A CREATIVE APPROACH FOR A RAPID ESTABLISHMENT
OF SUCCESSFUL ENGINEERING PROGRAMS

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Abstract — *The University of Sharjah was established in 1997, and has started with five colleges, including the college of engineering. Strong government support and careful planning have provided great opportunities for the engineering programs to pursue the highest standards of excellence. These opportunities were translated into rapidly developing effective engineering programs in the disciplines with the highest market demand in the United Arab Emirates. The university has supported the college of engineering in establishing modern resources and facilities, recruiting well qualified faculty and experienced support staff, and establishing proper policies and procedures. As a new college, the development of the educational aspects of the engineering degree programs is being continuously addressed taking into consideration national and international engineering accreditation criteria. This paper discusses the development stages and quality assurance processes followed in the rapid establishment of the engineering programs at the University of Sharjah. The paper addresses the role of the twin-hood agreement in establishing the engineering programs and the process of effective internal and external assessments that are used to continuously enhance these programs.*

Index Terms ¾ Accreditation, assessment, engineering education, new program development

INTRODUCTION

The University of Sharjah (UOS) was established in 1997 by a royal decree from His Highness, Sheikh Dr. Sultan Bin Mohammed Al-Qassimi, member of the Supreme Council, Ruler of Sharjah, and the Supreme President of the University. The University has started with five colleges, including the college of engineering with its three programs in civil, electrical and electronic, and computer engineering. The vision of the university founder, His Highness the ruler of Sharjah, is to provide quality higher education to the country's youth and to support the rapid technological development in the United Arab Emirates (UAE). In order to realize this vision, the university has made three significant commitments:

1. Link each college with an internationally recognized partner through a formal twin-hood agreement to help fast-start the college's programs

2. Attract experienced faculty and staff from developed countries and support them well
3. Build world-class facilities to ensure quality instructional delivery and research productivity, as well as support campus life for all students.

After four years of continuous building and relentless efforts, the university today has attracted more than 4000 students, has expanded its programs to include eight colleges, and has graduated its second class of students. The university is currently devoting significant efforts to gain national accreditation for its undergraduate programs as well as to obtain international recognition for some of its programs, including engineering. The University of Sharjah presents a unique case study in the Gulf region for many reasons, including:

• The university has a separate, but duplicate, campuses for men and women students.

• The university admission policy is open to all qualified students, regardless of nationality

• The university exists in a competitive environment, with many other institutions providing higher education opportunities in the UAE.

The college of engineering at UOS has grown very rapidly since its inauguration in 1997. About 800 students are currently enrolled in the three undergraduate degree programs in Civil, Computer, and Electrical & Electronic Engineering. The college has also succeeded in attracting 40 faculty from internationally recognized institutions and industries, with rich and diverse background in academia and research. The year 2002 marked the graduation of the first class of engineering students. All programs in the college are recognized nationally as accreditation-eligible, and are planning to seek full accreditation in 2002. The engineering programs are delivered in English, and they are developed based on international standards, incorporating ABET criteria and best practices.

Among the college's accomplishments achieved in the past four years are: (1) The continuous improvement of the engineering programs to meet national and international accreditation criteria; (2) The significant progress in developing the engineering laboratories with modern equipments to serve the educational needs of the programs and faculty research; (3) The active participation of the college's faculty in offering their expertise to the local

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society and specialized industry through joint research projects, continuing education and consultancy; (4) The increased research productivity of the college's faculty and their active role in promoting the stature of the college and the university through refereed journal publications and participation in many international conferences; and (5) The recent approval of the university's Board of Trustees to offer Master's degrees in our three engineering programs.

Mindful of the increased emphasis on measurable educational outcomes, the college has initiated and maintained an active assessment and review system for many aspects of its degree programs. As a result, the college is continuously revising its curricula to address the recommendations of the UAE Commission for Academic Accreditation [1] and satisfy the criteria of ABET EC2000 [2].

