Preparing for ABET Accreditation in a Non-Western, Non-English Speaking Environment

Adnan H. Zahed, Abdullah O. Bafail, Reda M. Abdulaal, and Ali M. Al-Bahi
King Abdulaziz University
Jeddah, Saudi Arabia

Abstract

The case study in the present work deals with a Non-Western, Non-English speaking institution seeking accreditation for its 12 Engineering programs. The programs received substantial equivalency accreditation under the conventional ABET criteria for 6 years in 2003. The upcoming visit is expected during the academic year 2008/2009 based on EC2000.

The authors started the institution-wide preparation activities in 2005 when an Academic Accreditation Unit (AAU) was formed. The unit held its first meeting in May 2005 and defined its mission as: "To *Qualify the Education System in the College of Engineering to Meet ABET EC 2000 Standards*."

The first task carried out by AAU was to define several college and departmental committees to address different aspects of ABET preparations. Nevertheless, the main work stream of the unit started one month later by a Technical Note that proposed a "*Rationale for an ABET EC2000 Road Map*." The Note outlined a Tentative Departmental Work Plan and led to a complete 2-year time schedule for both college-level and program-level preparations.

The follow-up of the plan immediately indicated several cultural-related problems. Linguistic barriers led to fruitless discussions among faculty members in interpreting EC2000 criteria. The "bean counting" culture of the classical ABET criteria dominated faculty understanding. Preparing for an ABET visit remained in their minds as the academic equivalence of El Niño—something to be weathered every six years until things go back to normal. Meanwhile, a certain number of professors continued to assume a limited responsibility in the students' learning experience considering that the role of a university professor is to lecture and not to teach.

The students were also very far from the quality assurance measures set forth in EC2000. Learning remained teacher-centered and subject-based activity with one target: passing quizzes and end of semester exams.

AAU concluded that a suitable approach to address these difficulties is to restart ABET EC2000 process by course level activities in order to involve each staff member and each student in the process as early as possible. Once the staff members found themselves involved through course level activities, they became willing to participate in the required program level tasks. The process succeeded in anticipating the expected resistance by starting from what the instructors are actually doing to create a continuous improvement cycle and initiate the paradigm shift.

In the present work, the process is outlined and the results of its implementation in addressing linguistic and cultural barriers are evaluated.

Introduction

For a long time, engineering institutions in the United States adopted the evaluation criteria of the Accreditation Board of Engineering and Technology (ABET) as a well established process to ensure the quality of their engineering programs. Seventy years after its establishment, ABET currently accredits some 2,700 programs at over 550 colleges and universities nationwide.

In a major shift influenced by pressures from industry and global competition, ABET introduced the Engineering Criteria 2000 (EC2000)[1], which addressed the effectiveness of engineering education programs by focusing on assessment and evaluation process that assures the achievement of educational objectives and outcomes. Since it was first introduced in 1996, these criteria have been the subject of extensive discussions. In the words of Jack Lohmann[2] (cited by Felder et al[3]), "Preparing for an ABET visit is no longer the academic equivalent of El Niño—something to be weathered every six years until things go back to normal." Since the work of equipping students with the attributes specified in program outcomes must be done at the individual course level, all faculty members involved in teaching required courses must now understand and be involved in the accreditation process on a continuing basis, not just in the months preceding each visit.

In this part of the world things were different. The institution, whose case study is discussed in the present work, had just started introducing itself to the world of quality education in 2001. At that time, ABET evaluated programs outside the USA, by institutional request, to determine if they were "substantially equivalent" to ABET-accredited programs. "Substantial equivalency" means the program is comparable in educational outcomes, but may differ in format or method of delivery. The evaluation process is quite similar to that used for programs inside the USA and uses the same criteria, known as ABET conventional criteria, with its bean-counting approach.

In 2003, once the ABET visit to evaluate the 12 programs of the college was completed and El Niño had passed with minor harms, things went back to normal, or it looked like. In fact, the college top management had another vision, and started, with a small team of staff members, to reflect upon the past, the present, and the future. The bean-counting process was somewhat successful, but we still have several concerns, some weaknesses, an interim report in 3 years, and a new evaluation visit by the end of a six-year period.

Some fundamental curriculum modifications were carried out starting from the year 2003. One aspect of these modifications was to follow the example of several institutions in introducing engineering design and problem solving skills at the freshmen level[4-7]. Based on a course initially developed by Arizona State University, two introductory freshmen engineering design courses were introduced in 2003 and 2004 respectively. A focus group adapted and redesigned the course material to suit the College learning environment. Both courses adopted active/cooperative learning approach as an efficient way to address the requirements of ABET EC2000. The careful design of an active/ cooperative learning course ensures that students will acquire technical as well as non-technical or soft skills specified in the famous eleven 3a-3k outcomes. Felder *et al*[3] discuss the instructional paradigms of cooperative learning and problem-based learning and estimate that each of them has the potential to address all eleven Criterion 3 outcomes effectively.

Participation of the authors in preparing these two courses as well as some other active/cooperative learning courses[8-10] was a good introduction to EC 2000 preparations and its associated cultural boundaries.

Getting Started

Awareness of EC2000 requirements started in the college in 2004 as a result of a series of presentations carried out by a visiting professor from the University of West Florida. Following this visit, one of the authors, who was acting as the head of the ABET committee in a department holding one of 12 engineering programs, prepared a technical note on the critical issues in EC2000 preparations. The *technical note* initiated an encouraging atmosphere in that Department to start a series of workshops on ABET EC2000 requirements. The Department Chairman was enthusiastic to allocate a major part of the Department Council weekly meeting for ABET activities. Three successive presentations/workshops were organized during the month of October 2004 as follows:

- Introduction to ABET EC2000
- Levels of Learning (Bloom's Taxonomy)
- Course Design According to ABET EC2000

The third hands-on workshop resulted in the preparation of course learning objectives (CLO), the CLO-Program Outcomes Mapping Matrix, and finally the Articulation Matrix for the majority of mandatory core courses of the department. Some necessary templates, such as *Articulation Matrix* and *course mapping matrix,* were also prepared to assist faculty members and insure a unified format inside the department.

