ASSESSMENT AND CURRICULUM MODIFICATION IN ELECTRONICS ENGINEERING TECHNOLOGY PROGRAM

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Abstract: The Electronics Engineering Technology at Texas Southern University has been actively involved with course embedded assessment techniques for more than nine years. The assessment project has spanned the engineering technologies programs, the organizational leadership and supervision programs. During the past nine years, the faculty members have learned much about structuring course-embedded assessments and using those assessments for continuous improvement in support of the program educational objective and ABET outcomes. This paper will outline the basic premises and methods of our assessments techniques.

In this paper, we present that how assessment data were obtained and analyzed. We also demonstrate that how the obtained feedbacks from analyzed data were utilized to enhance or modify either course or program's educational objectives and outcomes.

Key words: Assessment, Curriculum, Course-embedded, Continuous Improvement.

Introduction:

The Technology Accreditation Commission (TAC) of Accreditation Board for Engineering and Technology (ABET) developed a set of criteria for accrediting for TAC/ABET degree program called TAC2K. This procedure requires the faculty members of the accredited program to be heavily involved in the assessment and the continuous improvement of the program. The new criteria mandate a "closing the Loop" process to establish a continuous assessment and improvement of the program. To accomplish the aforementioned process, Criteria 2 (Educational Objectives) and 3 (Programs Outcomes) of the eight (8) TAC/ABET are required to be fulfilled [1].
Programs must also assess student performance as part of their accreditation process. The assessment process includes collecting and analyzing the data to support a conclusion. It is essential to demonstrate objectives and outcomes for the program are being measured and accomplished. Programs often struggle with deciding what data to collect and ensuring the data is measurable [2].

The ELET program has been in continuous accreditation since 1996. For the first time in 2008, the ELET program was accredited under the new TC2k criteria by TAC/ABET. In the last visit of 2007 by the TAC/ABET, the response was to accredit the programs to September 30, 2010, and require that a request be made to TAC/ABET by January 31, 2009 for a re-accreditation report evaluation. The report describing the actions taken to correct the shortcomings identified needed to be submitted to TAC/ABET by July 1, 2009. One of the program weaknesses reported by the TAC/ABET was Criterion 3 (Assessment and Evaluation) which states “Each program must utilize multiple assessment measures in a process that provides documented results to demonstrate that the result of the assessment of program objectives are being used to improve and further develop the program in accordance with a documented process” [3]. According to the TAC/ABET visiting team, a continuous improvement plan has been written but has not been fully implemented. The response to this assessment was to benchmark other institutions [4] and then revisit the program goals and educational objectives re-linking them to the a-k outcomes. Furthermore, the process of the closing loop for the continuous improvement was emphasized [5]. The newly modified assessment process was utilized starting academic year 2008-2009. As requested, a re-accreditation report was submitted to the TAC/ABET in July 1, 2009 outlining the corrective measures taken for the identified shortcomings. After implementing the assessment instrument along with the feedback received from different constituencies, two new courses were developed [6].

Assessment Report:

Assessment and evaluation are performed at the course and program level. Course level assessment seeks to ascertain the extent to which individual courses succeed in achieving instructional objectives which contribute to educational objectives and program outcomes; program level assessment evaluates the effectiveness of degree programs in achieving educational objectives and program outcomes, and career level assessment is aimed at evaluating the professional success of graduates, as well as their ability to function effectively in the real world. These are all related to the program assessment.

