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للأستاذ الدكتور محمد عبد الفتاح شامة

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1- "مستقبل الدراسات الهندسية البحرية فى القطر العراقى"- مجلة "المهندس"- جمعية المهندسين العراقية-(Iraq-1977)- Bull. College of Eng., Basrah University, – كلية الهندسة –جامعة البصرة – (العراق-١٩٧٧)- الدكتور داخل حسن جربو- والدكتور محمد عبد الفتاح شامة

2- "Towards the Development of Engineering Education to Comply with Society Requirements", 3rd world Congress on Engineering Education and Training, Cairo, November. Shama, M. A., Kherallah, H. N. and Rashed, O. F. (Egypt-1994)

3- "The Role of Staff Development in the promotion of Engineering Education", Regional Workshop on New Approaches to Engineering Education, April. Shama, M. A., Kheirallah, H. N. and Rashed, O. F. (UAE-1995).

4- "Towards the Development of Engineering Education to Comply with Society Requirements", Fourth World Conference on Eng. Education, Oct. Shama, M. A., Kheirallah, H. N. and Rashed, O. F. (USA-1995)

5- "نموذج عملى لادخال موضوعات الطاقة والبيئة فى مقررات الهندسة البحرية وعمارة السفن" - ندوة "ادخال طرق تدريس المواد البيئية فى التعليم الهندسى" – كلية الهندسة – جامعة الاسكندرية (Egypt-1997) - الأستاذ الدكتور محمد عبد الفتاح شامة

6 - "الادارة الجامعية من منظور التعليم الهندسي"- ورشة عمل عن "الادارة الجامعية"- الشبكة العربية للتطوير المهنى لأعضاء الهيئات التدريسية- كلية الهندسة- جامعة الاسكندرية - (Egypt-1997) - الاستاذ الأستاذ الدكتور محمد عبد الفتاح شامة

Towards The Development Of Engineering Education To Comply With Society Requirements

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Abstract

The scientific and technological development in all aspects of life is growing at such rate that requires continuous updating of our university educational system.

If we scrutinize the engineering education planning in Egypt, we realize a lack in the existence of society oriented plans and priorities. The ability of the engineer of the future to contribute actively in any development is essential for finding suitable technological solutions for our national engineering problems. This goal can only be achieved through the development of our engineering education and the introduction of new non conventional, and highly needed, disciplines and technologies.

The goal of this preliminary study is to evaluate the tendencies and motivations of the students for the enrollment in the different departments of the Faculty of Engineering at Alexandria University. Several questionnaires were designed for this purpose. Data from different samples of students was collected and analyzed. The results showed several general trends. It also indicated the correlation between students choices and their estimation of the available job opportunities .

In order to exploit the benefits of this study, an integrated engineering educational model is suggested. This model takes into consideration the main relevant parameters: 1- students trends and motivations, 2- requirements of industry and society, 3- capabilities of the different departments of the Faculty of Engineering.

Introduction

The main role of engineering education is to provide the society with qualified personnel capable of leading its way to technological advancement. The ever increasing demands necessitates the continuous development of engineering education. This development cannot take place successfully without taking into consideration all relevant factors affecting the education process. The engineering education can be viewed as a production process, as shown in Figure 1 , leading to the possibility of the adoption of Total Quality Management TQM principles. In this process:

1- the university plays the role of an industrial or services enterprise,
2- the students and the society problems represent the raw materials,
3- the engineering graduates and the research outputs are the end products,
4- the staff members and the faculty facilities are the machines and tools,
5- the continuing education and the education development are the maintenance for both the products and the enterprise.

In this context, it is expected that the end product, the engineering graduates, must comply with the society requirements, the end users, from both aspects of quality and quantity. In most education systems, engineering assessment and accreditation boards make sure that the quality of the graduates meets certain standards. However, general procedures to decide on the proper number of graduates in each discipline seldom exist.

Engineering education system in Egypt

Engineering education in Egypt follows a 5-year system; a preparatory year and four years of specialization. A major concern to all administrations of faculties of engineering is the way to distribute graduates from the preparatory year among the different departments. The procedure currently adopted at the Faculty of Engineering, Alexandria University, takes into consideration the following:

1- students wishes,
2- students grades at the end of the preparatory year,
3- students grades in certain courses,
4- success in qualifying exams,
5- number of students specified by each department.

It is clear that job market requirements have no influence on the students admission to the different departments. In fact, it is accustomed that more students be allocated to departments of greater capabilities and larger staff members independent of the prospects of job opportunities after graduation. We believe that a more appropriate distribution system must be based on the following pillars:

1- students trends and motivations,
2- requirements of industry and society,
3- capabilities of the different departments.

