A Curricular Reform Proposal for Egyptian Computer Engineering Education ECEE

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Abstract— **The ECEE is structured upon the technical skills of computer engineers. Through 5-year (preparatory + 4) education, ECEE introduces basic sciences then concentrates on specific technical skills for a computer engineer. There is a big gap between what the student learns and what he finds in practical life whether he would be an employee or an entrepreneur. This paper proposes a new approach where the ECEE will be oriented towards the type of business not the skill. This will narrow the gap between academic and vocational education. Choices of business are completely based on industry and market demand that should be flexible and dynamic. Based on the student's choice, he would study all what is related to that business. This will necessitate interdisciplinary programs oriented towards the business type to be inserted in the curriculum as well as cross-faculties projects which will require some kind of protocol between engineering and non-engineering faculties. It will also require a change in the curriculum of the non-engineering faculties that will participate in the cross faculty projects. Evaluation of this proposal is presented using questionnaire targeted at undergraduates and post-graduates.**

Keywords: business type, cross-faculty projects, computer specialization

I. INTRODUCTION

In Egypt, as in many other countries, there are two engineering degrees: the Bachelor degree which is a five year program (preparatory + 4years) and another two year program offered by the technical colleges. The former is a higher education degree which is our concern here.

Most faculties in the Egyptian public universities offer computer engineering as a specialization emerging from electrical engineering department where the student chooses between computer engineering, electrical power engineering or communications. The start of specialization year and accordingly the duration of specialization vary from one faculty to another.

Joining the computer engineering division is the last decision the student takes. He then carries on with the curriculum which emphasizes on technical skills and contains a wide range of computer sciences. Social subjects vary in number from one faculty to another.

Universities have the mission of elaborating a realistic policy for the recruitment of students, taking into account the evolution of the labor market (often unstable) and the diversifying of study programs. Excessive number of specializations is not an advantage. The diversification of study programs so as to keep up with labor dynamic market demand is a difficult process. In order to counteract the threat of graduate unemployment, a steady improvement of quality of training and curriculum is necessary. The fundamental restructuring of the curriculum must be done on the basis of self-assessment and of feedback from the most dynamic sectors of industry, business and public services. It is also necessary to improve and modernize teaching methods and practices and to stimulate staff/student human/social connections and interactions, the development of skills for business and civil management [1]. In this paper an approach is proposed whereby the computer engineering education is based on the computer business field that the student would like to work in after graduation

II. PREVIOUS REVIEWS

Ibrahim[2] has concluded that it may be difficult to define the quality of engineering education, but one describes its results in terms of ability to satisfy the current needs of industry. It is the duty of the educators to communicate with the industry to give meaning and value to the quality of education.

Any curriculum that is not developed systematically and as per the demands of the society becomes irrelevant and will soon have an adverse effect on all those who come in contact with it [3].There appears to be a growing need for graduates who can see the big picture and integrate solid technical skill and real business understanding early in their professional life [4]. This will require restructuring of the computer engineering curricula by not only adding topics but removing existing ones.

But how frequently should this be revised and assessed is an important question.

The market now is totally dynamic due to the global connection of the world. Not only the business market but the education market as well. New theories, research points arise frequently reflecting, henceforth, on the need of the market. Change is driven by technology.

Referring to [5], the aspirations of 2020 engineer include:

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- understanding spectrum of career opportunities accessible through engineering education.
- appreciating the value of an engineering education to engineers working successfully in non-engineering jobs
- Engineering profession will

a) *Create and accommodate new fields*
b) *Open to interdisciplinary fields that include non-engineering component like Science, Business and Social Science.*
c) *Be prepared to adapt to changes in global forces and trends*

III. Recent Developments in Egyptian Engineering Education

In 1992, an engineering Education Development Project initiated [6]. The objective of that project was focused on upgrading/redesigning the educational programs in 18 faculties.

In 2007, engineering projects in the field of engineering education in the Egyptian universities began HEEPF [7]. The objective of that project was to alleviate the student's level of learning through supplying AV equipment, library upgrades, installing fully functioning labs. The issue of interdisciplinary courses was not raised. Do society, industry and engineers see that education quality is enhanced by the inclusion of such courses?

