# Evolution of the Assessment of Educational Objectives of the Civil Engineering Program, United Arab Emirates University

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## ABSTRACT

This paper presents the outcomes assessment process adopted by the Civil Engineering Program of the Civil and Environmental Engineering Department, United Arab Emirates University. The assessment is done considering three sets of objectives; an original set considered prior to the academic year 2006-2007, a new set considered effective of academic year 2006-2007, and a modified new set considered in 2008-2009. The new and modified sets of objectives were developed to be consistent with the ABET definitions of objectives, to better reflect the changes of the curriculum and to consider feedbacks from various constituencies on the educational objectives. Different assessment-calculation approaches were considered for the three sets of objectives. The results show that the objectives of the five considered assessment cycles (five academic years) were met as per prescribed success criteria.

**Keywords:** Assessment, outcomes, objectives, ABET, Civil Engineering, United Arab Emirates University.

## 1. INTRODUCTION

As the oldest and most comprehensive educational and research institute in the United Arab Emirates, the United Arab Emirates University (UAEU) was established in 1977. Currently the university includes ten colleges offering more than 50 Bachelor and 15 Master Degrees in different fields. The Civil Engineering Department was inaugurated in 1980. Its name changed to Civil and Environmental Engineering Department (CEED) in 2003 to reflect the importance of environmental issues in all Civil Engineering projects. However, the name of the program remained as Civil Engineering (CE) Program and the graduates of the Department receive a Bachelor Degree in Civil Engineering. The program currently accommodates 145 male and 71 female students and a total of 19 Faculty members and six professional staff.

The Civil and Environmental Engineering Department was granted the recognition of "Substantial Equivalency" to the US accredited engineering programs by the Engineering Accreditation Committee (EAC), Accreditation Board for Engineering and Technology (ABET) in 1998 for a duration of 6 years and renewed the recognition for an additional 6 years covering the duration of 2004-2010. Effective of 2007, ABET does not differentiate among national universities in the US and other international universities outside of the US. In other words, "Substantial Equivalency" is not granted any more and all ABET reviews are for full accreditation. Therefore, the next ABET review process scheduled near the end of 2009 for the CE program is expected to be more comprehensive and rigorous.

## 2. ASSESSMENT OVERVIEW

Learning is an inherently social process, where different strategies for effective learning can be implemented [1]. Assessment is focused on improving the learning process by examining the adopted strategies with the goal of enhancing them. High-quality assessment provides educators with information they can use to move the field forward. On the other hand, inadequate or poorly constructed assessment can cause educators to pursue ineffective paths, resulting in the loss of time and efforts [2]. Program assessment can help achieve the program outcomes and objectives, defining outcomes that need improvement, and identifying effective and suitable tools for measuring outcomes.

Assessment and evaluation should be implemented at both formative and summative levels using validated, research-based strategies or theoretical models. The assessment-based approach in engineering education does not prescribe specific standard teaching methods but offers a principle for designing the teaching and learning methods so that the students are able to achieve the intended learning outcomes. Over the last few years, a number of studies have been published presenting different experiences in the assessment process [3-5]. Mourtos [6,7] described the design and implementation of a sustainable, systematic process for defining and assessing program outcomes. He presented a systematic way of addressing program outcomes through course and curriculum design. Hughes and Sayle [8] described the assessment process used by the School of Electrical and Computer Engineering in Georgia Institute of Technology, including the definition of objectives and outcomes, implementation of assessment measures, and efforts to use the assessment results for continuous improvement.

This paper outlines the experiences of CEED in the assessment process to meet ABET requirements and ensure the quality of Civil Engineering Education. Besides assessing the outcomes, the paper discusses the assessment of three sets of objectives of the Civil Engineering program, outlines the assessment tools for each and demonstrates the complexity and effectiveness of the selected tools. The paper presents recommendations to close the assessment loop and ensure that possible improvements are made. Five cycles were implemented so far in assessing the CE program objectives for the academic years 2004-2005, 2005-2006, 2006-2007, 2007-2008 and 2008-2009. Almehaideb and Nazmy [9] presented an overview of the considered assessment approach in the College of Engineering, UAE University, at large in addition to brief results of the first two assessment cycles. At the end of the second cycle, a review of the CE program objectives was done and the feedback from several constituencies in an open house was included and hence, a new set of objectives was defined.