The importance of taking into consideration the previous three main factors can be emphasized by the following examples:

1- If a large number of students wish to enroll in a certain specialization and the concerned department has the capability to admit them, unemployment among the graduates will result if the job opportunities are insufficient.
2- Suppose that requirements for a certain specialization increased without corresponding increase in the concerned department capabilities, therefore, we will be faced with either of the following prospects: a) the department will limit enrollment based on its capabilities and consequently a deficiency in this specialization will occur, or, b) the department will accept more students beyond its capabilities at the expense of the quality of education in this specialization.
3- If the society requirements of a certain specialization is large and the concerned department capabilities are adequate while students refrain from enrolling in this department, we may be faced with either a deficiency in that specialization or we may be inclined to force students to enroll in this department at the expense of having unwilling and uninterested students in this kind of study.

As a consequence of the previous examples, the development plans of the society may be hindered. In order to come up with a mathematical model for the proper distribution of students among different departments, a project has been initiated to access the influence of the previous three mentioned factors. This project comprises two phases:

1- Phase one is concerned with data collection of: a) current and prospect job opportunities in the different engineering disciplines, b) actual capabilities of the different departments and their expansion plans, c) students motivations and trends and factors affecting their decisions.
2- Phase two is concerned with the interpretation of these data and the translation of the results into parameters in the proposed mathematical model.

Questionnaires and data collection

Phase one of the project has been initiated and several types of questionnaires were designed to cover both the job market requirements and the students motivations. Up until now, only data from the latter has been interpreted.

A questionnaire has been distributed among preparatory year students in November 1993, two months after enrollment at the Faculty of Engineering. The same questionnaire was redistributed in March 1994, after the beginning of the second term, in order to assess the change in students interests after passing the first term examinations and after gaining enough experience about the Faculty environment. In March 1995, the same group of students were probed again after joining the different departments according to the constraints set by the Faculty. The same procedure was repeated for the new intake of students at the preparatory year in 1994/1995.

In each sounding, the data collected represent about 90% of the students population.

Data analysis and discussion

The first two columns in Table 1 show the variation in the tendencies of the same group of preparatory year students for enrollment in the different departments from November 1993 until March 1994. More than 55% of the students wish to enroll in either the Computer or the Electrical Engineering Departments. It is worthwhile to notice that the demands for enrollment to the Computer Department decreased in the second semester sounding. The same tendencies were noticed on the student intake of the subsequent year. No doubt that new students entering the Faculty of Engineering are more attracted by both the software and hardware aspects of computers. The third column in Table 1 shows the distribution of the graduates of the same group among the different departments according to the criteria set by the Faculty. We can notice that, despite the large demand, only 7% of the students are allowed to join the Computer Department due to its limited capabilities, while 20.7% were forced to join the Civil Engineering Department because of its larger capabilities.

Table 2 represents the reaction of the same group of students after joining the different departments. 94.4% of the students who joined the Computer Department stated that this was done according to their first choice. However, only about 83% realized that this type of study actually matches their preference and would have joined again the same department if given the opportunity. Conversely, only 63.3% of the students joining the Mechanical Engineering Department stated that this was their first choice and 66.3% stated that they would have joined the same department again.

Figure 2 shows the students choices of departments according to sex. As expected, most male and female students preferred to join the Electrical Engineering Department followed by the Computer Department. However, the third choice was the Mechanical Engineering Department for male students and the Architecture Engineering Department for female students. This tendency is probably due to both the nature of the study and the subsequent work environment. When asked about the reason for their choice of discipline, only one third of both female and male students attributed it to their expectation of the availability of job opportunities after their graduation. Their anticipation of the nature of the study was the main reason for their choice.

Tables 3 and 4 show the reason for students choice based on the chosen department . The sometimes large variation between the two soundings indicate the uncertainty of the students due to insufficient information. In any case, the family influence on the students decision making is almost nonexistent. When asked where the students expect to work, 69.3% chose the private sector indicating their knowledge and understanding of the new trends in the economy. 11.3% stated that they

expected to work in the engineering family business specially among those who chose Civil and Architecture Engin Departments. About 7% stated that they do not expect to work in the engineering profession at all after their graduation.

Conclusions and remarks

This study indicates the importance of finding an adequate means for the admission of engineering students . diff nt engineering departments in such a way to meet the society requirements without forcing students to study c disciplines against their wishes. The proposed eduction model takes into account all relevant factors since it materializ society/university interaction. However, the proper adoption of the model requires reliable data and a means to p sufficient information to students, before and after entering the Faculty of Engineering, on the nature of the study different engineering disciplines and the current and prospect job market opportunities.

References

1. Thomas S., "The cooperation of industry and universities in the aim of an actual education of engineers and developm advanced technologies", The Third World Congress on Engineering Education and Training, Cairo, November 1994.
2. Imai K., " Quality management in engineering education in Japan", The Third World Congress on Engineering Edu and Training, Cairo, November 1994.
3. Shama M, Kheirallah H.N. and Rashed O., "The evaluation of the tendencies of the preparatory year students f enrollment in the different departments in the Faculty of Engineering", The Third World Congress on Engin Education and Training, Cairo, November 1994.
4. Franklin B.S., "Total Quality in education", Quality Progress, October 1993.
5. Olsen B., "Third generation distance education", International Journal on Continuing Education, Vol. 2, 1992.
6. Howard R., "On becoming an engineer", IEEE Potential, December 1984.