The idea behind this approach of starting the ABET process by course level activities was to involve each staff member in the process as early as possible. Course level activities are the heart of the process in which every one must participate and from which every one should benefit. Program activities, on the other hand, could be carried out by the ABET committee, although the participation of all members guarantees more efficient process. Once the staff members found themselves involved through course level activities, they became willing to participate in the required on-campus and off-campus program level activities.

In order to anticipate the expected resistance the idea was to start from what faculty members are actually doing. They were guided in the hands-on workshop to go through the following process to establish the required continuous improvement cycle:

1. Start from the course topics and define for each topic at least one Course Learning Outcome (CLO). CLOs are statements of observable student actions that serve as evidence of the knowledge, skills, and attitudes acquired in a course. They represent the answer to the following question: What do I want the students to do in order to demonstrate that they have mastered this topic by the completion of the course? Each CLO has to start by an action verb that indicates the required level of learning using Bloom's taxonomy[11].

2. Map each CLO with its level of learning into one or more of the ABET Program Outcomes (POs), i.e. the famous 3.a through 3.k of the EC2000, to form a simple mapping matrix.
3. Define instructional tools and in-class as well as off-class learning activities that will be carried by the students to reach the level of learning specified in each CLO.
4. Define the assessment tools that will be used to measure the extent to which the students will achieve those CLOs up to the specified level of learning as well as the acceptable passing criteria.
5. Display the above course design elements in a course articulation matrix as defined by McNeill and Bellamy[12].
6. Evaluate the results of the assessment tools and specify the corrective actions to be carried out for the next course offering if some of CLOs are not satisfactory.

ABET activities were enriched through the use of the website of the department as an efficient internal communication tool. The website also served as a stimulator for other programs inside the College of Engineering.

The lessons learned from the activities inside the above mentioned engineering department were the following:

1. Commitment of the department chairman is a key element.
2. The Program has to start the preparation process as early as possible. Two years of ***intensive*** work is a critical minimum, in addition to one year of engines warm-up and ground run.
3. Start by simple course level activities and postpone those requiring out of campus communications. This will help every staff member to get involved in the process.
4. Do not make presentations and ask the staff members to do the work at home. Nothing will be done!
5. Do not enlarge the size of the ABET Committee. Two devoted persons can do the job more efficiently.
6. Instead of PowerPoint Presentations, try to have hands-on workshop activities in which each member works on one of his courses. Face-to-face-interaction seems to be important. People care for their image in face of others!
7. Devote a large amount of time of the Department Council Meetings to ABET preparations. Start the meetings by ABET-related activities; then move to the normal agenda.
8. Resistance from staff members is normal and is expected if you try to run very fast in introducing the new concepts. Follow salami tactics: "If you cannot get the whole salami all at once, try to get it slice by slice."
9. Start from the present course calendar and course topics to define course learning objectives. Start from the present exams, quizzes, and homework to introduce outcome-related assessment methods.

Cultural Aspects: Lessons Learned

The word ‘culture’ is often used loosely in everyday language. Kroeber and Kluckhohn[13] compiled over 200 definitions of culture. Nevertheless Stephan Dahl[14] concludes, after a long study of several definitions, that "it is possible to describe culture as a shared set of basic assumptions and values, with resultant behavioral norms, attitudes and beliefs which manifest themselves in systems and institutions as well as behavioral patterns and non-behavioral items." This definition goes well with that of Hofstede[15] who defines culture as "the collective programming of the mind which distinguishes the member of one group or category of people from another."

In fact, the work of Hofstede is considered as the most famous and most often cited work in this area[14] although his model is criticized by some authors[16]. Hofstede derived his culture dimensions from examining work-related values in employees of IBM during the 1970s. In his original work, he divides culture into four dimensions at culture-level: power distance, individualism /collectivism, masculinity/femininity and uncertainty avoidance[15].

Jennifer Tylee[17] outlines Hofstede culture dimensions as follows:

1. Power-distance refers to the extent to which less powerful members expect and accept unequal power distribution within a culture. High power-distance cultures have a tendency towards centralized power with hierarchies in organizations and large differences in salaries and status between individuals. Subordinates in the organization are expected to do as they are told and teachers are viewed as possessing wisdom and are automatically held in high esteem.
2. Collectivism in a culture means that people are integrated from birth into a strong, cohesive group that provides protection. In exchange for the protection, the group expects loyalty. Individualism in a culture means that the ties to others are loose and that everyone is expected to look after themselves or their immediate family. Collectivist cultures value harmony more than truth, silence more than speaking, and there is a striving for the maintenance of 'face' where shame is used to achieve desired behaviors. In these collectivistic societies, the emphasis is placed on collective socio-economic interests over the interests of the individual. In the workplace, these cultures value training, skills and the intrinsic rewards of mastery as opposed to individualistic cultures that value freedom, personal time challenge and material rewards as motivators for work.
3. Masculinity and femininity and refers to the traditional assignment of gender roles and not physical characteristics, that is, the feminine roles of orientation to the home, children, people and tenderness and the masculine roles of assertiveness, competition, and toughness. In masculine cultures the traditional distinction between the roles are maintained while feminine cultures tend to collapse the distinctions. Femininity pertains to societies in which both men and women are supposed to be modest, tender, and concerned with the quality of life.
4. Cultures vary in their avoidance of uncertainty or unknown matters creating different rituals and having different approaches to formality, legal and religious requirements and tolerance for ambiguity. In cultures with high uncertainty avoidance, businesses have more formal rules and require longer career commitments. They expect structure in organizations, institutions and relationships to help make events interpretable and predictable. Teachers are expected to be the experts who know the answers and it is expected that the teachers will sometimes speak in a cryptic language that excludes beginners to a field.