## 3. REVIEW OF CE PROGRAM OBJECTIVES AND OUTCOMES

The mutual correlation between the program objectives and outcomes emphasizes the need of maintaining a high level of consistency between the objectives and outcomes. As such, evaluation and improvement of the program outcomes are necessary for the development and attainment of the educational objectives. Success of students in accomplishing the program educational objectives is a strong indicator of success in achieving the program outcomes. This is in harmony with the fact that the accreditation process calls for detailed program educational objectives that are consistent with the targeted outcomes and the accreditation criteria [10].
Until year 2007-2008, the CE program outcomes have been the well known a-to-k ABET outcomes [11]:

a) An ability to apply knowledge of mathematics, science, and engineering.
b) An ability to design and conduct experiments, as well as to analyze and interpret data.
c) An ability to design a system, component, or process to meet desired needs.
d) An ability to function on multi-disciplinary teams.
e) An ability to identify, formulates, and solves engineering problems.
f) An understanding of professional and ethical responsibility.
g) An ability to communicate effectively.
h) The broad education necessary to understand the impact of engineering solutions in a global and societal context.
i) A recognition of the need for, and an ability to engage in life-long learning.
j) A knowledge of contemporary issues.
k) An Ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The educational objectives adopted by the CE program until the academic year 2006-2007 was initially developed to closely map the a-to-k ABET outcomes. Such objectives, here referred to as 'Original CE Program Objectives', are listed in Table 1 with their mapped outcomes.

The objectives of the CE program, along with their correlation to the program outcomes, have gone through a review/update process in order to be consistent with the ABET definitions of objectives, to better reflect the changes in the curriculum and to consider the input of various constituencies on the educational objectives. An Open House Day event was held in May 2006 to define a new set of program objectives with different constituencies including employers, industrial advisory board, alumni, parents, current students and faculty members. The modified set of educational objectives; here referred to as 'New CE Program Objectives', as suggested during the Open House Day event and approved at a later stage by the CEE department and university assessment committees are listed in Table 2. The new objectives introduce new components that relate the technical theoretical background to practical engineering applications. Emphasis is also placed on successful application of technical design specifications in a way that fits with other disciplines involved in the project without sacrificing client needs. Continuous career development is also included in the objectives through involvement in professional programs and/or pursuing graduate studies to keep up with the dynamic development in science and technology.

Table 1. Original CE Program Objectives and their Affiliated Program Outcomes

| Original CE Program Objectives | Outcomes |
|---|---|
| 1. Graduate students with knowledge of engineering principles and theories necessary for application in civil engineering projects. | a, j |
| 2. Develop students' capabilities towards innovation and creativity in engineering design. | c, e |
| 3. Develop students' computer skills to a highly competent level. | k |
| 4. Enhance students' ability to communicate effectively. | g |
| 5. Enable students to conduct experimental work effectively. | b |
| 6. Enable students to improve their team-working skills, and to achieve life-long learning habits. | d, i |
| 7. Help students to develop a positive attitude towards ethical, social, and environmental issues relevant to the engineering profession. | f, h |

Table 2. New CE Program Objectives and their Relevance Levels to Program Outcomes

| CE Program Educational Objectives | Outcome/ Relevance |
|---|---|
| 1. Take pride in their profession and have commitment to highest standards of ethical practices, and high level of awareness of social, economical, and environmental issues relevant to the civil engineering profession. | f:5, j:4, h:5 |
| 2. Successfully deal with real life civil engineering problems and achieve practical solutions based on a sound science and engineering knowledge. | a:4, c:4, d:4, e:4, h: 4, k: 4 |
| 3. Efficiently design, build and/or evaluate a civil engineering system/component to satisfy certain client needs per design specifications and/or interdisciplinary requirements. | a: 3, b: 4, c: 5, e: 4 |
| 4. Communicate effectively and use modern engineering tools efficiently in all aspects of professional practices. | d:4, g: 5, k: 5 |
| 5. Develop and update their knowledge and skills through professional programs and graduate studies to keep up with the rapidly evolving technologies." | i: 5, j:4, k:4 |

***** Based on 1 to 5 scale with 5 represents the highest relevance

Tables 1 and 2 indicate that each of the original objectives was related to one or two of the program outcomes. In order to obtain a more reliable measure of the educational objectives, each of the new objectives is linked to three to six program outcomes. Moreover, for the original objectives, each outcome

was used once to assess the achievement of one objective whereas it was used to assess the attainment of various new objectives through the application of proper relevance ratios that express the correlation between each outcome and the assessed objective, as presented in Table 2.

