

Recent Developments in Egyptian Engineering Education Through Competitive Projects

By

Galal Abdel-Hamid Abdellah¹, Salah El-Din Mohamed Fahmy Taher²,
Mohammed Abdel-Rahman³

1. Higher Education Minister's Advisor for Strategic Planning & Chairman of HEEPF National Committee
2. Executive Director, Higher Education Enhancement Project Fund, HEEPF
3. HEEPF Monitoring and Evaluation Consultant and Assistant Professor ,Faculty of Engineering at Mataryia, Helwan University, Egypt

Abstract

Well-established engineering higher education is considered one of the most important requirements for modern technological development. There is a gap between the currently available engineering qualifications in Egypt and the required levels which is attributed to some obstacles in Egyptian engineering education. This paper presents an overview of the engineering education in Egypt, current situation, comparison with different countries, structure of program and its outcome. It also presents an overview of the engineering projects funded by the Higher Education Enhancement Project Fund (HEEPF) and the impact of these projects on the performance of engineering education.

1. Introduction

The beginning of modern engineering education in Egypt dates back to 1816 when the famous Wali; Mohammed Ali Pasha established "Madrasat El-Mohandeskhana". In 1916, the school started to offer specialized studies in the final two years in five departments: Irrigation, Architecture, Municipal, Mechanical and Electrical Engineering. In 1935, the "Royal School of Engineering" was renamed as the "Faculty of Engineering" after being annexed to the "Egyptian University". Since then, a number of public and private institutes and technical colleges were established. Figure (1) presents the distribution of higher education entities (public and private) that include engineering specialties. Engineering higher education in Egypt includes faculties of engineering, computer & information, electronics, petroleum & mining, institutes of production sufficiency and technical colleges.

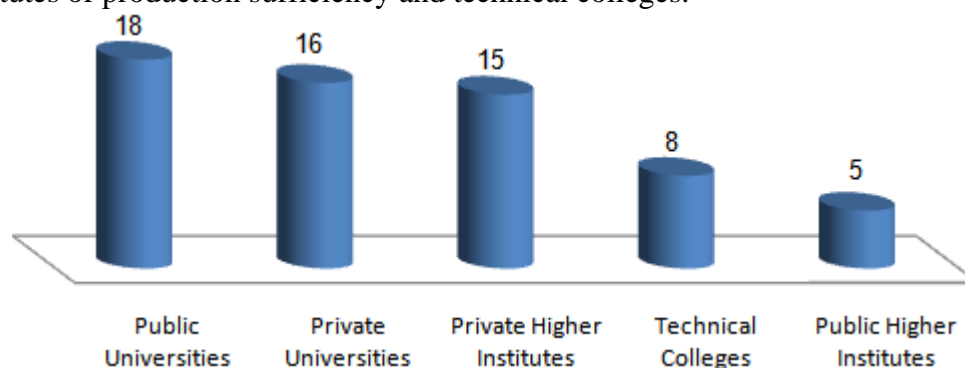


Fig. (1): The Distribution of the engineering higher education in Egypt 2007.

Figure (2) presents an overview of the percentage of the number of engineering students to the total number of the students in practical faculties (medicine, science, Agriculture, Engineering) for each public university. The average percentage of the number of the engineering students to the total number of the students in practical faculties is 16.77 %. Cairo University has the highest percentage of 30.9% while Mansura University has the lowest percentage of 7.1%.

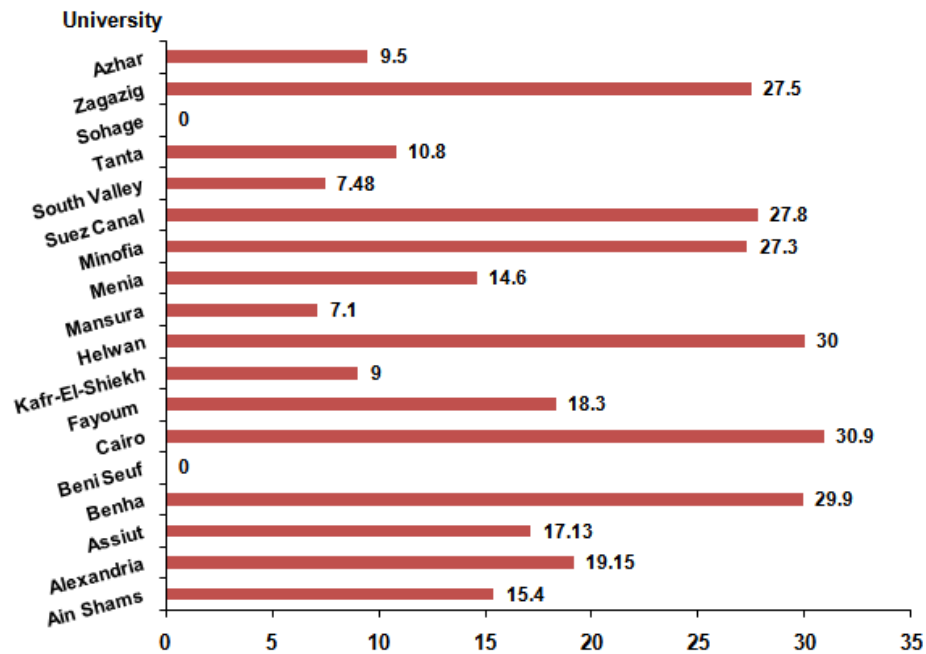


Fig. 2 Percentage of engineering students to the total number of the students in practical faculties for public universities

As reported by Micu (2002), a distinction is made - in Egypt as in many countries - between two engineering degrees: the Bachelor degree which is a five-year program offered by the Faculty of Engineering, and another two-year program offered by the technical colleges. Figure (3) depicts the structure leading to higher education for engineering programs in Egypt. Twelve years of basic education are pre-requisite to higher education.