In Hofstede model, cultures are ranked in each culture dimension from the highest to the lowest and assigned an index. The faculty members in our college are multinational, with a majority of over 90% belonging to one non-western culture and a limited number forming the other 10% belonging to 3, also non-western, cultural backgrounds; each one representing less than 5%. Consequently, we found ourselves in need of analyzing the corresponding cultural boundaries to enlighten our experience with ABET preparations in this particular cultural environment. Table 1 indicates Hofstede's ranks and indices of these cultures as compared to Germany and US[18].

Table 1: Ranking and indices of some cultures on Hofstede's culture dimensions

	Power Distance		**Individualim**		**Masculinity**		**Uncertainity Aviodance**	
	Rank	**Score**	**Rank**	**Score**	**Rank**	**Score**	**Rank**	**Score**
Culture #1*	7	80	26/27	38	23	53	27	68
Culture #2**	10/11	77	21	48	20/21	56	45	40
Culture #3**	32	55	47/48	14	25/26	50	24/25	70
Culture #4**	18/19	66	28	37	32/33	45	16/17	85
Germany	42/44	35	15	67	9/10	66	29	65
USA	38	40	1	91	15	62	43	46

*Main culture: over 90% of the faculty
** Other cultures: less than 5% each, summing up to 10% of the faculty

It is clear from Table 1 that the faculty members' community in the college, as compared to US and other western cultures has:

1. Higher power distance index
2. Lower individualism (i.e. higher collectivism) index
3. Lower masculinity index
4. Higher uncertainty avoidance index (except for culture #2)

It is interesting to notice that this model is in good agreement with the experience from the above mentioned engineering department whose faculty members evenly belong to a single culture; culture #1. The high power index (80 versus 40 for the US) is reflected in a tendency towards centralized power with hierarchies in organizations. This reflects the importance of the commitment of the chairman of the department as a key element in the success of the process.

The lower individualism index (38 versus 91 for the US) explains a striving for the maintenance of 'face'. In fact the ABET committee, unconsciously, used some sort of the fear of shame, to convince others to achieve the behavior that is desired!

The relatively lower masculinity index (53 versus 62 for the US) is translated into some modesty and tenderness. Every one wants to please others, remains ready to do some extra work without material compensation, and remains concerned by the quality of life.

The higher uncertainty index (68 versus 46 for the US and approximately the same as that of Germany) reflects the preference of formal rules that make interpretable and predictable. We noticed the interest of our staff members in having examples to follow, templates to fill in, and an algorithm, or a recipe, rather than a heuristic, or a rule of thumb, to use. In similar cultures risk-taking is avoided, changes need to be slow, and things should go step by step.

Institution-wide Preparations:

Official institution-wide preparation activities for EC2000 accreditation started in 2005 when an Academic Accreditation Unit (AAU) was formed under the presidency of the College Vice-dean. This hierarchical organization in which the unit reports directly to the Dean of the College of Engineering has proved to be very effective within the boundaries of the cultural environment of the college as it will be discussed later on. The unit held its first meeting in May 2005 and defined its mission as: "To *Qualify the Education System in the College of Engineering to Meet ABET EC 2000 Standards*."

The first task carried out by AAU was to define several college and departmental committees to address different aspects of ABET preparations. Nevertheless, the main work stream of the unit started one month later by a Technical Note that proposed a "*Rationale for an ABET EC2000 Road Map*"[19]. The Note outlined a Tentative Departmental Work Plan and led to a complete 2-year time schedule for both college level and program level preparations[20].

AAU started a set of college-wide presentations and workshops which were attended by a large number of college faculty members (more than 20% of the staff members attended each workshop, i.e. at least 3 faculty members from each engineering program) during the academic year 2005/2006 as shown in Table 2.

Table 2: Workshops prepared by AAU during the academic year 2005/2006

WORKSHOP	SUBJECT	DATE
AAU-WS-1	Introduction to ABET EC 2000 – a Road Map Proposal	Oct. 2005
AAU-WS-2	Course Design and Assessment	Dec., 2005
AAU-WS-3	Course Level Direct Assessment and Evaluation	April 2006
AAU-WS-4	HI-CLASS, a Handy Instrument for Course Level ASSessment	Nov. 2006

The material presented during these activities was made publicly available through the AAU website[21].

AAU also publishes a quarterly newsletter that covers AAU activities. Each newsletter addresses one main topic that usually goes online with the subjects discussed in the presentations and workshops.

The methodology adopted by AAU for ABET preparations also concentrated on starting by course level activities. After carrying out several visits to each program to make sure that the course design phase is carried out by each faculty member in his courses to an acceptable level, AAU started course assessment and evaluation phase. In order to enhance the process a programmed Excel workbook, called HI-CLASS (a Handy Instrument for Course Level ASSessment)[22] was made available to all faculty members accompanied by several hands-on workshops.