In March 2008 and during another open house day, further (yet minor) tuning was made to the new objectives and again went through evaluation by the college and university assessment committees. According to the tuned new objectives (here referred to here as "Modified New Objectives"), graduates are expected to achieve five objectives (Table 3) after 3 to 5 years of graduation.

## 4. ASSESSMENT APPROACHES

Three different approaches have been considered for the assessment of the three sets of CE Program Objectives as explained below.

**Original CE Program Objectives**

The assessment is performed through relevance to the a-to-k program outcomes that were assessed based on three direct tools (Curriculum Assessment, Exit Exam, and Capstone Course) and two indirect tools (Internship Advisor Survey and Students Exit Interview).

The curriculum assessment is carried out considering all core courses and most of the elective courses offered during one academic year. Each course is assessed based on three means, namely; student, faculty and grades assessment. The student and faculty assessments are conducted qualitatively while the grades assessment is conducted quantitatively using an in-house customized spreadsheet considering all course activities including exams, quizzes, homework assignments, lab reports, projects, class participation, etc. Curriculum assessment from several academic years revealed that the grade assessment usually yields higher results than the faculty assessment expectations and lower results than the student assessment expectations. Quantitative grade assessment is therefore considered in the final curriculum assessment.

Assessment of the Capstone Course is based on the grades of all students enrolled in two consecutive graduation project-courses; GPI and GPII. The number of students enrolled in each course ranges from 20 to 30 students. Based on the nature of projects offered in different semesters, all program outcomes are usually mapped to the project components in both courses except Outcome B (lab component) that is usually not addressed in GPI.

The exit exam assessment is carried out based on assessing the program outcomes/objectives mapped to fifty questions prepared by faculty members to address the main principles of various areas. Graduating students usually take this exam in the last week of study where the exam grade represents 5% of the overall GPII course grade. The Internship Advisor Survey is based on two-semester surveys filled out by the industrial supervisors of students conducting their "one-semester" training course, two semesters before graduation. The student exit interview is carried out based on feedback of graduating students in two semesters. Similar to the capstone course, the number of assessed exit exams, internship advisor surveys, and student exit interviews range from 20 to 30 in each semester.

Table 3. Modified New CE Program Objectives

| No | Objective |
|---|---|
| 1 | Be committed to highest standards of ethical practices, and high level of awareness of social, economic, and environmental issues relevant to the civil engineering profession. |
| 2 | Successfully deal with real life civil engineering problems and achieve practical and optimum solutions based on sound science and engineering knowledge. |
| 3 | Efficiently design, build, and/or evaluate a civil engineering system/component to satisfy certain client needs per design specifications and/or interdisciplinary requirements. |
| 4 | Effectively use modern engineering tools in all aspects of professional practices including technical communicat-ions. |
| 5 | Develop and update their knowledge, leadership and skills to keep up with the rapidly evolving technologies. |

Three more qualitative assessment tools were used in assessing the program outcomes/objectives prior to the academic year 2004-2005. These tools included: [1] Industrial Advisory Board Survey, [2] Alumni Survey, and [3] Employer Survey. Due to the limited number of completed surveys; the CEE Department decided to halt these assessment tools until having a relevant number of surveys. Such improvement can be attained by developing more precise surveys and devising better electronic management system for sending and collecting the surveys. This should eventually provide better responses so that more reliable qualitative assessment is achieved. The upgraded surveys and management system have been completed during the academic year of 2007-2008 and their assessment results are expected to be analyzed soon and considered in the future assessment process.

