriented new programs such as capstone design contest, engineering tool education of windows programming, technical writing, and management of technology.

Introduction

Engineering schools in Korea tried to train good quality engineering students under the rapidly changing environment of engineering education[1,2]. Amid the decrease in number of engineering major students, negative attitude towards engineering education contents, and an excess number of graduates compared to the market demand, there is a trend in operating accreditation programs in order to supply qualified graduates for the industry. Korean government is also trying the help this trend by fostering the Innovation Center for Engineering Education (ICEE) to improve quality of engineering education and to train graduates with hands-on experience.

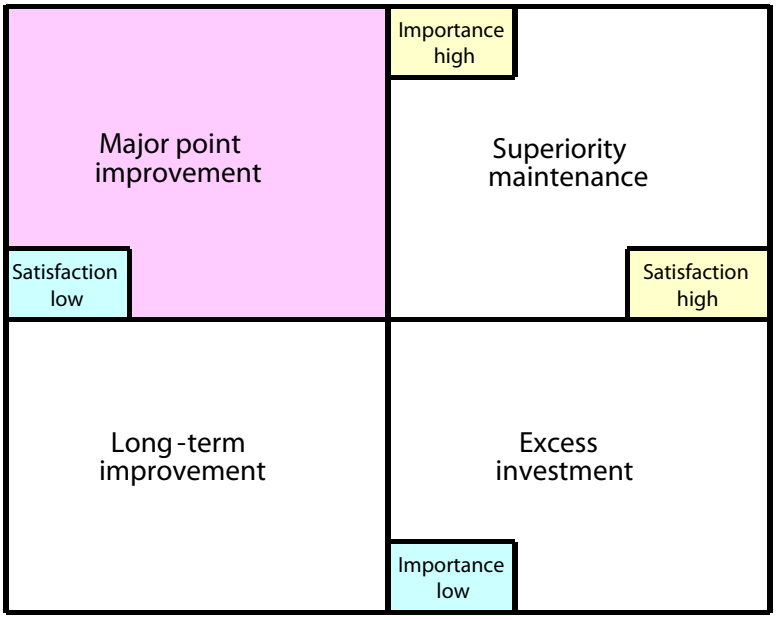
Thus, it became necessary for ICEE at the University of Suwon to initiate a survey on satisfaction and ways to improve our engineering education programs to improve employment rates. Recently, there have been many surveys in other universities to obtain the necessary information for a new and improved curriculum. There are also papers on improving fundamental engineering courses such as mathematics, science and computing along with liberal arts subjects[3], industry opinion regarding the degree of achievement in study result from Accreditation Board for Engineering Education of Korea(ABEEK)[2], and systematic improvements of coursework and curriculum development[4]. Our surveys were sent out to undergraduates, graduates, and industries that are all related to employment. It is meaningful that it shows the typical trends of metropolitan area universities in Korea where majority of students find employment in medium and small sized companies rather than going to the graduates school or research centers of big company. From the survey, we tried to complement necessary areas by finding out the industry side demand in order to enhance employment rates. Also, we tried to improve our curriculum, educational contents of the departments as well as enhance our university's image among the employers.

Survey method

Survey was conducted to junior students (2nd semester 2007) of 6 departments in the colleges of engineering and information technology (electrical, electronic materials, chemical, mechanical, civil engineering and computer science), graduates (2005~2007), and employers where our graduates are employed. In the case of companies, they are generally medium and small sized companies, and 91% of them are hiring 5 or less number of our graduates. Surveys were conducted in December 2007 for juniors, January 2008 for graduates, and February, March 2008 for industries. Questionnaires were consisted of common question as well as particular questions such as general understanding of educational environment for juniors, job finding preparation and actual job markets for graduates, and recognition of our school and requirements for prospective job seekers for the industries. Answers were evaluated from very satisfied(5), satisfied(4), average(3), unsatisfied(2) and very unsatisfied(1).

Survey results were analyzed utilizing the IPA (Importance - Performance Analysis) method shown in Figure 1. IPA method shows the relationships between the customer evaluated importance of elements that constitutes customer satisfaction item and satisfaction in the square. From this method, one can divide the square into 4 sections considering the importance and satisfaction, and deduce a strategic suggestion related to efficient distribution of the resources. Thus, from this plot, we can find the locations of each element within the 4 sections, and understand the relationship between the importance and satisfaction depending on meaning of elements.

Figure 1. Importance-Performance Analysis.



Survey analysis

1. Evaluation of educational activity and condition

Survey results of the 6 departments on the education activity and condition showed 3.03 for undergraduate and 2.93 for graduates in a 1 to 5 scale. Generally, undergraduates in the department of electronic materials, civil engineering and chemical engineering show higher satisfaction than the graduates. In contrast, graduates in the department of mechanical engineering, electronic engineering and computer science shows higher satisfaction than undergraduates. The highest discrepancy in the educational conditions between the undergraduates and graduates occurred in the department of civil engineering. From this survey, it was found that there was a large difference in each department when their educational activity and condition was applied to the real industry. Thus, utilizing IPA method items that are necessary for the improvement are analyzed.