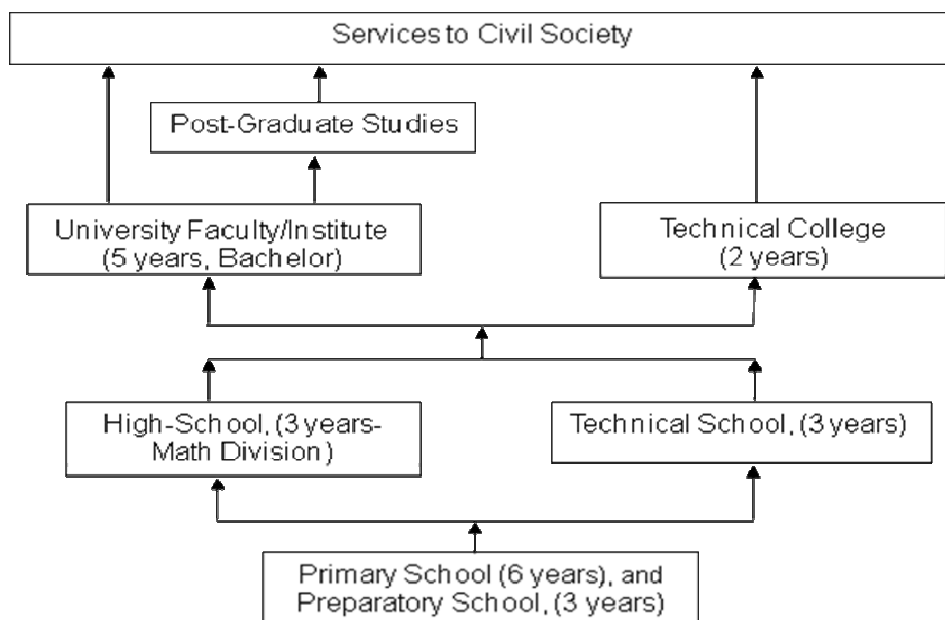


Fig. (3): Structure of education system leading to Engineering degree in Egypt

2. Situation Analysis of Engineering Education in Egypt

William (1993) mentioned that, in accordance with the objectives of university engineering education, the program combines specialization in a selected field of engineering with a sufficiently broad engineering education. The program of study has a nominal duration of five years; a major part of the program in each field of engineering is basic science and engineering, applied scientific courses, design research-oriented courses, and humanities courses. Although not all degree programs are offered by each university, most faculties of engineering organize programs in architecture, civil engineering, electrical engineering, and mechanical engineering. According to the ABET (Accreditation Board for Engineering and Technology), the graduate from the engineering program must demonstrate that their graduates have the ability to:

- a) Apply knowledge of mathematics, science, and engineering
- b) Design and conduct experiments, as well as to analyze and interpret data
- c) Design a system, component, or process to meet desired needs
- d) Function on multi-disciplinary teams
- e) Identify, formulate, and solve engineering problems
- f) Be responsible both professionally and ethically
- g) Communicate effectively
- h) Understand the impact of engineering solutions in a global and societal context
- i) Recognize of the need for, and engage in life-long learning
- j) Understand contemporary issues
- k) Use the techniques, skills, and modern engineering tools necessary for engineering practice.

The relation between the number of academic staff and the number of the students is one of the main important parameters in accreditation according to the ABET criteria. In Egypt, the distribution of academic staff and students across engineering education is shown in Figure (4) for the academic year 2004/2005 according to the statistical analysis from the Supreme Council of Universities SCU (2005).

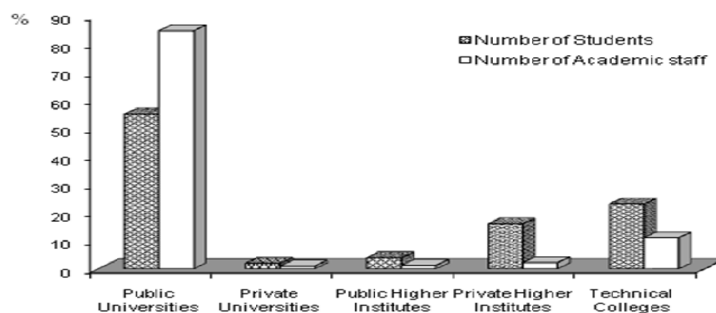


Fig. (4): Percent Number of academic staff and students distributed across engineering education establishments in Egypt (2004/2005) SCU (2005)

3. Current Status of International Engineering Education

As reported by (www.kfupm.edu), Figure (5) shows the numbers Bachelor's degrees awarded in the engineering field in selected countries for the academic year 2004/2005. The Figure depicts that China has the largest number which is logically attributed to its large population. In USA, the number is about 75,000 and while it is 20,000 in Germany. In Egypt, the number of is about 30,000.