This paper discusses the development stages and quality assurance processes followed in the rapid establishment of the engineering programs at the University of Sharjah. The paper addresses the role of the twin-hood agreement in establishing the engineering programs and the process of effective internal and external assessments that are used to continuously enhance these programs.

TWIN-HOOD AGREEMENT

The philosophy of the founder of the university is to link each college in the university with an internationally recognized partner through a formal twin-hood agreement to help start the college's programs based on sound experience. The agreements were established at an early stage of the university existence, so that the international partner can help bring to each college the long experience and best practices academically and administratively. The College of Engineering at the University of Sharjah was linked in a twin-hood agreement with the University of Exeter in the U.K. The agreement included provisions where the University of Exeter appointed the Dean of Engineering at the University of Sharjah. The Dean has served for about two years, 1998-2000, and has provided support in the following areas:

- Recruit qualified faculty for the programs
- Guide the continuous curriculum improvement of the engineering programs to meet the accreditation criteria
- Guide planning and acquisition of necessary equipment for engineering laboratories
- Establish the administrative support structure
- Establish the college and program policies
- Implement effective assessment measures

The starting period (1997-2000) was an intense, fast-growth period with the number of students and faculty members doubling in size each year. The faculty members spent significant efforts on administrative work as the programs were being established. It was essential to attract and recruit successful faculty members with demonstrated academic and administrative experiences. The university was very supportive in attracting quality faculty by providing competitive compensations as well as strong commitment and interest in faculty development and research.

The program curricula were being continuously examined as specialized faculty were filling their positions and delivering their courses at the university. In the year 2000, a comprehensive curriculum revision was carried out based on input from the faculty and a report from the national accreditation commission. The revised curriculum was consistent with the UAE Commission for Academic Accreditation and the criteria of ABET EC2000. Also, the revisions resulted in reducing to 140 the total number of credits required for a Bachelor of Science degree in engineering. Along with curriculum planning, the faculty were also heavily involved in designing the laboratory and identifying the needed equipment for instructional and research labs.

In addition to the early link with the University of Exeter, the college of engineering also relies on agreements with other universities including the American University of Beirut, where a team of experts plays a consulting role in reviewing the progress of the academic programs as well as the quality of their delivery and provide the college with an annual assessment report. Also, the University of Sharjah has signed several memorandum of understanding with leading Universities to facilitate exchange of faculty and students and joint research and scholarly activities.

The following sections describe the strategies and mechanisms followed by the college to ensure that engineering programs are fulfilling their objectives and satisfying the accreditation criteria.

DEVELOPMENT OF ENGINEERING PROGRAMS

With the strong government support for higher education in the UAE, the engineering programs at the University of Sharjah exist in a competitive environment, with more than five universities offering similar programs in the country. Mindful of the competition and the value placed by the public on accredited programs, the engineering programs at UOS were designed to:

- Meet the national needs and local market demands
- Satisfy the UAE national accreditation standards
- Be consistent with the international standards, particularly ABET EC2000 criteria

The college of engineering has made significant efforts in promoting its partnerships with industry to ensure that society and industry partners have an opportunity to provide their valuable input into the development process of the engineering programs. Towards that end, the college held an open "College-Industry Forum" in 2000, and has followed this activity with two forums in 2001 [3] and 2002 [4] that are focused on preparing engineering graduates to meet the

market's expectations. Additionally, the college has formed a dynamic "Program Advisory Committee" that meets regularly to provide its input to the college on future trends and opportunities in the profession and identify effective mechanisms for curriculum improvements to better prepare the graduates for future challenges.

The college is systematically addressing all of the ABET criteria, in addition to the UAE national accreditation criteria for effectiveness and excellence. To a great extent, the UAE accreditation standards [1] include, directly or indirectly, the well-known eight important ABET EC2000 criteria [2]. An important aspect of achieving quality and excellence is the issue of implementing an effective assessment process. In this regard, the college has initiated a process of continuous assessment and evaluation to enhance its undergraduate programs and ensures that its resources and facilities meet the national and international standards. Significant efforts are devoted to implement a culture of continuous program improvements in the various aspects of the college's activities. The college strongly believes that this process can be successful only if all stakeholders, including faculty, staff, students and external partners from industry and government agencies are committed to adopting and supporting this process. The college has hosted several seminars and forums on program outcomes and assessment, and the university has provided support for faculty to attend relevant international conferences and training workshops.