Figure 2. Satisfaction of educational activity and condition.

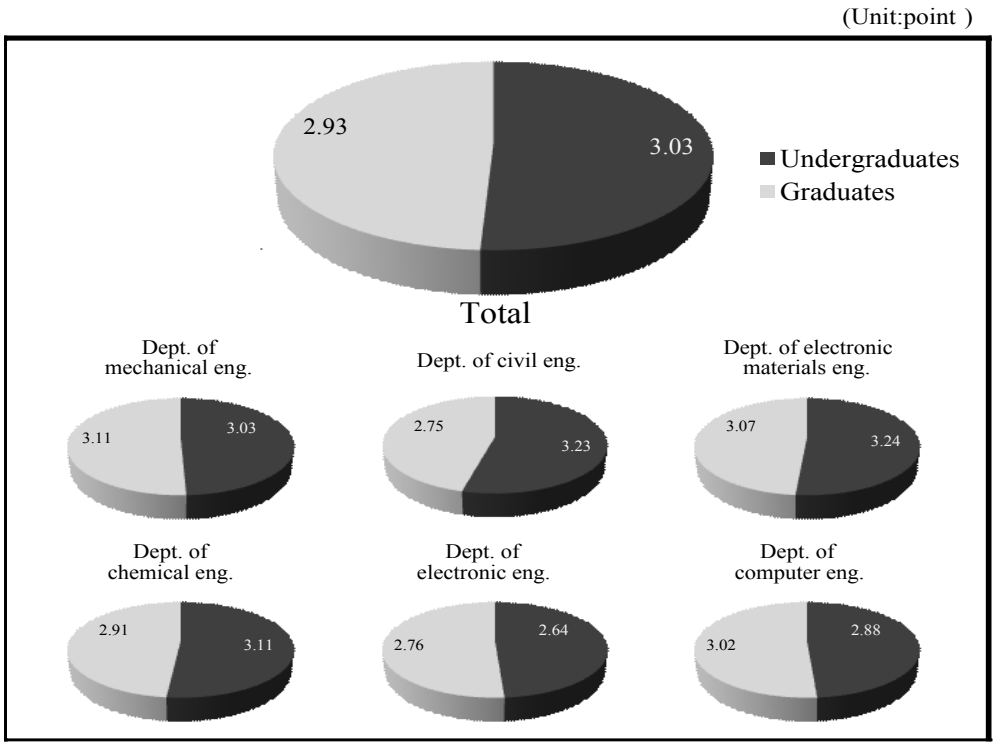


Figure 3. Importance-Performance Analysis of dept. of civil engineering.

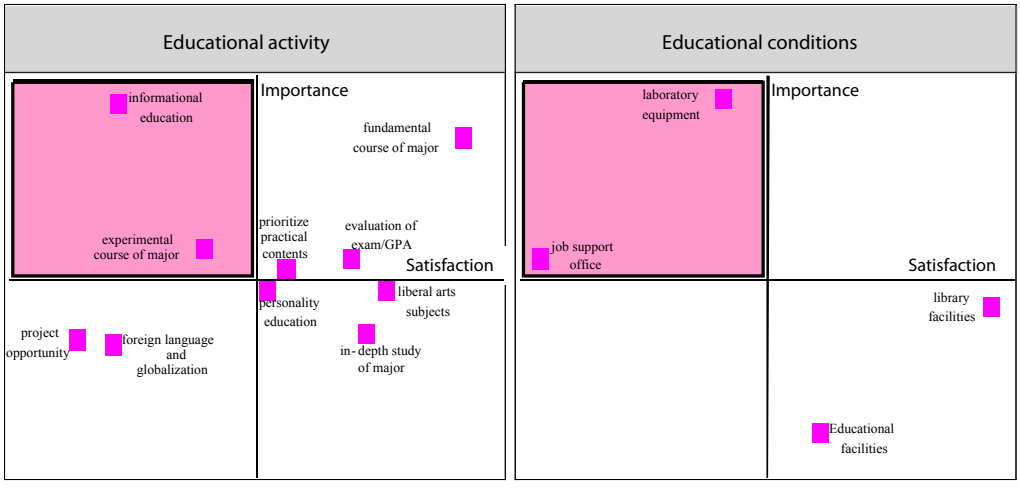


Figure 3 shows that through the IPA method, the major area of improvement is in the information and major related experimental courses in the education activity. In the educational condition, the student job support office and experimental equipments were found to be most important. It can be concluded that if long-term investment in theses areas are secured, satisfaction of the future graduates will increase, and our university's image within the industries will improve.

2. Evaluation of graduates

As can be seen in Table 1, graduates from 5 departments except electronic materials placed experimental courses including the design course as the most important courses in the curriculum. It was followed by applied courses, fundamental major related courses including fundamental science. It can be seen that design and experiment, funda-

mental major related courses and applied courses were considered important to students, therefore it is important to achieve a quality improvement in these courses.