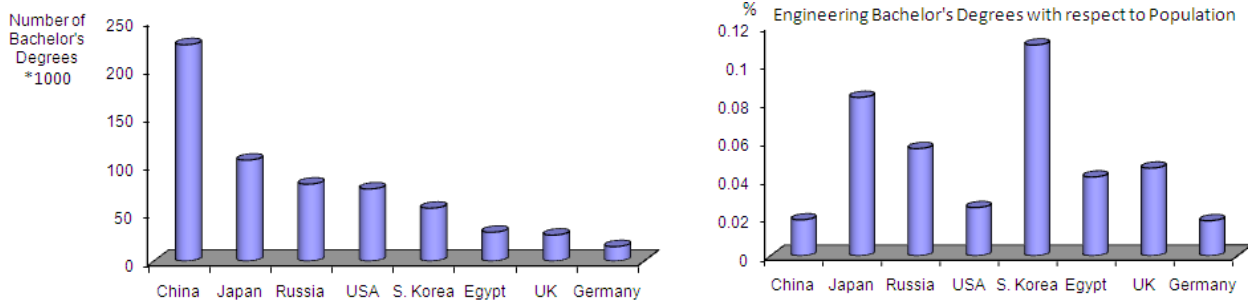


Fig. (5): Bachelor's degrees awarded in selected countries in Engineering Education Academic Year 2004-2005

Ibrahim (1999) has concluded that it may be difficult to define quality of engineering education, but one can describe its results in terms of ability to satisfy the current and future needs of industry, and life-long commitment to learning. It is the duty of educators to communicate with the industry and society to give meaning and value to quality education. A balance has to exist between ignoring the demands of industry and society and catering to these demands indiscriminately without considering the consequences. There are many useful and interesting things an engineer should know, but the main objective of a quality engineering curriculum is to put emphasis on science, engineering and technology.

There are some obstacles in improving engineering education in Egypt, these may be summarized in:

- Large enrolment of Egyptian students which leads to weak motivation of talented graduates
- Insufficient fund for scientific research and human resources development
- Deficient laboratory facilities, due to the insufficient funding
- The gap between academic curricula and engineering practice
- Low salary for the academic staff that leads to migration of young specialists
- Lack of use of information and communication technology, e.g. a shortage in digital libraries in engineering education and a shortage in automated administration systems.

The later critical obstacles are convincing enough to bring the transition reform to a quick end. To overcome some of these obstacles facing engineering education in Egypt, the Higher Education Enhancement Project Fund "HEEPF" is established. HEEPF is one of the six top priority projects for the enhancement of higher education. HEEPF started after the Higher Education Enhancement Conference that was convened in 2000 in Egypt. The six top priority projects present a promising strategy for the enhancement of higher education in Egypt on the basis of three five-year plans till 2017. They were partially financed at the beginning with a loan from the World Bank.

4. Competitive Projects in Engineering Education

HEEPF aims at creating a competitive environment among the academic institutions and faculty staff members as one of the important pillars for the enhancement and improvement of the quality of higher education institutions in Egypt. It also aims at supporting the academic, administrative, and financial potentials of these institutions to improve the curricula according to the international and local standards, and the quality of education and students' assessment to reach the international level. In addition, it supports the higher education institutions in training the faculty staff

members and their assistants to enhance their educational and research capabilities and improve their administrative structure and management of resources. Moreover, HEEPF aims at strengthening the cooperation between universities and the society that benefits from their services, which helps preparing graduates qualified for the labor market and the comprehensive development in Egypt.

As reported by HEEPF, (2007), Figure (6) summarizes the enhancement system that HEEPF had carried out to achieve its aims. This paper presents an overview about the engineering projects funded by HEEPF in the field of engineering education in the Egyptian universities and technical colleges through four cycles. The other counterparts of engineering education (Private Universities, Azhar, Public and Private Institutes) were not included in these cycles. Most of these projects are related to the areas of Academic Program (AP), Curriculum Development (CD), E-learning, Administrative System and Facilities and Laboratories. Most of these projects are also concerned with specific disciplines of engineering such as civil, mechanical, electrical, electronic, control, computer and information, geomatics, welding and technical writing. It is important to mention that the accepted projects by HEEPF are subject to an in-depth evaluation for both academic and financial aspects.

It is worth to say that HEEPF is not the first project established to develop engineering education in Egypt. The first one is an Engineering Education Development Project (EEDP) which was initiated in Egypt in January (1992) as reported by Anis (1992). This project has also been funded through a loan agreement between the World Bank and the government of Egypt. The objectives of the project are focused on upgrading or redesigning of the educational programs at eighteen faculties of engineering.