For the first two cycles (AY 2004-2005 & AY 2005-2006), assessment of each objective was obtained from the arithmetic average of assessment results of outcomes associated with the objective under consideration. Similarly, the outcome assessment is calculated from the arithmetic average of assessment results obtained from different assessment tools associated with that outcome.

**New CE Program Objectives**

Starting from the third cycle (AY 2006-2007), the assessment of objectives has been obtained from a weighted average of the assessment results of associated outcomes based on pre-specified relevance weights (Table 2). The outcome assessment is also calculated from a weighted average of its assessment results based on relevance weights relating the outcome to a number of assessment tools (Table 4). The weights associated with curriculum assessment are identified based on the total weights of considered courses with different outcomes. Similarly, the weights of other assessment tools are defined so that credible representation of each tool in assessing a certain outcome is achieved.

**Modified New CE Program Objectives**

Assessment of the modified new objectives (AY 2008-2009) was based only on direct feedbacks from three constituencies; Alumni, Employer, and Industrial Advisory Board. Twenty eight Alumni, twenty employers, and seven advisory board members participated in evaluating the program objectives and

Table 4. Relevance Weights of CE Program Outcomes and Assessment Tools used in Assessing the Revised Objectives

| Outcome | a | b | c | d | e | f | g | h | i | j | k |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Curriculum | 5 | 4 | 5 | 3 | 5 | 2 | 4 | 2 | 1 | 1 | 4 |
| Capstone Course | 4 | 2 | 5 | 5 | 5 | 3 | 5 | 3 | 2 | 3 | 5 |
| Exit Exam | 4 | 0 | 3 | 0 | 3 | 2 | 0 | 2 | 0 | 2 | 3 |
| Internship Advisor Survey | 4 | 0 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| Student Exit Interview | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

filled out surveys. A new surrogate representative weight, referred to here as Equivalent Quotient "EQ", is employed to represent each class of surveyed group. This quotient is considered as follows:

1. Alumni: Number of affiliated UAEU-CEE graduates
2. Employer: Summation of Quotients representing each employer. The Quotient for each employer is calculated from the number of affiliated UAEU-CEE graduates amplified according to the following equation:

$$Employer\ \ EQ = N + 0.5 * sqrt\,(T - N)$$

   Where N is the number of affiliated UAEU-CEE employees and T is the total number of CEE employees. The above equation gives more weight to the employer who has Civil Engineers not graduated from UAEU that represent a reference to compare with and enable him to better evaluate the UAEU graduates. The "square root" is used here to limit the increase of calculated EQ in case T-N grows.
3. Advisory Board: EQ for Advisory Board is calculated similar to the Employer Equivalent Quotient but multiplied by an amplification factor of 2. This is done to account for the experience of the Advisory Board Members qualifying them to provide a better judgment and evaluation of the UAEU-CEE graduates.

The total Equivalent Quotient calculated for all surveyed bodies was about 140 and the overall level of each survey question (as well as objective) was calculated as a weighted average based on its Quotient ratio to the total Quotient.

**Assessment Success Criteria**

The goal of the assessment analysis is to determine the success level in achieving the CE program outcomes and objectives. The data are aggregated to evaluate individual program outcomes and objectives separately. The success criteria utilized in such assessment are considered as follows:

**SI:** Suggested Improvement. The program outcome/ objective has been met, but some improvement may be suggested. The score is greater than or equal to 3.5 for all assessment tools and the score for the Exit exam should be above 60% and varies for capstone courses.

**NI:** Needs Improvement. The program outcome/objective has been marginally met. Improvement should be suggested and implemented. The score is between 3.0 and 3.49 for any assessment tool except for Exit exam and Capstone Courses. The score of the Exit exam is between 50%-60% and varies with outcomes for capstone courses.

**MI:** Major Improvement. The program outcome has not been met. Major improvement should be suggested and implemented. The score is less than 3.0 for any of the assessment tool except for the Exit Exam and Capstone Courses. The score for the Exit exam and capstone course is less than 50%.