Table 1. Important elements in the engineering education curriculum.

(Unit : %)

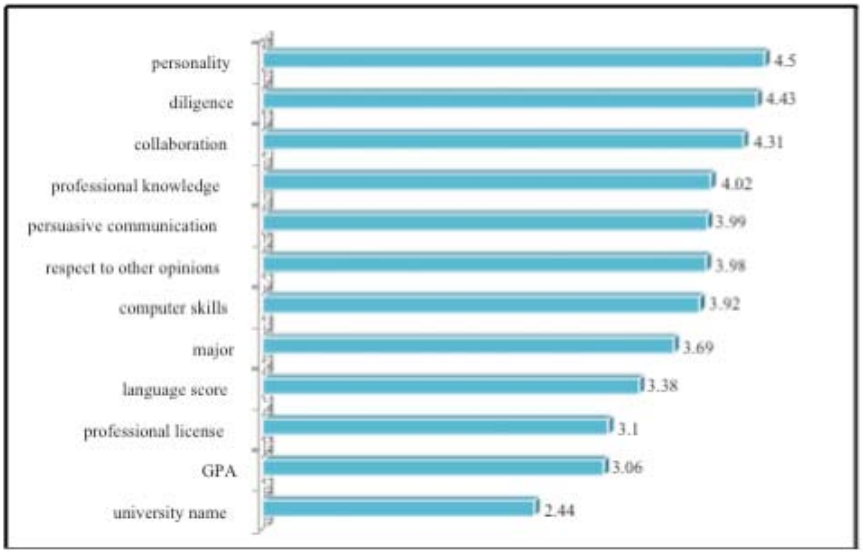
	Total	Department					
		Mechanical	Civil	Electronic materials	Chemical	Electronic	Computer
Total	(229)	(35)	(46)	(42)	(40)	(30)	(36)
Experimental courses including design	44.1	40.0	71.7	23.8	40.0	43.3	41.7
Applied courses	27.5	37.1	19.6	26.2	22.5	30.0	33.3
Fundamental courses including fundamental science	22.7	17.1	6.5	45.2	30.0	23.3	13.9
Language	2.2		0.0	0.0	2.5	3.3	2.8
Real-life practice	1.3	0.0	0.0		0.0	0.0	2.8 2.8
In-depth study of major	0.4	0.0	0.0	0.0	0.0	0.0	
Fundamental courses in major and experiment	0.4	c	0.0	0.0	2.5	0.0	0.0

3. Industry demand

Figure 4 shows the list of important criteria for selecting a new employee, and as can be seen the most important criterion was personality and diligence. In addition to these, collaboration teamwork, persuasive communication skill, professional knowledge and computer skill were considered important. It was also found that the importance of language skill and low university reputation along with GPA which are often considered most important for the graduates were actually not very important in selecting a new employee. Thus, it confirms again the importance of educational activities in the university. Meanwhile, large corporate and public industries often emphasize the persuasive communication skill and personality; meanwhile medium and small sized industries emphasize professional knowledge and diligence.

Figure 4. Important criteria for selecting an employee.

(Unit : point)



Conclusion

In this investigation, in order to train demand-oriented engineering majoring students, surveys were conducted to 6 departments at the University of Suwon, and the following conclusions could be made.

In the educational objectives, undergraduates and graduates all agreed on the importance of specialty in their majors and training, whereas the corporate placed high importance on creative power cultivation. For graduates, design and experiments, fundamental courses in major and applied courses were considered important. For industries, fundamental courses, ethics, harmony among the people, and major related job-handling skill were considered important. Industry generally preferred the graduates with diligence, ethics, teamwork, job-handling skill, self-development and/or development ability. Thus, it can be safely concluded that in addition to major related education, it is necessary to reinforce creative power, design and experiment, and ethics education for the undergraduates.

In order to improve theses areas, ICEE at the University of Suwon started to offer industry oriented new programs such as the capstone design contest, engineering tool education via windows programming, technical writing, and management of technology.

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References

01. J. Park, K. Hwang, K. Cho, and H. Baek(2007), Analysis of Recognition of the Engineering Education Participators for Practical Engineering Education, *Journal of Engineering Education Research, 10(1)*, pp.29-33.
02. B. Kim, E. Lee, and J. Park(2005), Industrial Survey Analysis for Engineering Education of Civil, Chemical, and Electronics Engineerings, *Journal of Engineering Education Research, 8(3)*, pp.5-16.
03. H. Baek, J. Park, S. Sim, and P. Shin(2005), A Study on Improving the Quality of General Education at an Engineering College, *Journal of Engineering Education Research, 8(1)*, pp.86-98.
04. B. Han, S. Choi, B. Kim, S. Cho, J. Kim, H. Jee, and S. Park(2004), A Case Study and Survey for Development of New Curriculum and Learning Method for Mechanical and System Design Engineering, *Journal of Engineering Education Research, 7(2)*, pp.40-50.