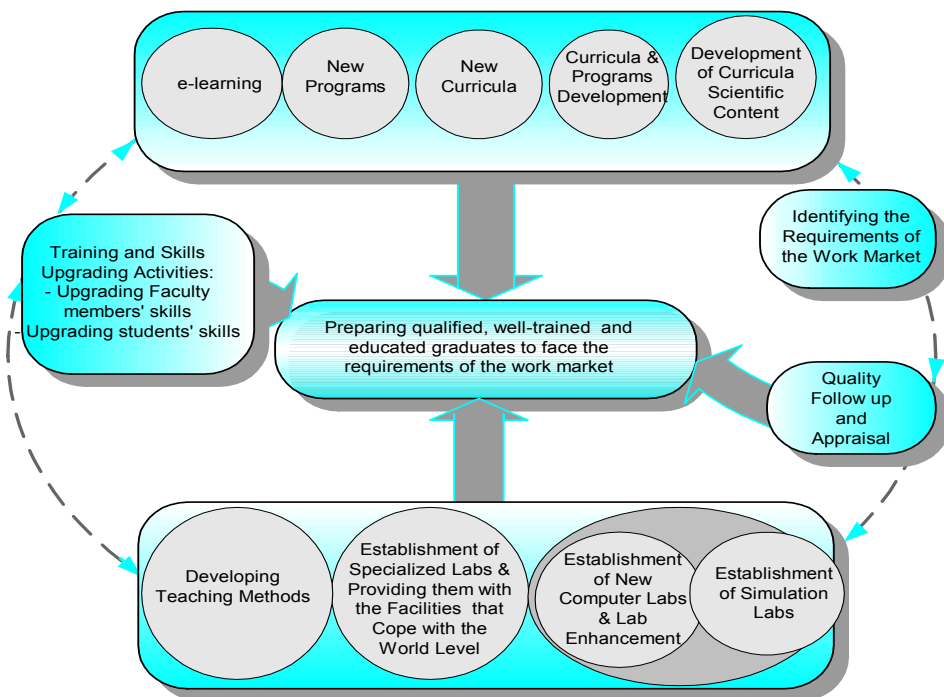


Fig.6 Overview of Higher Education Enhancement System of the HEEPF Projects

5. Engineering Projects Funded by HEEPF

As reported by HEEPF, (2007), The Higher Education Project Fund National Committee has approved 158 projects submitted by different universities as shown in

Figure (7). Among these projects, 28 out of those submitted by engineering faculties were accepted for funding. It can be easily noticed that the number of accepted engineering projects represents about 17.7% of the total number of accepted projects. Cairo and Ain-Shams universities have the highest number of engineering funded projects. Table (1) summarizes all funded engineering projects by university, department and title. This table shows that not all the departments in the engineering field have got projects funded by HEEPF.

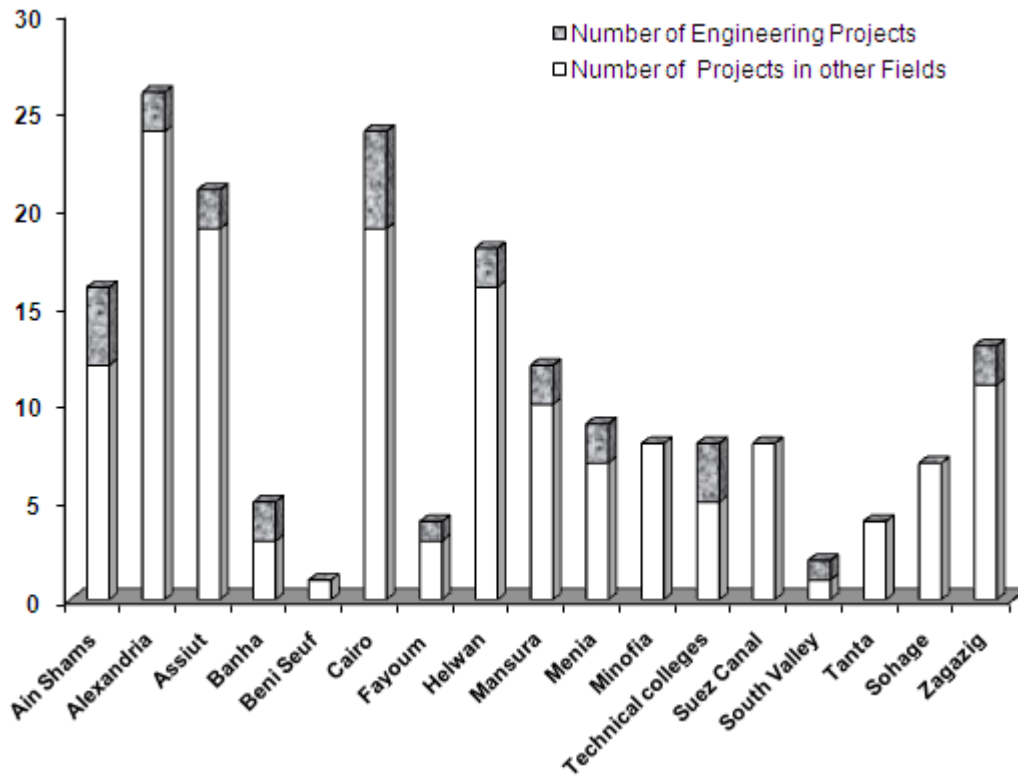


Fig. (7): Distribution of Engineering projects among universities

The education enhancement system of the projects financed by the HEEPF in the four cycles of the first phase is based on various axes to achieve the desired development goals. This enhancement system aims at encouraging self-learning, creativity, and innovation to qualify university graduates for the practical life and enable them to face the requirements of the work market.

