A Computer-Based Interactive Package for ABET Self-Study

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Abstract

In preparation for an accreditation visit in 2002, the faculty of Biological and Agricultural Engineering at the University of Arkansas assembled an interactive package designed to provide easy access to the needed information. The Self-Study document, including our educational objectives, assessment plans for program outcomes, copies of all course syllabi, examples of student work, and examples of our feedback loops in action have been organized on a computer CD. Each electronic document has links to all the other pertinent documents on the CD. The packaging is intended to increase the efficiency and accuracy of the accreditation review.

Introduction

Accreditation is a process of peer review through which we (society, the engineering profession, the university) give assurance to our students and their families that we provide a high quality educational program for engineering students. In the USA, the Accreditation Board for Engineering and Technology (ABET) developed "Criteria 2000", its most recent set of accreditation protocols (ABET, 2001a). Through Criteria 2000, institutions have the opportunity to apply innovative and creative ideas to insure that their engineering programs are not only outstanding, but will continuously improve.

In 1996, the College of Engineering at the University of Arkansas was one of the first units to be reviewed under the new system during the pilot phase. In studying the new criteria, it was clear that things had changed dramatically. Under the old protocols, program administrators and faculty simply presented evidence that students in their program had been exposed to appropriate and sufficient inputs. The new criteria, however, asked that we demonstrate that these inputs resulted in appropriate outputs from the students. In addition, they asked that we present our plans for continuing to evaluate and improve our program. In response, the faculty of the Biological and Agricultural Engineering Department embraced the concept of a Continuous Quality Improvement (CQI) program and wrote our "Volume 2000" (a planning document required by ABET) accordingly.

While the new process provides more opportunities for innovations, and has led to more enthusiastic participation on the part of our faculty, the need for documenting a wide variety of activities has been challenging. Thus, we have focused not only on improvements to our program, but also on improvements in our CQI plan, and in methods

of documentation. The plan was intended to function like a classical feedback control system, and there are multiple feedback loops to be documented.

In the process of designing and refining the biological engineering program at the University of Arkansas, the faculty developed several methods to summarize and document the integrated program and the CQI plan we envisioned. The system then facilitated implementation of changes suggested by various constituencies. The usefulness of these tools provided motivation to further develop an integrated electronic documentation package that would meet self-study requirements of ABET. Our goal was to collect all materials needed for the ABET Self-Study Report in electronic format, copy onto a computer CD and cross-link these materials in a way which facilitates their review. We also plan to provide detailed course documentation and evidence of student achievement in a similar format for the visiting ABET team. This paper focuses on the Self-Study package.

Description of the Package

The required content (ABET, 2001b) of a Self-Study report is summarized in the upper part of Figure 1. Sections B.2 to B.4 focus on the specialized program design and detail the processes used by the faculty in defining the program objectives and in developing and maintaining a curriculum to meet those objectives. It is in documenting these three sections that we have developed special interactive techniques to present the detail of the program. The Self-Study package we designed includes a suite of documents with extensive cross-linking and includes optional components that we developed to facilitate the review. The main document provides a point of entry for the reviewer, and includes the structure for what is essentially an electronic table of contents (see Figure 1), with links to each of 12 sub-documents. Table 1 shows a list of the included sub-documents and their interconnectedness.

The Program Educational Objectives (EO) sub-document lists the current program educational objectives and describes their relevance to the mission of the institution and the accreditation criteria. The process used to establish and review the objectives are stated and links are provided to lists of stakeholders and other constituencies, as well as to minutes from the relevant meetings at which these were discussed. Major steps in the evolution of the objectives are detailed in the "Closing-the-Loop" sub-document (described below) for which a link is provided. Evidence that the objectives are being met is provided by a link to the "Program Achievements" sub-document (described below).

The Program Outcomes and Assessment (PO) sub-document lists the current program outcomes (required by Criteria 3, ABET, 2001a) and outlines how these relate to program educational objectives. Our list of outcomes map exactly to those suggested by ABET (e.g., the so-called "a-k", ABET, 2001a) because not only were we satisfied with this set of outcomes, but we also felt the uniformity would facilitate review by ABET (reviewer's evaluation forms explicitly show the a-k outcomes, ABET, 2001c). For each outcome,

there is a link which provides an accounting of how each course in the curriculum is intended to help effect the result. Also detailed is the process design for CQI along with appropriate links to show the actual process of development, review and action taken to make improvement. Links to previous versions of the plan are also provided. The structure of the sub-document and its linkage to other relevant information is illustrated in Figure 2.

The Professional Component (PC) sub-document details that part of the program as required in Criteria 4 (i.e., describing how students are prepared for engineering practice through the curriculum, mentioning major design experience incorporating engineering standards and realistic constraints, etc., ABET, 2001a). The structure and links in this are similar to the PO sub-document.

The Curriculum Matrix (CM) sub-document is a supplemental informational item that we developed to itemize the intended contribution of each course in the curriculum to the overall achievement of each of the a-k outcomes (Criteria 3) and the professional components (Criteria 4). The matrix is a large table (Figure 3) with a column for each course in the curriculum and a row for each outcome. The main entries in the table are keywords that we defined to indicate the level or depth at which each course addresses the particular outcome. The keywords include 'Introduction', 'Bridging', 'Development', 'Comprehensive', 'Practice' and 'Capstone Experience' to represent a spectrum of experiences from initial exposure through terminal professional practice. Also included are detailed entries (inserted as 'comments', described in the Electronic Tools section below) which give specific examples of how the course contributes. These comments are mapped from the course syllabi, in which our standard format includes a section that explicitly addresses the course contribution to meeting each ABET outcome. The matrix includes many links, most notably to the PO and PC sub-documents, and provides a launching point from which a reviewer can study either: (a) how a particular course contributes to the overall program, or (b) how the integrated curriculum covers a specific ABET outcome. The faculty found this matrix very useful in the process of visualizing, designing and improving the integrated curriculum.