As part of an academic institution, a department will have many stakeholders, or constituents. Our department lists its stakeholders for our undergraduate students as follows:

- Current and prospective undergraduate students
- Faculty of the department
- Faculty of the related to program such as mathematics, physics, and etc
- Former students
- Employers of graduates
- Departmental industry advisory board

Table 1 presents a list of various mechanisms used in our assessment and evaluation, their frequency of use and key participants. The process of assessment, evaluation and continuous improvement employed by the ELET program is demonstrated by the flow diagram presented In Figure 1. The diagram shows that a committee of program faculty serves as a clearing-house for any and all changes submitted for consideration. The source of these changes can come from any one or more of the tools employed in the assessment process, such as Industry Advisory Board (IAB) meetings, Graduate (Alumni) survey, Employer survey, Graduating senior survey, Lecture survey, Laboratory survey, Faculty survey, and the result of outcomes a-k. Once the change has been agreed upon the present process makes no attempt to link the change to any one of the assessment tools. A summarized list of the assessment and evaluation feedbacks is as follows:

Course-Level Assessment:
Mechanisms used in course-level assessment include the course, lecture, laboratory, exit surveys, senior seminar, comprehensive (exit) examination, performance evaluation, and the curriculum committee.

- Lecture Survey
- Laboratory Survey
- Faculty Survey
- Exit Survey and current trends.
- Comprehensive Exit Examination
- Results of the outcomes A-K
- Curriculum Committee

Program-Level Assessment:
In addition to the mechanisms discussed above, alumni surveys, employer surveys and advisory board reviews are conducted as indicated on Table1, for assessment and evaluation at the program level.

Alumni Survey: A survey of recent graduates is conducted annually to ascertain the personal satisfaction of alumni with their academic experience as students in the department, as well as their perceived professional success in their current employment.

Employer Survey: Like the alumni survey, the employer survey is conducted annually.

Objectives/Outcomes Survey: Every three (3) years, our constituencies (IAB, Faculty, and Students) will participate to complete the educational program objectives and outcomes assessment questionnaire to measure the currency and effectiveness of the current ELET educational objective and outcomes.

Advisory Board: The department maintains an advisory board, comprising members from business, industry and the public sector, for each program area. This board meets periodically to review the academic programs and supporting facilities and resources.

Course-Embedded Assessment:
The faculty member developed the Course Assessment Report (CAR) that would be supported by the coursework completed by students in the Electronics Engineering Technology (ELET) program.
The faculty members are required to analyze and evaluate the students' work and report them to the ELET curriculum committee each semester. In the academic year of 2011-2012, outcomes a-k of each course in ELET curriculum was reported and according to the course assessment report, we have not only met the minimum expectation (70%) but also we have exceeded in some instances more than 17%.

The average outcome measured for entire courses in the ELET curriculum was 79% for academic year of 2011-2012. Any subject with outcome less than 70% considers being weakness and improvement plan was required. The only course that did not meet the minimum outcome requirement was ELET 243 – Digital Hardware Design. Students in this course scored 61% for the outcome D. An improvement plan was developed to address this weakness.

New Course Addition:
The assessment committee in the department of Engineering Technology at the Texas Southern University has presented detailed performance criteria that can be used to assess TAC recommended program outcomes. Based on the analyzed assessment results and feedback from different constituencies, these changes were implemented in the Electronics Engineering technology program; two digital courses were combined and the content of this newly formed course was revamped to focus more in design aspect of the course. This action will address the weakness observed in the outcome D of the course which is related to design and application. Furthermore, two new courses were developed which are "Introduction Project Management" and "Ethics and Engineering Professionalism". These courses have been approved by the different committee within the University as well as the Texas Higher Coordinating Board. Currently, we have included these newly developed courses into both Computer and Electronics Engineering Technology programs. The covered materials in these courses are as follows:

Introduction to Project Management: The course aims at enhancing project team leadership skills, defining the work environment of project teams, and the roles and responsibilities of all project team members including the setting of team guidelines, learning methods to promote teamwork, understanding the stages of development, and managing team dynamics. Additional skills covered: delegation, managing accountability without direct authority over project team members, managing dysfunctional teams, performance improvement, input to performance appraisals, rewards, recognitions, celebrations.