Table (1): List of Engineering Projects Funded by HEEPF

Department	University	Title
Civil	Cairo	Courseware Development for Reinforced Concrete Structures
		Enhancing Earthquake Engineering Education and Research
		An Integrated Curriculum in Hydrologic Field & Laboratory Methods
	Ain Shams	Establishment of Land Information Curriculum and Certificate
		Technical Data Analysis & Presentation for Engineers
	Menia	Improving Transportation Engineering Education Through Field Problems, Prototype Development and Testing
		Modernization of Engineering Postgraduate Program & Establishment of New Specialized/Interdisciplinary Diplomas (Menia & Tanta Universities)
	Benha	Engineering Development of Geomatics Educational Courses Based on the Society Needs
	Helwan	Enhancement of Soil Mech. And Structure Courses
Mansura	Use of Centrifuges as educational Tools and Base for virtual Laboratories in Civil Engineering	
Zagazig	Development of Teaching Tools for Engineering Courses & their Presentation in Electronic Format	
Electrical	Ain Shams	optical communication and Optoelectronic Engineering Technology Education and Consultation Facility
		Enhancing Power Electronics & Systems Courses using MAT/LAB/SIMULINK in LAN
	Benha	Enhancing High Voltage Engineering & Power Systems Education Using Software Packages in a LAN
	Cairo	An Integrated Curriculum in Automation and Instrumentation for Electrical Energy System
	South Valley	Applying Computer-Aided Design Tools to Enhance the Electrical Engineering Teaching/Training Process
Mechanical	Technical Colleges	Engineering Drawing Curricula Development Project
		Development An Inspection section in Port Said technical college
		Establishment of New Section for Ready Made Garments
	Alexandria	Development of a University/ Industrial Training Program in Desalination Technology Using Conventional& E-Learning
	Helwan	Development of Middle Technical Institutes
	Cairo	Modernization of Post-Graduate in FECU
	Assiut	Development of Mechatronics Courses for Undergraduate program
Computers	Assiut	On Line Teaching Between the Faculty of Computers and Information at Assiut University and Cairo university
Electronics	Mansura	Enhance and Coordinate Modern Electronics Engineering Courses for the E-learning Era in Mansoura University
General	Zagazig	innovative Interactive Basic Sciences Laboratory Teaching for Large Number Engineering Students
Others (Management System)	Fayoum	Integrated University Management System
	Alexandria	Educational Administrative System(EAS)

6. Outcomes of Engineering Projects

All the engineering projects funded cover all/some of the following objectives:

1. Academic Development
2. Laboratories and Educational Environment Enhancement
3. E-Learning and Simulating Laboratories
4. Making use of Information and Communication Technology and Learning Resources
5. Specialized and Mediating Centers
6. Restructuring Administration Systems
7. Human Resources Development

In the following sections, detailed description of the outcomes of some of the engineering funded projects is presented.

6.1 Academic Development

One of the fundamentals of higher education enhancement process is upgrading the curricula taught at the Egyptian universities to keep place with the world level in terms of the internationally recognized criteria. In the framework of the engineering projects, 72 undergraduate curricula were developed through 24 projects in the field of engineering sciences (including Engineering, Computer and Information, and Technology Faculties) ten post-graduate curricula were developed during the different phases of the fund through three projects.

Another very important outcome of the HEEPF projects in its different stages was the new programs that were carried out in most Egyptian universities. These programs tangibly crystallize the concept of enhancement and self-sustainability in the shape of new undergraduate and postgraduate programs (Diploma and Ph.D.). Twenty-one projects developed six new undergraduate and 15 postgraduate programs. In the sectors of Engineering and Engineering Sciences undergraduate programs, three new programs were established. Eleven new programs were implemented in the post graduate program. It is difficult to mention all the projects which developed curricula and program, but the following are some examples of the distinguished undergraduate projects:

- In the faculty of engineering, Benha University, the curricula related to spatial information systems were developed and led to the rise of the success rate in the subject that was taught using advanced methodology and curricula. The developed curricula also led to a change in the assessment system, i.e. the test was administered electronically and the questions required understanding, analysis, and intelligence. This was achieved through the project, "Development of the Engineering Education of Spatial Information Systems in Accordance With the Community Needs." In addition, the developed curricula could be used to develop new curricula in the specialization of Geometrics using satellite photos.
- Another example of engineering project in academic enhancement has been done in the Faculty of Engineering, Assiut University. Undergraduate Mechatronic curricula were developed using multimedia and the scientific content was published on the Internet through the project. The developed curricula are: An Introduction to Mechatronics, Designing the Mechatronic Systems, Programmable Logic Controllers, Mechatronic Laboratories 1 and 2, and Graduation Projects.

6.2 Educational Environment and Laboratories

There are 51 new computer laboratories established through the projects financed by the fund distributed on 13 universities. In addition, 13 existing laboratories were enhanced and equipped with a number of modern computers in these universities. The engineering sector had the biggest share in the establishment of new computer laboratories.

The number of computers added to computer labs, regardless of those used in developing curricula, including laptops reached 1000 computers for all the projects financed by the HEEPF during the four cycles of its first phase till the end of 2006

Therefore, most projects were provided with new and advanced laboratory equipment and appliances to serve the educational process as one of the most important axes on which most projects were based. This section presents the general view of the labs financed by the fund in the field of engineering projects. As stated before, it is difficult to present all the laboratories in the field of engineering but the following are some examples of these projects:

- In the context of the efficient use of simulation experiments, students could watch experiments and follow their analysis and results through the internet through the project that was carried out in the Faculty of Engineering, Mansoura University. The project used the central lab in preparing a database that forms the basis of simulation laboratories where students perform experiments on the computer without the need of visiting the laboratory.
- In the Faculty of Engineering, Ain Shams University light communication and electronic lights technology center was established to offer its service to civil and military applications. The project provided the center with 8 light signal transmitters/ receivers with 2.7 gigahertz on which work was done to increase their capacity to 10 gigahertz in addition to 4 light magnifiers using EDFA and the establishment of 14 laboratory experiments to measure the features of light networks, circles, and components.