The idea behind HI-CLASS is that Direct assessment is the key element to demonstrate satisfying the requirements of ABET Engineering Criteria. Surveys and similar indirect measures could only provide secondary evidence and should be used in conjunction with direct measures of graded student performance. The grades obtained by the students in course quizzes, exams, reports, projects, presentations, etc., have to be converted to levels of achievement of Course Learning Objectives (CLOs). The mapping of these CLOs into Program Outcomes (POs) is used to obtain the degree of achievement of each student in the POs addressed by the course. This paper describes an EXCEL workbook developed to carry out this task. HI-CLASS is designed to be used by the course instructor on daily basis. In the beginning of the semester the instructor enters the main elements of the course design into a master sheet. The data and the results of each graded assessment are to be entered in a separate assessment work sheet that calculates the scores achieved by every student in each CLO and each PO addressed by the course, the class average, and the percentage of students exceeding specified passing criterion. Overall course results are calculated and displayed in tabular and graphical format. The instructor could easily evaluate the class achievement even after each assessment to continuously improve the course offering. By the end of the semester, the instructor will have documented results of the class achievement and the course contribution to the achievement of program outcomes.

Later on several course-level indirect assessment tools were added to HI-CLASS including:

1. Course evaluation survey
2. Course Learning Objectives Survey, and
3. Outcomes Survey for the program outcomes addressed by the course.

HI-CLASS is now being used by half of the 12 engineering programs. The remaining engineering programs are using 2 similar Excel worksheets that they have developed based on the same ideas.

The use of these worksheets facilitated preparing a course binder for each course. AAU imposed a unified format for these course binders and carried on periodic checking visits to every engineering program using a detailed checklist (see Fig. 1). As a result of this continuous monitoring, the college arrived to have course binders for more than 90% of the courses offered each semester.

Students' Cultural Boundaries

In several courses the results obtained from surveys, the first time they were applied, were somewhat questionable. This, in fact, makes reference to the work of Yopp and Brown[23]:

"As societies become increasingly pluralistic in nature and global in their outlook, questions have begun to arise concerning the fairness and equity of these measures of quality and competency assurance. A cultural boundary could be defined as any attribute of a culture that inherently limits the equivalency, and fairness, of tests or other forms of quality assurance. Such attributes may include social forms or behavioral and educational traits, or customs specific to a particular racial, ethnic, social, or religious group."

PROPOSED COURSES BINDERS CHECKLIST (ABET EC-2000)

[If an alternative format is utilized, at least the information identified in this checklist should be included in the courses binders. In all cases, however, a unified format should be used for all courses in one program]

(_____ Dept.) - (______ Semester) (Year 20___ /20___)	COURSES																																						
	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP
• Cover Page																																							
• Table of Contents																																							
DIVIDER 1: Course Design Data																																							
• Course Syllabus (ABET EC-2000 Format)																																							
• Course Calendar																																							
• Course Instructional Methods & Assessment Tools																																							
• Mapping of Course Learning Objectives into Program Outcomes with Performance Targets or Passing Criteria																																							
• Articulation Matrix or similar (at least: Learning activities & Assessment tools versus CLO)																																							
DIVIDER 2: Course Assessment Data																																							
• Indirect CLO Assessment Tools (Copies of prerequisite exam, Entry & Exit Surveys, Instructional Methods Surveys, etc, as applicable)																																							
• Results of Indirect CLO Assessment Tools																																							
• Direct CLO Assessment Tools (Copies question papers of Exams, HW, Project assignments, etc)																																							
• Results of the Direct CLO Assessment Tools																																							
• End of Semester Course Assessment and Improvement Report																																							
DIVIDER 3, 4, 5, etc: Supported Program Outcomes, one divider per Outcome																																							
• Instructional Methods used to address the outcome																																							
• Selected Lecture Materials addressing the outcome																																							
• Outcome Assessment Tools (Direct & Indirect)																																							
• Results of Outcome Assessment Tools																																							
• Outcome Assessment and Improvement Report																																							
• Students Work Samples (with attached outcome rubric)																																							

Ok: Complete and well formatted, IC: Incomplete, and NP: Not Present

Fig. 1: Course binder checklist

Several studies in recent years discussed the impact of cultural aspects on e-learning and distance education,[24] international students,[25] minorities in the American education,[26] and learning styles.[17] Tylee states that "much of the literature relating to adult learning styles has been written from a particular cultural perspective."[17] In that work it is also mentioned that Knowle's theory of adult learning[27] is based on assumptions related to the cultural perspectives of low power-distance, individualistic and low uncertainty avoidance culture. On the other hand learning of an adult from a culture that emphasises high power-distance and is collectivistic with high uncertainty avoidance, such as the one we are dealing with, is revolving around:

- relationships and the importance of social roles;
- a certainty about what is to come with links to the past and tradition, and
- an acceptance of group opinion.

It was noticed that in our classes instructors are viewed as possessing wisdom and are automatically held in high esteem, as it is expected in a high power distance culture. Surveys demonstrated tenderness in criticizing instructors. Instructors needed, before distributing a survey, to give a long explanation of the importance of fair opinions. In many cases, it was noticed that social relation with the instructor is a key element in forming students' opinions. This seems to be expected for social or contextual learners, where relationship that is established could be more important than the content that is delivered. In this case, it was concluded that opinion-based surveys should be avoided, should be replaced whenever possible by fact-finding questionnaires, and that the results of these surveys should be used with extreme caution as an indication of the general atmosphere.

Course level assessment in active/cooperative courses faced some problems related to peer-to-peer assessment tools. A grade of 5 out of 5 is given in many cases to each team member by each team member. Team members tend to cover each other and it is difficult to know who has done what. The only way to evaluate team working skills is to have on job assessment and observations through assigned in-class team tasks. Instructors also needed to struggle with the spirit of the acceptance of group opinion.