Promoting Students Excellence

One of the major challenges for new Universities is attracting quality students. A carefully planned new program directly fits in the needs of the community and as such attracts quality students from the start. In this regard, the college of engineering at UOS has concentrated its resources on providing engineering programs in the three highly demanded engineering fields in order to meet the needs of the fast-developing community. This strategy was successful in attracting good quality students of diverse background. Another very helpful factor is that the University of Sharjah provides many positive incentives for the students to encourage them to always pursue excellence in their education. Among these incentives are:

- Substantial tuition discount (50% discount) for excellent students who maintain a cumulative GPA of 3.6/4.00 or higher
- Financial Assistance to excellent students that cannot find the means to support their higher education
- Significant recognition and an annual university-wide event for students and their parents to recognize excellence and achievements of excellent students
- Providing on-campus, work-study opportunities in libraries, computer labs, as well as students' residence halls.

These positive incentives have influenced and encouraged students to compete with their peers and always

seek better performance in order to deserve these rewards and recognition. Relating rewards to excellence has effectively demonstrated the university's commitment to the highest educational standards in its aspiration to become a provider of quality higher education in the region.

While the initial admission criteria to the engineering programs were chosen following careful study, the college continues to monitor the progress of its students and graduates. As such and to ensure that the admission criteria continue to meet the needs of the profession, the college has established the following formal procedures for review and assessment:

A. Continuous progress of students is studied and correlation is made with performance prior and after college entry.
B. Department and college committees are charged with monitoring the relevant indicators and conducting their own review process. The indicators include students' actual progress and performance, market needs, input from peers and professional advisors, and applicable university policies.

The results of these studies are discussed in the college and recommendations for actions are communicated to the university administration to improve the quality of admitted students into the engineering programs.

Educational Objectives

The University of Sharjah caters for the needs of local and regional communities as well as international exchange programs. As such, and while the engineering programs have been developed with the view of serving the local and regional markets, the international standards for engineering education have been adopted. In line with best practice, the engineering programs have clearly stated and published objectives and outcomes that are periodically reviewed. Department and college committees have been set-up to proactively review the program objectives in view of demand, community needs, and degree of attainment of stated outcomes. To ensure that the engineering programs meet their stated objectives, the programs adopted a systematic review and assessment approach that include:

1. Peer evaluation of educational methods and course contents
2. Continuous professional feedback of regional industries that are representative of the engineering programs.
3. Department review of overall performance of individual students.
4. Peer review of programs by invited imminent professors and through established formal process of cooperation with sister universities
5. Surveys of direct supervisors of students doing their practical training
6. Surveys of national market and employers as well as student (Exit and Alumni) surveys

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The results of the review process are used to modify and update the objectives of the engineering programs to ensure their effectiveness and quality. The initial curricula have been designed in view of community needs and are subject to regular review and improvements. All engineering programs have been through a major update in the year 2000 following a process of continuous peer review and assessment by external and internal constituents.

Program Outcomes

The undergraduate programs in engineering are outcome oriented. The aim of the programs is to prepare students for a productive career as practicing engineers, and as such the programs emphasize the professional aspects of engineering education. Gradually, the college is building its industrial contacts of employers and professional bodies and proactively promoting the interest of its graduates. The capabilities and qualities of a graduate engineer are issues of active discussion and assessment in the college. The following are among the measures implemented in monitoring the achievements of program outcomes:

1. A range of examples of student portfolios are kept and evaluated
2. Portfolios of student's design projects are kept and evaluated independently
3. Course assessment procedures are periodically reviewed and results are documented
4. Input from Professional Advisory Committee are reviewed and incorporated in the curriculum
5. Benchmarking of program content, assessment, and students' performance against other national, regional and international programs are undertaken
6. Portfolios of accomplishments of graduates will be documented
7. Employer surveys are undertaken to assess degree of competencies of the graduates
8. Peer review of programs by external imminent professors and established organizations are continuously undertaken