6.3 E-Learning and Virtual Laboratories

Although the worldly recognized E-learning was not clear for many of the faculty staff members participating in the HEEPF projects, yet many projects developed electronic courses that could be displayed on a screen using the PowerPoint (453 courses distributed on 64 projects) during the four cycles of the HEEPF first phase. When calculating the number of courses that were subject to e-learning, they were 213 courses using one of the e-learning management systems (LMS), i.e. Moodle and A-Tutor. As reported by HEEPF (2007), the graph in Figure (8) shows the total number of electronic courses produced in all specializations and the number of the HEEPF financed projects that produced these courses. From this Figure it can be concluded that the numbers of the engineering courses in the e-learning form are 72 courses. It is worth to say that Cairo University comes at the top with regards to the number of courses that use E-learning systems. Table (2) gives some of the titles of the electronic courses developed by the HEEPF projects in the Engineering fields arranged in alphabetic order.

Table (2): Electronic courses and e-learning developed by the HEEPF projects in the Engineering fields

Department	Course Title	Department	Course Title
Civil	Earthquake Engineering	Electrical	Advanced Control
	Elements of Reinforced concrete Architectural Engineering students		Automatic Control
	Engineering Elements of Geotechnical		Computer Applications in High Voltage
	Engineering geology and Soil Science		Computer Control
	Environmental Engineering		Computer Networks
	Geotechnical Engineering B.SC project		Control of Electrical Machines
	Geotechnical engineering designs		Data Communication Networks
	Irrigation		Deep Foundation
	Computer Aided Analysis of Structures I, II		Concrete Establishments
	Reinforced Concrete 1,2,3,4		Digital Control systems
	Shallow Foundation		Electrical Drives
	Soil Hydraulics		Electrical Measurements
	Soil Mechanics		Electrical Power
	Solid State Electronics		Components of Control Systems
	Fundamentals of soil Mechanics		Generation & Transmission of electricity power
	Structural Analysis 1,2,3,4		High voltage engineering (Grounding)
	Structural Mechanics I, II		Advanced Control
	Foundations		Automatic Control
Mechanical	Desalination		Computer Applications in High Voltage
	Desalination (Advanced Course)		Computer Control
	Material Characteristics		Computer Networks
	Mechanic Measurements		Control of Electrical Machines
	Mechanical Vibrations		Data Communication Networks
	Mechanics of deformable solids		Deep Foundation
	Mechatronic Systems Design		Concrete Establishments
	Mechatronics laboratory		Power Electronics
	Oil and Gas Pipeline Design		Power system analysis
	Industrial Control		Power system Protection
	Pumps & Generators		Processing, Simulation, & Hidden Systems
	Robotics Engineering		
Electronics	Basic Electronics	Electrical	Programmable Logic Controller (PLC)
	Digital Electronics & Accurate Processing		Fundamentals of electrical engineering
	Digital Integrated Electronics		
	Electronics Labs		
	Intelligent Control Systems		
	Introduction to Mechatronics		
	Microprocessor		
	Special Topic: Electronics Cooling		

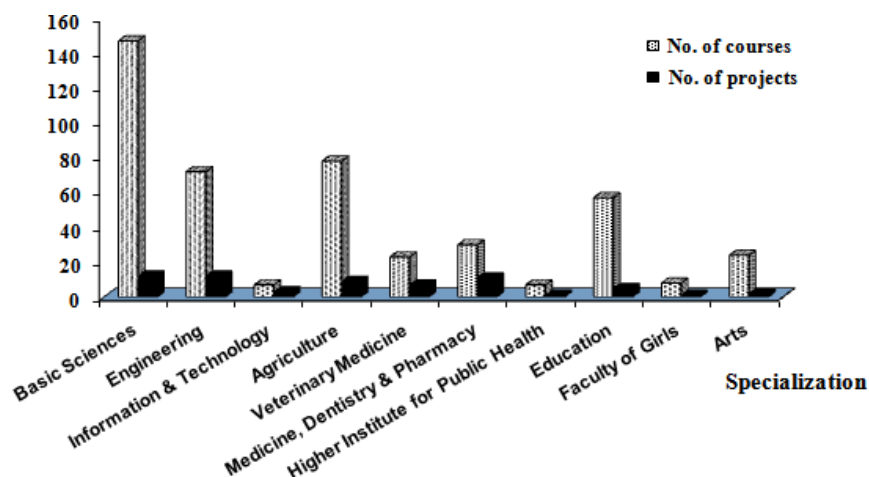


Fig. (8): Number of electronic courses and projects in different specializations

6.4 Using Information and Communication Technology and Learning Resources

In the present era, information and communication technology represents the corner stone for the renaissance of society and decision-taking. The technology system is related to several axes: preparing integral infrastructure and advanced equipment using the latest specialized software programs, and preparing technical applications that satisfy the requirements of the work market. Among the projects concerned with these topics are ones that aim at establishing an integral electronic management system for universities. Through the HEEPF financed projects, ideas were given shape through upgrading information and clinical skills to enhance education either by using different educational media, or designing and producing electronic courses. Given the importance of recording information, some example projects displayed the contents of the digital libraries developed using databases and connected with a unified digital network. As reported by HEEPF (2007), Figure (9) shows the HEEPF projects fields related to information and communication technology and their joint efforts with the Information and Communication Technology Project (ICTP) in Egyptian universities.