Additionally, students learn techniques for deciding whether to undertake a project and for planning project outcomes and schedules. The relationship of projects to organizational planning and budgeting, information and performance appraisals systems is discussed. Approaches are shared for identifying and classifying project stakeholders and designing and conducting a cost benefit analysis. How to define desired project outcomes clearly and completely and how to determine project work to be performed using decomposition and templates are all addressed. Moreover, students learn how to develop a project charter, a scope statement, a Work Breakdown Structure, a WBS dictionary and a Linear Responsibility Chart. How to create a network diagram and analyze schedule possibilities using the Critical Path Method (CPM) and the Program Evaluation and Review Technique (PERT) are explained.

Another aspect of the course is that students are able to learn how to estimate the needs for personnel and other types of projects resources; and to develop a project budget, and to plan for additional project support activities. Emphasis is placed on the determining of the type, amount and timing of resource needs. Approaches to resource leveling are discussed, and the different types of project costs are explained including the use of analogous estimating, parametric modeling, and bottom-up estimating and computerized cost estimation tools.

Ethics in Professional Engineering Practice: This course develops students' knowledge of: the nature of engineering ethics (legal, professional, historical, and personal definitions of "engineering ethics"); the value of engineering ethics (varied contemporary and historical legal, professional, and personal reasons why an engineer should be ethical); and the resolution of ethical dilemmas (using common ethical dilemmas, identify possible actions to be taken in response, and probable consequences of those actions). Topics covered in this course are as follows:

- Professional and Personal Codes of Ethics
- State and International Licensing Laws
- Business Ethics
- Risk Assessment
- Development of the Profession of Engineering
- Engineering Disasters
- Whistleblowing
- Professional Relations
- Engineering and the Law
- Moral Reasoning
- Ethical Case Studies

Contribution of course to meeting the professional component: This course focuses on the ethics of engineering practice and in doing so students are encouraged and expected to consider the effects of their actions (and non-actions) -- including the economic, environmental, political, societal, health, and safety, consequences of their work -- while also keeping in mind the manufacturability and sustainability of their structures and products.

Relationship of course to undergraduate degree program objectives: This course focuses on helping students to understand the nature and value of "professional and ethical responsibility." In order to develop this understanding, students must be able to communicate their ideas effectively to others (in both written and oral form), they must explore the "effect of technological solutions in a global and societal context," and they must become familiar with "contemporary issues" both within and beyond the profession of engineering. In addition, by making students aware of the ever-changing nature of engineering ethics, this course presents students with an example of the need for lifelong learning.

Conclusion:

A comprehensive assessment program contains assessment methods using a multi-source approach with regards to the stakeholder groups to maximize validity and reduce bias of any one approach. This paper provides guidance on the assessment process developed and implemented by the Electronics Engineering Technology program at Texas Southern University to ensure compliance with TAC/ABET Criterion 3. The assessment instrument utilized to measure and evaluate the program outcome is sufficiently unobtrusive without scarifying normal educational process. Also, the additional information necessary is the evaluation of the courses where students are not achieving the minimum standard specified for the course outcomes, and reflection on how to implement the corrective action in accordance with the laid-down improvement plan. The result of the utilized instrument also led to development or modification of several courses. Furthermore, the enhancement of the curriculum is expected to have significant impact on overall education and infrastructure development by the addition of aforementioned courses.

REFERENCES

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Table 1. Mechanisms for Assessment and Evaluation

Mechanism	**Periodic**	**Participant**
Lecture survey	Semester	students
Laboratory survey	Semester	students
Faculty survey	Annual	faculty
Exit survey	Semester	graduating seniors
Graduate (Alumni) survey	Annual	graduate employees
Employer survey	Annual	employers of graduates
Objectives/outcomes survey	Every three years	All
Senior Design (Capstone Course)	Semester	senior students enrolled
Comprehensive examination	Semester	graduating seniors
Curriculum committee	twice per semester	faculty
Industrial Advisory board	annual, plus on call	industry/business reps