As previously mentioned, the college has organized and held two regional engineering education forums in 2001 and 2002 with a focus on the desired skills and attributes of engineering graduates. The aim of this activity is to support the efforts of the college in continuously improving its undergraduate programs by incorporating feedback and best practices from regional employers and educators. The forums are also used to raise the awareness of faculty on the value of committing time and efforts to improving the quality of the educational experience provided to the students. The college seeks to play a major role in establishing a regional engineering education society that provides a means for sharing best practices and improving the quality of engineering education in the region.

Program Resources

The University of Sharjah has invested significant resources in building state-of-the-art IT and computing infrastructure, modern engineering labs, and library resources in the various engineering disciplines. In addition, the basic educational capabilities are duplicated in separate men and women facilities. With the goal of continuously monitoring and improving the progress of building its resources, the college has established special committees responsible for the assessment and future acquisitions of educational and research resources. Engineering faculty have also produced a significant volume of printed and electronically available materials to advance the students' learning process. The policy of the college is to make the best possible use of the university computer network, both the Intranet and the Internet, as a valuable supplemental learning resource assisting the delivery of our courses. The college website is continuously updated and enriched with relevant resources. We currently have forty engineering courses with significant web resources.

Faculty Development

The college of engineering employs a diverse team of professors at all academic ranks that are appointed, after a careful recruiting process, for their strong international experience in teaching, research, administrative, and professional and community service. Assisting the professors, the college employs lecturers and laboratory technicians to support the teaching and learning as well as research activities and students projects. The college provides ample opportunities for staff development through mentoring and financial support for participation in professional development activities, including specialized conferences and training courses.

Given the pressures associated with the start-up of undergraduate programs, it is gratifying to note that engineering faculty members have made significant efforts to promote the research profile of the college and university. For the past two years, more than 100 research papers are annually published in refereed journals and international conferences. The college has adopted a number of periodical review and assessment mechanisms to promote faculty development and monitor quality of performance, including:

- Monitoring of students/faculty ratio across disciplines
- Student assessment of teaching and course content
- Peer evaluation of teaching and research
- Mentoring of academic and non-academic staff
- Annual performance assessment

Results of these assessments are communicated in a timely way to the faculty in an effort to promote areas of strength and encourage actions to address areas of weakness. This is a continuous process, where assessment results and faculty feedback are undertaken on semester and annual basis.

SUMMARY AND CONCLUSIONS

Strong and continuous commitment from the highest university levels and careful planning have provided great opportunities for the engineering programs to pursue the highest standards of excellence. These opportunities were translated into rapidly developing effective engineering programs in the relevant disciplines, establishing modern resources and facilities, recruiting well qualified faculty and experienced support staff, and establishing proper policies and procedures.

The development of new programs is achieved in a relatively short and very intense period, during which the college has counted on the extra efforts from its faculty, staff and administrators. The rewards, however, for participating in building new programs are enormous. During this building period, the focus has been on establishing and fine-tuning the educational programs and academic resources. This emphasis does not leave adequate time for pursuing all of the desired objectives of the college on equal footing. Nevertheless, the college has made significant achievements in terms of research, and has established professional links and provided valuable community services. With the graduation of the first class of engineers, the college has completed a full cycle of its programs. The college is now approaching a steady state in terms of its normal activities associated with the current undergraduate programs.

The college has adopted a rigorous program of assessment and continuous quality improvement for all engineering programs within the college. In this regard, the college has initiated a process of effective internal and external assessments to enhance its undergraduate programs and to ensure that its resources and facilities meet the national and international standards. Following this assessment and improvement program, significant achievements were made in various areas of excellence, as discussed in this paper.

The college of engineering is committed to continue its progress and leadership in providing excellent engineering education, promoting scientific and applied research, and serving the community and the profession. Our goal is to create the very finest educational, research and continuing education programs that address the needs of the UAE and regional societies.

ACKNOWLEDGEMENT

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