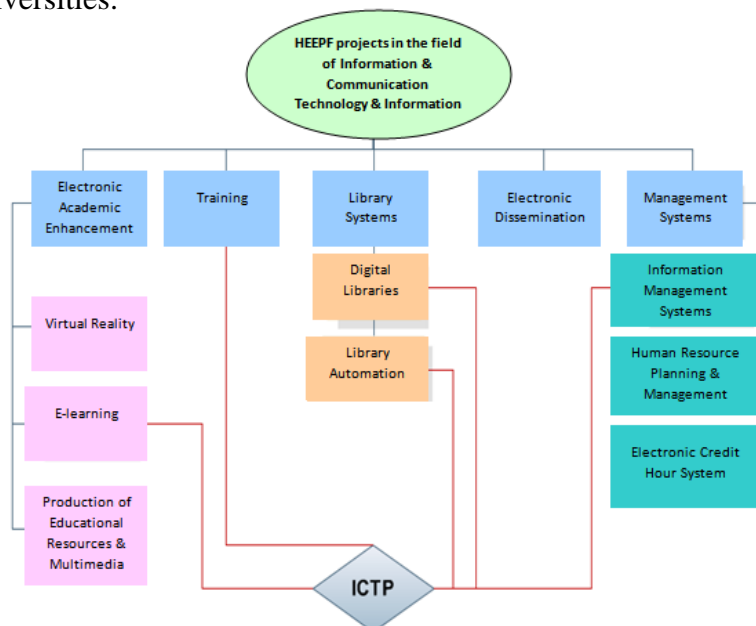


Fig. (9): The HEEPF financed projects work in the field of information and communication technology and their relationship with other enhancement projects

6.5 Specialized and Interdisciplinary Centers

The establishment of scientific and research centers of excellence in most Egyptian universities is one of the most important outputs of the HEEPF projects financed in the first phase. These specialized centers contribute to the upgrading of scientific and laboratory skills of students in different fields. They also enhance the concept of development and self-sustainability in a tangible form. They reached 59 centers distributed on 15 Egyptian universities including the different sectors of higher education (Engineering, Medical, Agricultural, Veterinary Medicine, Basic Sciences, and Theoretical Specializations Sectors).

The Engineering sector got 12 specialized centers distributed in 8 universities and one example of these centers in the engineering field is the Energy Research Center which was established in the Faculty of Engineering, Cairo University. This center was used to enhance the field of training on advanced and applied systems and designing laboratory experiments. The project management contacted service agencies to learn about their needs and qualify graduates by giving them the required scientific and laboratory skills to deal with automatic control and measurement technology. A cooperation protocol was signed with the Eastern Company for Tobacco, the Holding Company for Vaccines, and the Ministry of Electricity.

Another example of the specialized centers in the engineering field has been established at the faculty of engineering, Mansoura University. This center is used in the framework of connecting the education enhancement process with the fields of scientific research. The center, one of its kinds in the Middle East, aims at transferring a virtual image of laboratory experiments to students' mind. It enables students to watch the process of performing experiments, getting results, and following up their analysis through the internet. The whole course together with questions, problems, and examples of field experiments are presented to students through the internet. In addition, an information database was prepared to form the basis of virtual laboratories in which students do experiments using the computer.

6.6 Restructuring, Administration Systems, Quality Assurance, and Accreditation

HEEPF projects were centered in three basic axes: academic enhancement, projects related to the market and industry, and administrative enhancement projects. The faculty of Engineering at Alexandria and Fayuom universities implemented administrative enhancement and restructuring projects. These projects focused on providing electronic administrative systems, electronic infrastructure to facilitate administrative work in the faculty as well as software programs to organize work, and training employees on using this system. With respect to the quality assurance, and accreditation, it is worth noting that the HEEPF projects outperformed other enhancement projects in terms of implementation especially in the field of quality assurance. The first phase of the Quality Assurance and Accreditation Project (QAAP) began in 01/10/2004, while the HEEPF announced two cycles and projects started their implementation before that. HEEPF management was keen on coordinating with the previously financed projects in the field of quality assurance like SCM-TEMPUS financed by the EU to train faculty members on quality systems as is the case in Helwan, Menoufyia, and Tanta Universities.

6.7 Human Resources Development

Training is one of the main pillars for the development of capabilities, skills, and competencies in all social sectors. The advanced countries support long life learning and offer training programs. The present world witnesses a remarkable scientific progress in different scientific and technical fields. This progress has been

accompanied by a change in job opportunity competition. Focus on producing well trained graduates who have the knowledge and skills necessary to deal with modern technology has become one of the most remarkable interests of education institutions. Training with its different programs is considered an advanced means for applying knowledge. It is based on the theory that the education process takes place in various stages classified cumulatively. It started in the first and second stages with knowledge and awareness of the basic skills that can be successfully learnt through repetition and memorization in classrooms/ or training halls. Then followed by advanced stages of education process that begin with application, then analysis and finally evaluation to measure the outcome of training. These advanced stages cannot be optimally achieved except through practice and application of knowledge in different training programs. Hence, the role of the HEEPF in supporting such activities is well identified.

In addition in raising the level of awareness about the continuous development, some projects focused on capacity building and offered training courses to faculty and technicians:

- For example, a project at Helwan University, offered training programs for all engineers and technicians of the technical colleges for teaching refrigeration, air-conditioning, cars and tractor mechanics, in using new methods of teaching, education films, and designing models using computers.
- Another project offered many training courses on using the computer in teaching engineering drawing courses in different fields in technical colleges in Sahaffa, Mattereya, and Qesna.
- Technical college at Mahalla Kubra initiated the ready-made clothes department and organized training courses to prepare faculty members for teaching the new courses.

7. Integration and Coordination among Projects

The idea of integration and collaboration among HEEPF projects was achieved through funded projects in Engineering. The first conference for projects integration was held at Cairo University in April 2006. During the conference criteria of measuring the success were set, which included number of beneficiaries before and after integration, evolving new products, better sustainability, improved education /teaching quality, and enhanced capacity building.