Difficulties associated with English language skills have also been reflected in the first surveys that were used. Surveys needed to be explained to the students, question by question. It was necessary to wait until the students answer a question before moving to the one after. This process, although very time-consuming, proved to be more reliable than using bilingual surveys.

Programs-level Evaluations

Program level evaluations include:

1. Direct and indirect assessment of program outcomes
2. Direct and indirect assessment of program objectives

Direct assessment of program outcomes is a continuation of course level direct assessment which was based upon HI-CLASS and similar approaches. The idea behind HI-CLASS is to convert the grades obtained by the students in course quizzes, exams, reports, projects, presentations, etc to levels of achievement of course learning objectives. The mapping of those Course Learning Objectives into Program Outcomes is used through HI-CLASS to obtain the degree of achievement of each student in the Program Outcomes addressed by the course and consequently evaluate the efficiency of the course in addressing these outcomes and take corrective actions if needed. A method is, then, required to use these course level measures of achievement to evaluate the students' achievement of all Program Outcomes. An Exposure Matrix approach proposed by one of the authors of the present work was successfully applied in his engineering department[28]. The approach is based on the idea that, simple averaging is not suitable. In fact, each course addresses only some of the program outcomes at certain levels of learning (i.e. learning height). Also, the students in different courses could be exposed lightly, moderately or extensively to the same program outcome (i.e., learning coverage). A weighed average of the achievement of program outcomes is then obtained using a combination of learning height and learning coverage in different courses. Learning height is quantified by a modified measure of Bloom's levels of learning while contact hours allocated to each program outcome is used to quantify the learning coverage**.**

The exposure matrix approach was adopted by several engineering programs in the college, particularly after inserting the weighing factor in the new versions of the HI-CLASS workbook. It is now being used as a quantitative method for direct evaluation of program outcomes.

Each Engineering program was asked to prepare a program binder by the end of each semester. AAU, once again, imposed a unified format for those program binders and carried on periodic checking visits to every engineering program using a detailed checklist (see Fig. 2).

PROPOSED PROGRAM BINDER CHECKLIST (ABET EC-2000)

[If an alternative format is utilized, at least the information identified in this checklist should be included in the program binder]

(_____ Dept.) - (_____ Semester) - (Year 20___ /20___)	OK	IC	NP
• Cover Page			
• Table of Contents			
DIVIDER 1: Program Data			
• Mission Statement and Program Educational Objectives			
• Program Constituencies			
• Process for Establishing & Maintaining Objectives			
• Mapping of Program Objectives into Program Outcomes and Mapping of Program Outcomes into ABET Outcomes			
• Mapping of Program Outcomes into Courses			
• Direct and Indirect Assessment Tools (Constituencies Surveys, Course Level Surveys, Course Level Direct Assessment & Industrial Advisory Board)			
DIVIDER 2: Assessment of Program Objectives			
• Assessment Tools for Program Objectives (Constituencies Survey Questions Pertaining to Program Objectives)			
• Results of the Assessment Tools of Program Objectives			
• Inputs from Industrial Advisory Board Related to Program Objectives			
• Annual Program Objectives Assessment and Improvement Report			

DIVIDERS 3, 4, 5, etc: Assessment of Program Outcomes (one Divider for each outcome)*

	a			b			c			d			e			f			g			h			i			j			k			l			m		
	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP	OK	IC	NP
• Outcome Definition (Elements, Attributes, Indicators, Performance Targets or Passing Criteria and Supporting Courses used to Assess the Outcome)																																							
• Results of Indirect Assessment Using Outcome Surveys in Supporting Courses																																							
• Results of Indirect Assessment Using Related Questions in Constituencies Surveys																																							
• Related Industrial Advisory Board Input, if any																																							
• Outcome Assessment and Improvement Report of each Supporting Course (*a copy taken from the outcome divider of the corresponding course Binder*)																																							
• End of Semester Program-wise Outcome Assessment and Improvement Report																																							

*A separate binder for each outcome could be made, if desired.

Ok: Complete and well formatted, IC: Incomplete, and NP: Not Present

Fig. 2: Program binder checklist

The program binder is assumed to include both direct and indirect assessment methods and results for program outcomes as well as program objectives. Indirect assessment is usually carried out using surveys of program constituencies. These included:

1. Students exit survey
2. Faculty member survey
3. Alumni survey
4. Employer survey

The first 2 surveys were successful for all engineering programs. On the other hand, several programs found it difficult to collect sufficient replies from alumni and employers. The corrective action was to rely on an alumni day, once a year, for each program to have several activities including:

1. Industrial Board Meeting
2. Collecting alumni surveys
3. Social alumni-students gathering
4. Updating alumni data base
5. Strengthening industry-academia link

On the other hand, summer training was used to collect replies for alumni and employer surveys. Since during summer training, a large number of students spend, with their supervisors, 2 months in the industry it is a suitable chance to raise the reply rate. The experience of the last summer was successful. Instead of a response rate of less of than 1% using postal letters and e-mails, AAU received about 60% of the distributed employers' surveys during the summer training. This also reflects the importance of taking cultural aspects into consideration. Once again, it is the maintenance of face, the fear of shame and the desire to please every one.

Corrective Actions

By the start of the academic year 2006/2007 AAU carried out an overall evaluation of the preparation activities in the college. The evaluation revealed the necessity of some corrective actions regarding:

1. Design of lab experiments (outcome 3.b)
2. Non-technical or soft skills (outcomes 3.d, 3.f, 3.g, 3.h, 3.i, and 3.j)
3. Courses administered by other colleges (particularly math, basic sciences, and humanities).
4. Displaying students course work as convincing evidences of achieving program outcomes.