IV. The current approach

A preparatory year should be covered in all engineering education. Most of the public universities offer CE from year 3. In years 1 and 2, the student is enrolled in Electrical Engineering department where he learns all related basic subjects to electrical power engineering, communication and CE. Based on supply and demand, the faculty determines the minimum grades by which a student can join CE. During years 3 and 4, the student studies a diversified variety of computer related subjects(system analysis, computer graphics, neural nets, software engineering, programming skills, hardware design and many others depending on when the specialization year begins). During the 4 years, the student is exposed to non-engineering courses as well. Every faculty specifies what courses to be taught, for how long and whether they would be credit courses or not. In year 4, the student chooses a topic for the project graduation. That project is carried out by a group of students and is defended at the end of the year.

We can see from the above review that:

- The student, in most of the faculties, begins the specialization in year 3 leaving 2 years to learn CE.
- During these 2 years, the student studies courses that could be of non-interest to him.
- The interdisciplinary courses are non credit subjects.
- Any experience the student takes is strictly confined to his faculty.
- The student is not exposed to the market demands. When he graduates, he has only the technical skills that he learned.
- The entrepreneurial knowledge is nil

V. The proposed approach

Due to globalization, markets are wide open. The supply and demand are not anymore locally driven, but globally driven.

Educators are the ones responsible for keeping the communication and cooperation channels always open between academia, industry and business. Within each university, a consulting committee is to be created that is responsible to research the market demands, to provide advice, recommendations and put a plan in collaboration with the industry people. The committee members should be from engineering and non engineering fields, academic staff and business people.

Ever since the e-world has emerged, many business fields are being created, e.g. e-commerce and e-learning. New Technologies drive the needs for new applications e.g. mobile and video applications. Why should a student who is interested in graphics application study compilers? Why should a student who is interested in e-business applications study image processing?

The proposed approach is to create divisions in the CE education based on the emerging fields. Accordingly, there would be, for example, CE: e-commerce or CE: mobile applications.

In this scope,

- The educators, in collaboration with the industry, specify the business divisions based on the market.
- The syllabi of each division should cover all related technical skills.
- The syllabi of each division should cover all related business aspects.
- The syllabi of each division should include cross faculty projects. If, for example, the division is graphics, then a project should be carried out in cooperation with faculty of fine arts and Faculty of applied arts.
- Cross faculty projects will require a full cooperation between the faculty of Engineering and the concerned faculties. It will require educators from both institutes to cooperate to achieve common beneficial goals.
- The student would decide on which type of business he would like to work in after graduation. Thus, he would join the division that suits his desire. This is done by the help of advisors who explain the scope of each division. The question here is:"when is the student most ready to decide on what he wants?"

VI. RESULTS

Data sources for this paper included closed/open ended questionnaires directed to different sectors dealing with computer engineering e.g. academia, students, practitioners. The results support the proposal listed in this paper and suggest that interdisciplinary education is essential. It also recommends that studying computer engineering oriented towards the business need is what students prefer and what the industry requires. Table I summarizes the results of the questionnaire.

TABLE I. QUESTIONNAIRE SUMMARY

Question	Yes %	No %	Couldn't decide %
Courses are sufficient for work	33	34	33
Studying irrelevant courses	52	48	0
Specialization based on business type	46	30	24
Cross faculty projects	70	19	11
Interdisciplinary courses	74	1	25
Increase working chances	70	15	15
Flexibility to move between jobs	59	9	32

Participants were asked to specify the preferred start of specialization year. Table II shows their response while table III shows the age groups participating in the survey.

TABLE II. START OF BUSINESS TYPE SPECIALIZATION YEAR

Starting Year	%
Year 1	13
Year 2	24
Year 3	24
Year 4	19

TABLE III. PARTICIPATING AGE GROUPS

Age group	%
Year 1	0
Year 2	2
Year 3	15
Year 4	35
Graduates	48

Finally, table IV shows, based on the survey feedback, the suggested interdisciplinary courses that need to be added to the curriculum. (People may select more than one topic, so percentages may add up to more than 100%)

TABLE IV. SUGGESTED INTERDISCIPLINARY COURSES

Course	%
Marketing	72
Legal Issues	48
Sales	30
Accounting	28
Others	32

VII. CONCLUSION:

Responding to the industry and market is one of the major factors that make an education system successful. The ultimate goal is to give a profound education that will enable the learner to join the practical field quickly and fit fast enough into the business. Moreover, adapting to the changes of market needs is very important. Introducing into the computer engineering specializations based on the market demand will help to achieve the mentioned goals. Narrowing the gap between vocational and academic education would also be achieved by cross faculty projects. This approach was highly accepted from different age groups of CE people.