## 5. ASSESSMENT RESULTS

**Original CE Program Objectives**

Table 5 lists the assessment results for the original CE program objectives for the academic years 2004-2005 and 2005-2006. The results show that all original objectives were met as per the success criteria explained above. However, Objective 2; related to the engineering design component, and Objective 5; related to the effective conduct of experimental work were both marginally met. The low assessment of these objectives in the academic year 2004-2005 was attributed to the deficiency in the internship advisor assessment about the students' performance in these two areas. This is explained by the fact that a number of students joined the training program without being fully equipped with tools to design a system component or interpret experiments and/or processes to meet desired needs. This shortage was absolutely eliminated in the academic year 2005-2006 after making sure that all students finish the majority of their core courses and a number of technical elective courses before joining the training. The results indicate much better evaluation by the Internship Advisory Board for both objectives in the academic year 2005-2006.

The low results in the exit exam (Table 5) was due to the fact that the grade of the exam was reduced in the academic year 2005-2006 from 10 points in the capstone course to only 5 points. Such reduction apparently resulted in less students' attention to the exam because of its minor weight in the overall students' grade. Since increasing the exam grade in the capstone course was not feasible, other means were sought to encourage the students paying more attention to the exit exam.

**New CE Program Objectives**

Table 6 lists the assessment results of the program outcomes for the academic years 2006-2007 and 2007-2008 based on the relevance-weights introduced earlier (Table 4). Most outcomes were met in both of academic years 2006-2007 and 2007-2008. However, Outcomes c, h, and j were marginally met in AY 2006-2007. While slight improvement in Outcome c assessment was achieved in Year 2007-2008, major improvement took place in the assessment of Outcomes h and j. Such improvement was related to the continuous effort of faculty in explaining the impact of engineering solutions in a global context and in presenting and highlighting contemporary issues related to various engineering topics.

To address the concerns related to the exit exam assessment, it was decided to develop a booklet of questions in different areas and distribute it to graduating students prior to the scheduled day of the exam. A total of 350 questions were developed by all faculty members in all areas and distributed to the students one week before the exam. The distributed questions prompted the students to take the exam more seriously and to prepare for it. This is evident by the improved assessment results of AY 2007-2008 especially for Outcomes a and c (Table 6).

Table 5. Assessment Results of Original CE Program Objectives

| Original CE Program Objectives (Table 1) | Academic Year | Assessment Tools: Curriculum | Capstone Course | Exit Exam | Internship Advisor Survey | Student Exit Interview | Average |
|---|---|---|---|---|---|---|---|
| Objective 1 | 2004-2005 | 3.9 (SI) | 4.2 (SI) | 2.9 (NI) | 3.6 (SI) | 3.7 (SI) | 3.7 (SI) |
| | 2005-2006 | 3.8 (SI) | 4.1 (SI) | 2.4 (MI) | 4.2 (SI) | 3.7 (SI) | 3.6 (SI) |
| Objective 2 | 2004-2005 | 3.9 (SI) | 4.0 (SI) | 3.4 (SI) | 3.0 (NI) | 3.4 (NI) | 3.5 (SI) |
| | 2005-2006 | 3.6 (SI) | 4.0 (SI) | 2.9 (NI) | 3.7 (SI) | 3.6 (SI) | 3.5 (SI) |
| Objective 3 | 2004-2005 | 4.1 (SI) | 4.8 (SI) | 3.4 (SI) | 3.7 (SI) | 3.6 (SI) | 3.9 (SI) |
| | 2005-2006 | 4.0 (SI) | 4.4 (SI) | 2.9 (NI) | 4.1 (SI) | 3.9 (SI) | 3.9 (SI) |
| Objective 4 | 2004-2005 | 3.8 (SI) | 4.3 (SI) | N/A | 3.6 (SI) | 3.4 (NI) | 3.8 (SI) |
| | 2005-2006 | 3.8 (SI) | 4.2 (SI) | N/A | 4.2 (SI) | 3.4 (NI) | 3.9 (SI) |
| Objective 5 | 2004-2005 | 3.5 (SI) | 4.0 (SI) | 3.4 (SI) | 3.2 (NI) | 3.6 (SI) | 3.4 (SI) |
| | 2005-2006 | 3.8 (SI) | 4.0 (SI) | 2.3 (MI) | 3.9 (SI) | 3.7 (SI) | 3.5 (SI) |
| Objective 6 | 2004-2005 | 4.1 (SI) | 4.3 (SI) | N/A | 3.5 (SI) | 3.4 (NI) | 3.8 (SI) |
| | 2005-2006 | 3.4 (NI) | 3.4 (NI) | N/A | 4.2 (SI) | 3.4 (NI) | 3.6 (SI) |
| Objective 7 | 2004-2005 | 4.1 (SI) | 4.4 (SI) | N/A | 3.8 (SI) | 3.8 (SI) | 4.0 (SI) |
| | 2005-2006 | 4.3 (SI) | 4.2 (SI) | N/A | 4.3 (SI) | 3.7 (SI) | 4.1 (SI) |