AAU organized a one day hands-on workshop for the faculty members teaching lab related courses on how to introduce design elements in these courses. The workshop was centered on the 13 fundamental learning objectives of engineering laboratories formulated in the 3-day conference organized by ABET, with support from the Alfred P. Sloan Foundation in January 2002.[29] The workshop was concluded by a set of rubrics to evaluate design oriented students' lab work.[30]

AAU failed to sell the idea of students exit portfolio to the 12 engineering programs. The idea was to ask each student in one of the early courses to create a reflective portfolio subdivided according to ABET outcomes. The student will insert in each outcome divider reflected-upon artifacts, i.e. Drawings, designs, projects, presentations, or any other student work, that demonstrate mastering the corresponding outcome. The portfolio is kept by the student, updated by the student by inserting new artifacts and checked by the instructor in one of the mandatory courses at least once a year. The portfolio is finally checked and evaluated during the BS project before graduation. Although the idea is applied in several institutions including MIT,[31] University of Arkansas,[32] Rose-Hulman Institute of Technology,[33] Worcester Polytechnic Institute,[34] and Colorado School of Mines,[35] some engineering programs in the college resisted the idea because of the workload involved for both students and faculty members.

As a replacement strategy AAU proposed the key courses approach which is being now applied in several engineering programs of the college. In this approach Key courses for a given outcome are defined as those courses that the program identifies as the most likely to display evidence of student's work that can be used to assess that outcome. It is advised to have at least *2 key courses* for each of the 11 ABET outcomes a-k and that each core course should be nominated as a key course for at least *2 outcomes*; one of them is non technical. The course is considered as a *related* course for the remaining outcomes it addresses other than those for which it is considered as a key course

Key courses identified for a particular outcome are not by any means the only courses that contribute to developing the skills students need to master the outcome. Program enhancement requires that all opportunities for improvement be considered in both key courses and related courses. The idea of key courses is intended to minimize the faculty workload associated with the compilation and assessment of outcomes. It establishes an efficient process for collecting the convincing evidences required by ABET. It also solves the problem of courses taught outside the college (math, physics & humanities). These courses will be considered as *related courses*. A similar idea is applied in some universities such as West Virginia,[36] and Southern Illinois.[37] Fig 3 is an example from one of our engineering program of key and related courses.

KEY AND RELATED COURSES

Required Courses		Units	Program Outcomes											# Critical Outcomes
			a	b	c	d	e	f	g	h	i	j	k	
ELC 101E	English Language (1)	2							R					0
ELC 102E	English Language (2)	2							R					0
ARAB 101	Arabic Literature (1)	3							R					0
ARAB 201	Arabic Literature (2)	3							R					0
ISLS 101	Islamic Culture (1)	2						R						0
ISLS 201	Islamic Culture (2)	2						R						0
ISLS 301	Islamic Culture (3)	2						R						0
ISLS 401	Islamic Culture (4)	2						R						0
MATH 101E	Gen. Mathematics (1)	4	R											0
MATH 102E	Gen. Mathematics (1)	4	R											0
MATH 203E	Calculus and Vectors	4	R											0
MATH 204E	Differential Equations	3	R											0
EE 300	Analytical Methods (I)	3	R				R							0
EE 332	Computation Methods	3	R				R							0
IE 331	Probability and Statistics	3	R				R							0
PHYS 101E	Physics (1)	4	R	R										0
PHYS 102E	Physics (2)	4	R	R										0
CHE 101E	Chemistry (1)	4	R	R										0
MENG 102	Engineering Graphics	3	R										R	0
CE 201	Statics	3	R				R							0
MENG 262	Dynamics	3	R				R							0
MENG 130	Basic Workshop	2		R										0
IE 201	Introduction to Engineering Design (I)	3			R	R		R	R		R			0
IE 202	Introduction to Engineering Design (2)	2			R	R	R	R	R		R		R	0
EE 201	Structured Computer Programming	3	R										R	0
EE 255	Basic Electrical Engineering	4	R	R										0
IE 255	Engineering Economy	3								R				0
MEP 261	Thermodynamics (I)	4	R				R							0
MEP 290	Fluid Mechanics	4	R	R			R							0
MENG 204	Computer Aided Graphics	3	R										R	0
MENG 270	Mech. of Materials	4	R	R										0
MENG 310	Machine Elements Design	3	R		R		R							0
MENG 410	Mechanical Systems Design	3	R		R	R	R		R					0
AE 301	Fundamentals of Flight	3	K				R		R		K			2
AE 311	Low Speed Aerodynamics	3	R		R		K		R			K	R	2
AE 331	Aircraft Structures (1)	3	R				K			K				2
AE 361	Aircraft Performance	3	K		R		R		R		K			2
AE 371	Aircraft Engines	3	R				K	K				R	R	2
AE 412	Compressible Aerodynamics	3	R		R		K		R	R	K	R		2
AE 414	Aerodynamics Lab.	2	R	K	R	R	R						K	2
AE 432	Aircraft Structures (2)	3	K		R		R					K	R	2
AE 433	Flight Vehicle Materials	3	R	K	R	R	R		R			K		2
AE 434	Structures Lab.	2	R	K	R	K	R			R		R		2
AE 435	Aircraft Design	3	R		K	K		R	K	R		R		3
AE 436	Aircraft Structural Design	3	R		K	R	R	R	K				K	3
AE 462	Aircraft Stability & Control	4	R	R	R		R	K		K	R		R	2
AE 472	Aircraft Propulsion	4	R	R	K	R	R	R					K	2
AE 390	Summer Training	2				R		K	K				R	2
AE 499	Senior Project	4	R		K	K	R	R	K	K	K	R	R	5
AE -------	Technical Elective	3	R				R						R	0
---------	Social Elective	3								R		R		0
TOTAL / # Key Courses		155	3	3	4	3	4	3	4	3	4	3	3	