VIII. FUTURE WORK

Further studies will be carried out to examine how the interaction between engineering and non-engineering faculties be implemented.

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A Curricular Reform Proposal for Egyptian Computer Engineering Education

Overview

- Current Situation of CE in Public Univ.
- The Proposed Approach
- Survey Results
- Conclusion

Current Situation of CE in Public Universities

- Engineering degree: prep. year + 4 years.
- CE is a branch of electrical engineering dept. (*in most of univ.*)
- CE begins in year 3 (*based on grades*).

Current Situation in Government Universities (cnt'd)

- Education emphasizes on *technical* skills.
- Practical experience is *confined* to the faculty of engineering.
- The interdisciplinary courses are *non credit* subjects.

Ideal Picture

- ***Educators*** are the ones responsible for keeping the communication and cooperation channels always open between academia, industry and business.
- This requires ***restructuring*** of the computer engineering curricula by not only adding topics but removing existing ones.

THE PROPOSED APPROACH

New Technologies drive the creation of new fields,

➔ *New fields need specialized business oriented graduates.*

CREATE

Computer Engineering

Specializations

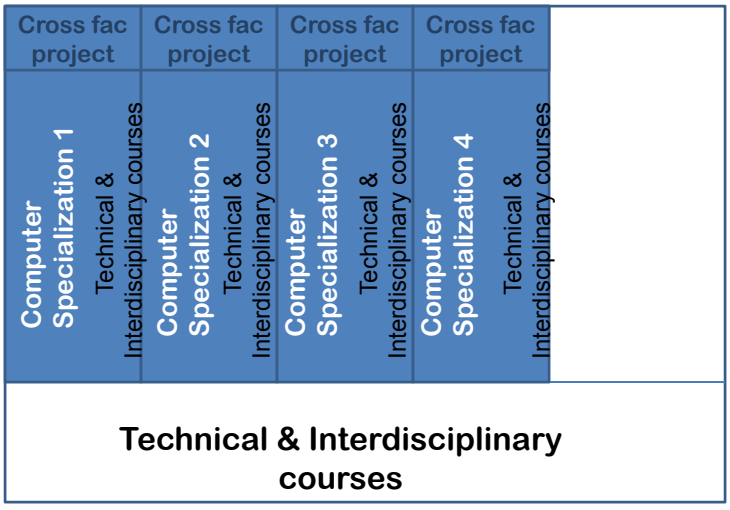
based on

Market Demands

THE PROPOSED APPROACH

1. The educators, in collaboration with the industry, **specify the business divisions** based on the market.
2. The student chooses one of those divisions.
3. The **syllabus** of each division should cover all related **business aspects** and technical skills.
4. The syllabus of each division should include **cross faculty projects**.

THE PROPOSED APPROACH



CONCERNS

- *"How Frequent should the Curriculum respond to the Market?"*
- *"When is the student most ready to decide on what he wants?"*
- *"When should the specialization year begin?"*
- *" How could the practical experience be widened?"*

Who participated in the Survey?

Year group	%
Year 1	0
Year 2	2
Year 3	15
Year 4	35
Graduates	48

When should Specialization Begin?

Year	%
Year 1	13
Year 2	**24**
Year 3	**24**
Year 4	19

SURVEY RESULTS

	Yes %	No %	Couldn't decide %
Agree with Proposed Approach	46	30	24
Interdisciplinary courses	74	1	25
Cross faculty projects	70	19	11
Increase work chances	70	15	15
Flexibility to move between jobs	59	9	32

What does it require

- Regular evaluations of the market needs.
- Flexibility of changing divisions.
- Coherent cooperation between computer engineering and non-engineering faculties

➔ *Council composed of business people, industry people and academic, engineering & non-engineering, people.*

Conclusion

The Proposed Approach

- ✓ Responds and adapts to the industry and market.
- ✓ Gives a profound education that will enable the learner to join the practical field quickly and fit fast enough into the business.
- ✓ Narrows the gap between vocational and academic education through cross faculty projects.