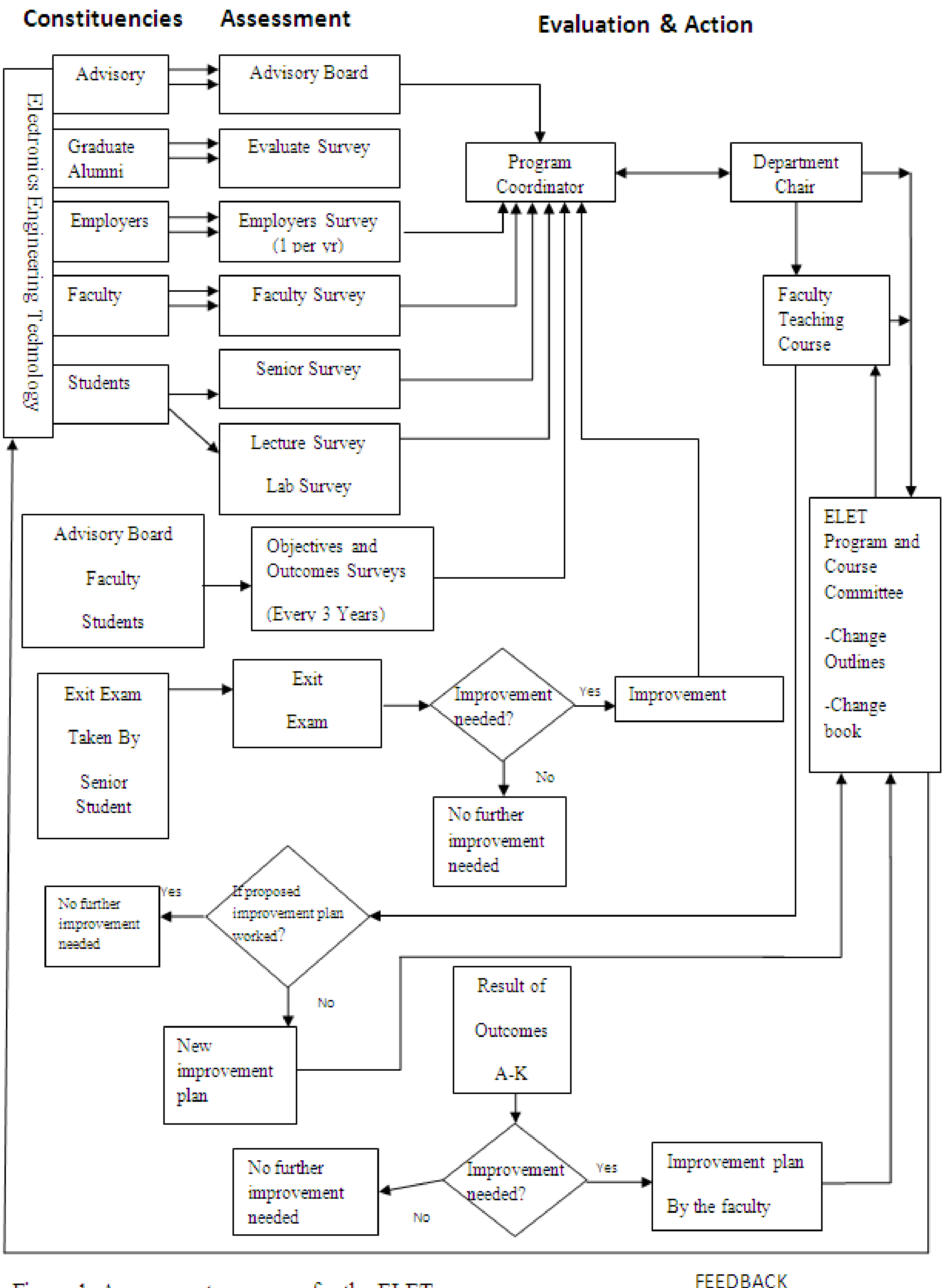

Figure 1. Assessment processes for the ELET program