Fig. 3: An example of key and related courses from an engineering program

Final Quality Auditing

As the date of the ABET visit approached, it was necessary to carry out a final quality auditing. A college-wide committee was formed to revise, support, and help different programs to achieve ABET requirements. The committee was divided into 3-member subcommittees; each headed by one of the college top management to assume the responsibilities of the follow-up of two engineering programs. No member of any committee belongs to the program he is assumed to evaluate. The sub-committees conducted weekly visits to their allocated programs using detailed checklists to evaluate the degree of achievement in each of the following 16 evaluation items:

1. Self study report
2. Course binders
3. Program binders
4. Organizational structure
5. Updated college bulletin
6. Updated program bulletin
7. Published mission statement
8. Published program educational objectives
9. Program outcomes documentations
10. Meetings minutes
11. BS projects
12. Laboratories
13. Classrooms and faculty offices
14. Students activities
15. Department official website
16. Faculty data and web pages

The progress is presented biweekly to the College Council meeting and a copy is sent to the president of the university who follows, step by step, and fully supports the college preparations for the visit. The success of this quality auditing process is, once again, fully compatible with high power distance and high uncertainty avoidance cultures.

Conclusions and Recommendations

The case study of a non-western institution preparing for ABET EC2000 accreditation is discussed. The study demonstrated that some tools normally used to demonstrate satisfying ABET requirements, such as surveys and questionnaires, could be culturally biased and should be carefully prepared and administered. The preparation process itself, which requires the participation of all faculty members, administrators, and students, also depends on the cultural environment. Good understanding of this environment is necessary to insure a smooth and successful preparation process. In this aspect Hofstede's cultural model seems to be efficient to interpret and guide the process. The model indicated that the considered case study represents a higher power distance, higher collectivism, lower masculinity, and higher uncertainty avoidance culture as compared to the US and other western countries which are known to represent a lower power distance, higher individualism, higher masculinity, and lower uncertainty avoidance index. The linguistic dimension should be added to this model to characterize the cultural environment. This dimension may affect the extent to which students, as well as some limited number of faculty members, understand and follow the process. The present study demonstrates the importance of taking cultural and linguistic aspects into consideration in dealing with ABET preparations and other quality assurance systems. The results could also be generalized for the education process itself which remains culturally-dependent. Cultural perspectives of several adult learning theories needs to be analyzed and their inherent assumptions need to be examined before adopting them in non-western environment.

Bibliography

1. "Criteria for Accrediting Engineering Programs, Effective for Evaluations During the 2007-2008 Accreditation Cycle," Engineering Accreditation Commission, Accreditation Board for Engineering and Technology, Inc., http://www.abet.org, [Last Accessed 2008-1-12].
2. Lohmann, J.R., "EC 2000: The Georgia Tech Experience," *J. Engr. Education, 88*(3), 305–310, 1999.
3. Felder, R.M., and R. Brent, "Designing and Teaching Courses to Satisfy the ABET Engineering Criteria," Journal of Engineering Education, 92 (1), 7-25, 2003. Available on-line at: http://www.ncsu.edu/felder-public/papers [Last Accessed 2008-1-12].
4. Nikos, J. Mourtos and Burford, J. Furman, Assessing the Effectiveness of an Introductory Engineering Course for Freshmen, *Proc. 32nd ASEE/IEEE Frontiers in Education Conference*. Boston, USA (2002).
5. Tonkay, G., Sause, R., Martin-Vega, L., and Stenger, H., Integrating Design into Freshman Engineering: A Lehigh Experience, *Proc. ASEE/IEEE Frontiers in Education Conference*. Pittsburgh, PA, USA (1997).
6. Sheppard, S. and Jenison, R., Thoughts on Freshman Engineering Design Experiences. *Proc. Frontiers in Education Conference,* Salt Lake City, Utah, USA (1996)
7. Christopher J.R. and Anita M.J., Module-Based Freshman Engineering Course Development, *Proc. American Society for Engineering Education Annual Conference* (2004).
8. Olwi, I., "An Active Learning Fluid Mechanics Course Based on Outcomes Assessment," Accepted for presentation in the 2006 American Society for Engineering Education Annual Conference & Exposition, 2006.
9. Al-Bahi, A.M., "Development of a Design Phase Checklist for Outcome Based Active/Cooperative Learning Courses," 2006 Annual Conference & Exhibition of the American Society of Engineering Education, June 2006.
10. Al-Bahi, A.M., Zahed, A., Bafail, A., and Abdel Aal, R., "Triangulation in Course Assessment Applied in a Freshman Modelling Course," 10th UICEE Annual Conf. on Eng. Education, Bangkok, Thailand, March, 2007.
11. Bloom, B.S., Englehart, M.D., Furst, E.J., Hill, W.H. and Krathwohl, D.R., *Taxonomy of Educational Objectives: Handbook 1: Cognitive Domain,* Longman, New York 1956 & 1984.
12. McNeill, Barry W., and Bellamy, Lynn, *Introduction to Engineering Design; the Workbook*, 6th Edition, McGraw-Hill, Inc., 1998.
13. Kroeber, A.L. and Kluckhohn, C. Culture: A Critical Review of Concepts and Definitions. Harvard University Peabody Museum of American Archeology and Ethnology, Volume 47, 1952.
14. Stephan Dahl, "Intercultural Research: The Current State of Knowledge," Middlesex university, Business school of London, http://www.mubs.mdx.ac.uk/Research/Discussion_Papers/Marketing/dpap marketing no26.pdf, [Last Accessed 2008-1-12].
15. Hofstede, G., Cultures and Organizations: Software of the Mind, Intercultural Cooperation and its Importance for Survival, McGraw-Hill, New York, NY, 1997.
16. http://www.clearlycultural.com/geert-hofstede-cultural-dimensions, [Last Accessed 2008-1-12].
17. Jennifer Tylee, "Cultural issues and the online environment," www.csu.edu.au/division/landt/resources/documents/cultural_issues.pdf , [Last Accessed 2008-1-12].
18. Vatrapu, R. , "Culture and International Usability Testing: The Effects of Culture in Interviews," MS thesis in Computer Science and Applications, August 06, 2002, Blacksburg VA, Department of Computer Science Virginia Tech, Blacksburg, VA 24061, scholar.lib.vt.edu/theses/available/etd-09132002-083026/unrestricted/Vatrapu_Thesis.pdf, [Last Accessed 2008-1-12].