Table 6. Outcomes Assessment for the Academic Years 2006-2007 and 2007-2008

| Outcome | Academic Year | Curriculum | Capstone Course | Exit Exam | Internship Advisor Survey | Student Exit Interview | Relevance-Weighted Average |
|---|---|---|---|---|---|---|---|
| **A** | 2006-2007 | 3.7 | 4.2 | 2.4 | 4.1 | 3.4 | 3.6 |
| | 2007-2008 | 3.8 | 4.4 | 2.8 | 4.1 | 3.9 | 3.8 |
| **B** | 2006-2007 | 3.8 | 4.0 | N/A | 3.9 | 3.7 | 3.8 |
| | 2007-2008 | 4.0 | 4.3 | N/A | 3.8 | 4.3 | 4.2 |
| **C** | 2006-2007 | 3.5 | 4.0 | 2.7 | 3.3 | 3.5 | 3.5 |
| | 2007-2008 | 3.8 | 4.2 | 2.9 | 3.3 | 3.5 | 3.6 |
| **D** | 2006-2007 | 3.8 | 4.4 | N/A | 4.1 | 3.5 | 4.0 |
| | 2007-2008 | 4.1 | 4.5 | N/A | 4.3 | 3.7 | 4.2 |
| **E** | 2006-2007 | 3.7 | 4.0 | 3.0 | 4.1 | 3.6 | 3.7 |
| | 2007-2008 | 3.9 | 4.2 | 2.9 | 4.1 | 4.2 | 3.9 |
| **F** | 2006-2007 | 4.3 | 4.4 | N/A | 4.4 | 4.0 | 3.7 |
| | 2007-2008 | 4.0 | 4.5 | N/A | 4.1 | 4.1 | 3.9 |
| **G** | 2006-2007 | 3.8 | 4.2 | N/A | 4.2 | 3.4 | 3.9 |
| | 2007-2008 | 4.0 | 4.5 | N/A | 4.3 | 4.0 | 4.2 |
| **H** | 2006-2007 | 4.2 | 4.0 | N/A | 4.2 | 3.3 | 3.4 |
| | 2007-2008 | 4.0 | 4.2 | N/A | 4.4 | 3.6 | 3.9 |
| **I** | 2006-2007 | 3.0 | 4.4 | N/A | 4.3 | 3.2 | 3.9 |
| | 2007-2008 | 4.0 | 4.6 | N/A | 4.2 | 3.3 | 4.0 |
| **J** | 2006-2007 | 3.9 | 4.0 | N/A | 4.3 | 4.0 | 3.5 |
| | 2007-2008 | 3.9 | 4.2 | N/A | 4.3 | 4.8 | 4.2 |
| **K** | 2006-2007 | 4.0 | 4.4 | 2.9 | 4.1 | 3.9 | 3.9 |
| | 2007-2008 | 3.9 | 4.4 | 2.9 | 4.1 | 4.1 | 4.0 |

Table 7 lists the assessment results of the revised CE program objectives for two academic years 2006-2007 and 2007-2008. The results show that all revised objectives were met as per the success criteria defined earlier. While slight improvement was achieved in most objectives over the last year (AY 2007-2008), more pronounced improvement is noticed in the students' design skills (Objective 3).