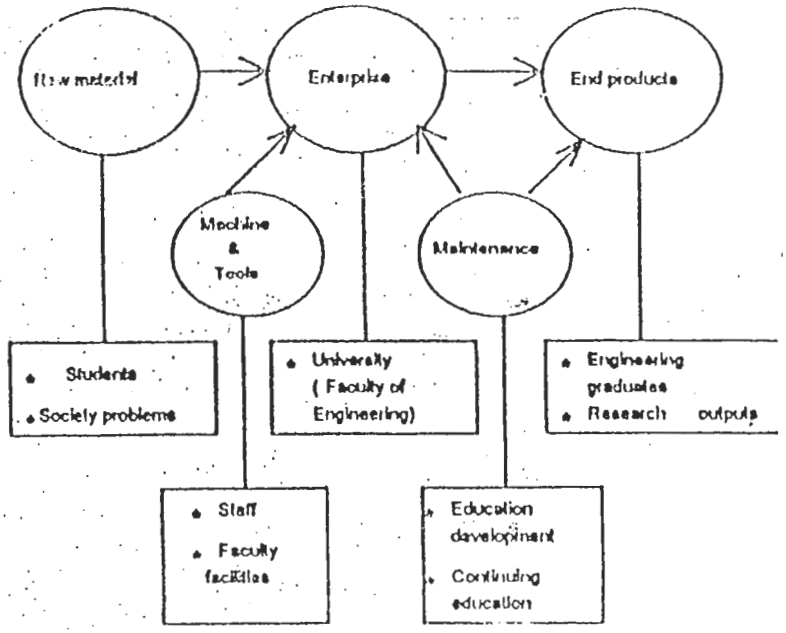

Fig. (1) Engineering Education Model

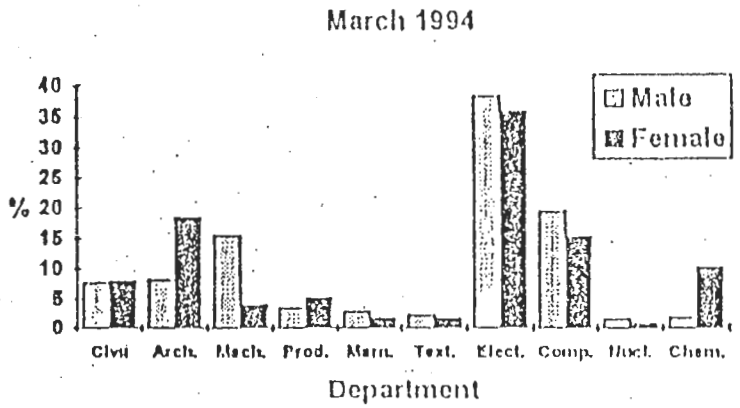

Fig. (2) Students choices of departments

Table 1 Students choices for the enrollment in different departments.

Department	November 93 %	March 94 %	Actual enrollment %
Civil	3.9	7.7	20.7
Architecture	14.2	11.3	6.4
Mechanical	6.1	11.6	17.5
Production	0.7	3.9	9.5
Marine	2.7	2.4	2.3
Textile	6.7	2.0	3.6
Electrical	28.1	37.3	23.4
Computer	32.2	18.0	7.0
Nuclear	0.8	1.3	0.8
Chemical	4.4	4.4	8.8

Table 2 First-year students opinions after joining departments in March

Department	Department actual choice %	Study matches preference %	Choose same department again %
Civil	72.7	78.6	81.3
Architecture	90.2	94.1	84.3
Mechanical	63.3	69.3	66.3
Production	73.2	80.5	82.9
Marine	77.4	80.6	77.4
Textile	81.1	67.6	64.9
Electrical	91.1	82.8	82.2
Computer	94.4	82.9	83.3
Chemical	83.1	76.3	78.0

Table 3 Reason for students choices of different departments in Novemb

Department	Personal motivation %	Job opportunity %	Family request %
Civil	60.0	30.0	10.0
Architecture	86.5	11.5	2.0
Mechanical	70.0	29.7	-
Production	57.1	42.9	-
Marine	52.2	47.8	-
Textile	40.0	40.0	20.0
Electrical	63.5	33.2	3.3
Computer	63.5	33.2	3.2
Nuclear	66.7	16.7	16.7
Chemical	85.7	7.1	7.1

Table 4 Reason for students choices of different departments in April 95

Department	Personal motivation %	Job appotuinty %	Family request %
Civil	55.7	32.9	11.4
Architecture	82.8	12.5	4.7
Mechanical	64.1	35.9	-
Production	61.1	38.9	-
Marine	80.0	20.0	-
Textile	37.5	62.5	-
Electrical	56.5	36.5	7.0
Computer	61.0	32.4	6.6
Nuclear	85.7	7.1	7.1
Chemical	70.6	23.5	5.9