19. Al-Bahi, A.M., "Rationale for an ABET EC2000 Road Map," http://engg.kau.edu.sa/~albahi/Rationale_ABET_Paper_June7_2005.pdf, [Last Accessed 2008-1-12].
20. http://engg.kau.edu.sa/~albahi/Time Plan_AAU.pdf, [Last Accessed 2008-1-12].
21. http://engg.kau.edu.sa/aau, [Last Accessed 2008-1-12].
22. Al-Bahi, A.M., "HI-CLASS – a Handy Instrument for Course Level Assessment," ICEET- 2 Int. Conf. on Eng. Education and Training, Kuwait, April, 2007.
23. Yopp, J.H. and Brown, C.R., "Reducing Cultural Boundaries: Initiatives in Quality Assurance, Curricular Reform and Test Adaptation," International conference on engineering education, ICEE 2000, Taipei, Taiwan, August 2000. www.ineer.org/Events/ICEE2000/Proceedings/papers/WA6-3.pdf , [Last Accessed 2008-1-12].
24. Bates, T., "Cultural and ethical issues in international distance education," Presented in Engaging Partnerships Collaboration and Partnership in Distance Education, UBC/CREAD conference, Vancouver, Canada, September, 1999. http://bates.cstudies.ubc.ca/pdf/CREAD.pdf, [Last Accessed 2008-1-12].
25. Dalglish, C. and Chan**, A., "**Expectations and Reality – International Student Reflections on Studying in Australia." Proceedings, Australian Int. Education Conf., Gold Coast, Australia, 2005. http://eprints.qut.edu.au/archive/00002337/01/2337_1.pdf, [Last Accessed 2008-1-12].
26. Nerenberg, R., "Challenges and Opportunities in Working with Minority/Overseas REU Students," 2006 Annual Conference & Exhibition of the American Society of Engineering Education, June 2006.
27. Knowles, M.S 1970, The modern practice of adult education: Andragogy vs. pedagogy. Association press, New York,1970
28. Al-Bahi, A.M., "Exposure Matrix - an Approach to Evaluate Program Outcomes Using Course Level Direct Assessment," ICEET- 2 Int. Conf. on Eng. Education and Training, Kuwait, April, 2007.
29. Feisel, L.D. and Peterson, G.D., "A Colloquy on Learning Objectives for Engineering Education Laboratories," Proceedings of the 2002 ASEE Annual Conference & Exhibition, Montreal, Quebec, Canada, 2002.
30. Al-Bahi, A.M., "Designing Undergraduate Engineering Lab Experience to Satisfy ABET EC2000 Requirements," Accepted for presentation in the 2008 Annual Conference & Exhibition of the American Society of Engineering Education, June 2008.
31. Brodeur, D.R., "Using Portfolios for Exit Assessment in Engineering Programs," 32nd ASEE/IEEE Frontiers in Education Conference, November 6 - 9, 2002, Boston, MA downloaded from http://www.fie.engrng.pitt.edu/fie2002/papers/1366.pdf, [Last Accessed 2008-1-12].
32. García, C.E. and Clausen, E.C. , "Student Portfolios - Assessing Criteria 2000," Proceedings of the 2000 American Society for Engineering Education, Albuquerque, NM, June 2000, downloaded from: http://www.rowan.edu/colleges/engineering/clinics/asee/papers/2000/garcia01.pdf., [Last Accessed 2008-1-12].
33. Williams, J.M., "The Engineering Portfolio: Communication, Reflection, and Student Learning Outcomes Assessment," Int. J. Eng. Ed. Vol. 18, No. 2, pp. 199-207, 2002.
34. Heinricher, A. C., Miller, J. E., Schachterle, L., Kildahl, N. K., Bluemel, V., and Crawford, V. "Undergraduate Learning Portfolios for Institutional Assessment", Journal of Engineering Education, vol. 91, no. 2, April 2000, 249-253.
35. Olds, B. M. "The Use of Portfolios for Outcomes Assessment," Frontiers in Education Conference, Pittsburgh, PA, 1997.
36. Barbero, E.J., Banta, L.E., Prucz, J.C., and Stanley, C.F., "Outcome Portfolios as an Assessment Tool for ABET EC-2000," Proceedings of the 2004 ASEE Annual Conference & Exposition, Salt Lake City, UT, June 2004
37. Morgan, S.M., Bradford Cross, W., Rossow, M.P., "Innovative outcome portfolios for ABET Assessment", Proceedings of the 2000 ASEE Annual Conference & Exposition, Albuquerque, NM, June 2000.