**Modified New CE Program Objectives**

Table 8 lists the assessment results for the modified new objectives based on the feedbacks of three types of surveys (Alumni, Employer, and Advisory Board) and considering the Equivalent Quotients explained earlier. Even though that all objectives satisfied the target success criteria, it is noted that the scores of all objectives were mostly and considerably lower than their counterparts using the quantitative assessment approach considered for 2006-2007 and 2007-2008 cycles (Table 7); with the exceptional of the score of Objective 5. This gives an impression that the qualitative surveys are more conservative in assessing the objectives than other mapping quantitative approaches. The score of Objective 3 (Design Skills) was at the "Suggest Improvement" level was hardly met (Table 8). The alumni feedback in this objective was considerably below the success criteria and compensated by the feedback of employers and advisory board members. This indicates again that more efforts are still needed to improve the student skills in this respect.

Table 7. Assessment Results of New CE Program Objectives

| CE Program New Objectives (Table 2) | Ac. Year 2006-2007 | Ac. Year 2007-2008 |
|---|---|---|
| Objective 1 | 4.1 (SI) | 4.2 (SI) |
| Objective 2 | 3.8 (SI) | 3.9 (SI) |
| Objective 3 | 3.6 (SI) | 3.9 (SI) |
| Objective 4 | 4.0 (SI) | 4.1 (SI) |
| Objective 5 | 4.0 (SI) | 3.8 (SI) |

Table 8. Assessment Results of Revised New Objectives (Based on Qualitative Surveys)

| Surveyed Body | Alumni | Employer | Adv. Board | Overall Score (out of 5) | Assessment |
|---|---|---|---|---|---|
| Number of Affiliated CEE Graduate "N" | 28 | 64 | 11 | | |
| All Affiliated CEE Graduate "T" | NA | 233 | 18 | | |
| Equivalent Quotient "EQ" | 28.0 | 85.8 | 25.7 | | |
| Objectives (Table 3) | | | | | |
| Objective 1 | 3.54 | 3.79 | 3.81 | 3.75 | SI |
| Objective 2 | 3.52 | 3.82 | 3.42 | 3.69 | SI |
| Objective 3 | 3.35 | 3.54 | 3.75 | 3.54 | SI |
| Objective 4 | 3.70 | 3.77 | 4.50 | 3.89 | SI |
| Objective 5 | 3.50 | 3.98 | 4.00 | 3.89 | SI |

## 6. CONCLUSIONS AND RECOMMENDATIONS

A major consideration in the evaluation of any engineering program is the quality and performance of the students and graduates of the program. This requires continuous evaluation and monitoring of students/graduates to determine the success in achieving the program's goals.

The CEE Department of UAE University has gone through a dynamic process of assessing its program including educational outcomes and objectives. Different sets of objectives have been adopted by the department at different stages reflecting different focuses and priorities associated with evolving technologies and industrial needs. The educational objectives adopted by the department until the academic year 2006-2007 were developed to map closely to the a-to-k ABET outcomes. New program objectives were implemented in order to be consistent with the ABET definitions of objectives and consider the input of various constituencies on the educational objectives. The calculation approach pursued in producing the final assessment results for each set of objectives was also modified. While limited qualitative tools were considered in assessing the first two sets of objectives, the current objectives have heavily been relying on qualitative assessment tools, mainly industrial advisor board surveys, alumni surveys, and employer surveys.

The objectives of the five cycles assessed in this paper were properly met as per the prescribed criteria and therefore required neither major improvements nor modifications. However, in two assessment cycles the objective addressing the student's design skills has marginally achieved the target success criteria. This has been noticed in the students' performance in the exit exam, the feedback of the Internship Advisory Board, and the acquired feedbacks of surveyed alumni. The student performance in the exit exam has improved by motivating them to take the exam more seriously and orienting them towards better preparation for the exam. Improving the students' academic advising and assuring that the students finish the majority of their core courses and a reasonable number of elective design courses before joining training improved the Internship Advisory Board feedback. The department needs to make more efforts in order to achieve solid improvements in the students design skills so that better qualitative feedbacks are attained from both the alumni and employers. Proposed actions include introducing new design courses, increasing the design and application aspects of existing courses, inviting external speakers with industrial experience to teach some modules of selected courses, .etc.

## 7. ACKNOWLEDGMENT

The authors would like to thank all faculty members in the CEE Department for their involvement in the assessment process.

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