Academic areas of integration among projects included exchange of developed course materials (text and E-learning), holding workshops and training programs for staff among other activities as shown in Figure (10). One of the successful examples was the exchange of developed simulation experiments in soil mechanics among two projects in Helwan and Zagazig University. At university of Cairo, there are five projects in engineering field. These projects exchange equipment, software and participate in buying a common server to enhance the fiber-optics network.



Fig. (10) Integration and collaboration among HEEPF projects in Engineering Field

8. Requirements for Accreditation According to the ABET and the Impact of the HEEPF on the Engineering Education

No doubt that the implementation of the HEEPF projects on the engineering education in the universities which got these projects enhances the quality of the faculties, but the question is to what degree of quality? According to the ABET, the program must demonstrate some criteria for accreditation as shown in Table (3). This table also shows the impact of the HEEPF on the engineering education. The table prepared by the HEEPF monitoring teams and the project managers.

Table (3): Impact of HEEPF on Engineering Education according to ABET Criteria

Accreditation Criteria	Description	Impact Level			
		To Great Extent	Moderate	Weak	Not at all
Students	Setting requirements for evaluating, advising, monitoring and enforcing Policies for evaluating transfer courses, etc...				✓
Program Education objectives	Establishing, maintaining and evaluating objectives achievement.		✓		
Professional Component (curriculum)	The curriculum must include; one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. One and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. A general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives		✓		
Faculty	Sufficient with appropriate qualifications number to accommodate adequate levels of student-faculty interaction, student advising, etc...				✓
Facilities	Classrooms, laboratories, and associated equipment must be adequate to support the scholarly activities	✓			
Institutional Support and Financial Resources	Resources must be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty.		✓		
Program Criteria	Each program must satisfy applicable program criteria derived from the requirements set forth by the corresponding professional societies.	✓			

9. Future Strategic Vision for Higher Education

The first phase of HEEPF projects resulted in a wide array of experiences that could be exploited for future strategic planning. Outputs of the first phase should be maximized through integration and collaboration among projects. Future strategic vision should focus on making outcomes available to other similar departments, expanding E-learning to become part of the educational system, establishing graduates- follow up units and develop programs for distinguished students, use of credit hour systems, improving the administrative system, establishing center of

excellence, establishing collaboration protocols with foreign universities and the private sector, upgrading the universities infrastructure and modernizing laboratories, establishing connection between education and research projects, improve student training and focus on students skills that meet the market requirements.

10. Concluding Remarks

The purpose of the HEEPF is to enhance quality, relevance and efficiency in Higher Education through financed projects. The implementation of these projects has already contributed to the following achievements:

- Enhancing the capabilities of learners by introducing new courses through the upgrading curricula of courses and up-to-date scientific and technical information resources,
- Exposing instructors to international experience by attending training courses abroad which leads to improvement of the skills and experience of staff,
- Upgrading the library facilities from books and software and up-to-date scientific and technical modern electronics resources,
- Supplying audio-visual equipment to enhance the teaching and learning resources,
- Installing fully functional laboratories and upgrading existing equipment and establishing a Virtual Learning Unit,
- Establishing links with nation and international societies to determine the needs of the market/industrial sector and recognizing of the interdisciplinary demands,
- Building an IT infrastructure of necessary H/W and communication,
- Building an integrated S/W system to automate the working processes at the Universities,
- Enhancing capabilities of undergraduate and graduate engineering students,
- Establishing unique specialized centers.

Acknowledgements

The authors are indebted to the support of the Ministry of Higher Education to conduct this research. Thanks are due to the entire HEEPF team and sub-projects managers who contributed to adopting such a dynamic management system. The contribution of Dr. M. E. Said, Director of the Project Management Unit (PMU) through the implementation process is highly appreciated. The authors also wish to thank Dr. Ahmed Heggi, Dr. Ibrahim Shafie and Dr. Aly El-Bahrawy, for their valuable revision and remarks on this manuscript

References

- [1] Ibrahim, A., 1999, "Current Issues in Engineering Education Quality" Global J. of Engng. Educ., Vol. 3, No. 3'.
- [2] William, D., 1993, "The Relation between Technology, Science, Engineering and Mathematics", Annual conference of American Vocational Association, December.
- [3] Micu, E., 2002, "–Engineering Higher Education Issus Within Economic Reform" A Romanian Case Study.
- [4] Anis, H., 1992, "Developing Engineering Education in Egypt Experience and Achievements" Personal communication.
- [5] Higher Education Enhancement Project (HEEP), 2007, HEEP web site: <http://www.heep.edu.eg>.

- [6] Higher Education Enhancement Project Fund (HEEPF), 2007, "Academic Development in Higher Education Enhancement." In Arabic, 2/9.
- [7] Higher Education Enhancement Project Fund (HEEPF), 2007,"Development of Labs and Learning Environment in Higher Education Enhancement." In Arabic,3/9.
- [8] Higher Education Enhancement Project Fund (HEEPF), 2007, "E-Learning and Simulation Labs in Higher Education Enhancement." In Arabic, 4/9.
- [9] Higher Education Enhancement Project Fund (HEEPF), 2007, "Specialized and Interdisciplinary Centers in Higher Education Enhancement." In Arabic, 6/9.
- [10] Higher Education Enhancement Project Fund (HEEPF), 2007, "Development of Human Resources." In Arabic, 8/9.
- [11] Supreme Council of Universities, 2006, "Statistical Data about University Education in Egypt," Department of Statistics, September, (pamphlet).