The Closing-the-Loop (CL) sub-document presents a tabular record of the on-going assessment activities and their resulting action for improvement of the program. A sample from this table is shown in Figure 4. Links are provided to facilitate reviewing the constituencies involved in the assessment and to view the minutes from the meeting in which the assessment occurred. The EO and PO sub-documents link to Closing-the-Loop to show how the CQI processes that we designed have actually been implemented.

The Program Achievements (PA) sub-document presents a sampling of the types of student work and other evidence of program achievement that will be available to the visitor at the time of the campus visit. It is arranged in tabular format with columns representing each course and rows representing each objective or outcome. Table entries show links to examples of student work (homework, design problems, projects, presentations, reports, etc.) that are contained in word processing, spreadsheet, graphics and other file formats. This arrangement allows the reviewer to move quickly to the item

of interest, as prompted by a study of either the achievements of a particular course or the attainment of a particular objective or outcome.

Tools for Electronic Access

The main difference between this suite of linked documents and a conventionally-formatted report is the links. With a conventional report, the material is presented linearly from start to finish. A table of contents or perhaps an index would provide the reviewer with a guide to manually move through the material to get to a desired item of information. Using cross-linked documents, we have been able to provide quick paths for the reviewer to move logically from one path of study, to check on a related detail, and then return to the original path of study. This is accomplished by first defining bookmarks within each sub-document that mark the major sections. Wherever we anticipate that the reviewer may want to view that content from another location, a link (also called a 'hyper-link') is added to connect to that book-marked location. After viewing the information at the link, the reviewer can click-on the back-button to return to the original document. More links provide greater opportunities for the reviewer to navigate the whole complex of information easily in a logical connected manner.

Another tool that we utilized was the 'comment' facility of most word processors and spreadsheet software packages. We often chose to present information in tables (to provide two axes from which to access the information) with abbreviated entries to summarize the information in a compact space (e.g., the Curriculum Matrix). These abbreviated entries were then supplemented with detailed comments which were inserted into the document at specific locations of choice. Once inserted, a graphic icon (highlighted text or a red triangle in a cell) showed that a comment had been defined, and that the user could then view the comment by moving the mouse over the comment icon. This allowed us to include detail that appears upon request but then disappears to leave the keyword entry for better summary comprehension.

Summary

All of the information required of a Self-Study report for ABET has been compiled onto a computer CD containing multiple documents that are cross-linked. The suite of documents includes an electronic table of contents. Specific informational items are book-marked and links to them are defined from multiple relevant locations. Many items are presented in tabular format to provide two axes from which to launch a line of study. Tabular entries can be abbreviated to allow compact presentation while providing detail through the use of links or inserted comments. These techniques allow reviewing and accessing information contained in the report to be done more quickly, conveniently and directly than with traditional report formats. This convenience was confirmed by feedback from our academic advisory committee who received only the electronic package, and by the enthusiastic endorsement of a colleague with extensive accreditation experience. It is hoped that the packaging will increase reviewers' efficiency and

ultimately lead to more accurate accreditation assessments. Faculty also found that these tools helped in program design, implementation, maintenance and improvement. To request a template copy of the package, visit our web-site www.baeg@engr.uark.edu.

Bibliography

1. ABET. (2001a) "Criteria for Accrediting Engineering Programs, Effective for Evaluations During the 2002-2003 Accreditation Cycle." Accreditation Board for Engineering and Technology, Inc., Baltimore MD, 19 pp. http://www.abet.org/criteria.html.

2. ABET. (2001b) "Self-Study Questionnaire, 2002-03 Visits." Accreditation Board for Engineering and Technology, Inc., Baltimore MD, 39 pp. http://www.abet.org/info_prgs.html.

3. ABET. (2001c) "Program Evaluator Report, Engineering Criteria 2000 2001-02 Visits." Accreditation Board for Engineering and Technology, Inc., Baltimore MD, 15 pp. http://www.abet.org/info_prgs_eva_eac.html.

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Table 1. Sub-Documents and their links in the interactive ABET Self-Study package.

Document	Content	Cross-Linked to the Following Documents											
		EO	**PO**	**PC**	**CM**	**CL**	**PA**	**CS**	**FV**	**SC**	**SD**	**ME**	**RA**
Educational Objectives (EO)	List of program educational objectives.					x	x			x		x	
Program Outcomes (PO)	List of program outcomes and assessment techniques.	x			x	x	x			x	x	x	
Professional Component (PC)	List of desired professional components to the program.	x			x	x	x			x	x	x	
Curriculum Matrix (CM)	Summary of integrated curriculum design.	x	x	x			x	x					
Closing the Loop (CL)	Record of program assessments and actions.	x	x	x	x					x	x	x	x
Program Achieve-ments (PA)	Evidence of success in meeting objectives/outcomes.		x	x	x	x					x		x
Course Syllabi (CS)	Set of course syllabi in standard format.				x				x				
Faculty Vitae (FV)	Set of faculty vitae in standard format.							x					
Stakeholders and Constituencies (SC)	Lists of constituencies that helped in program design and improvement.		x	x		x	x						
Surveys, Other Data (SD)	Collection of survey results and other collected data.		x	x		x	x						
Meetings and Events (ME)	Minutes from program development meetings.	x	x	x		x							
Recruiting-Advising Materials (RA)	Catalog copy, brochures, sample student schedules, advising materials, etc.					x	x						

Figure 1. Contents of an ABET Self-Study report. The optional links are not required by ABET but were included to facilitate the review process.

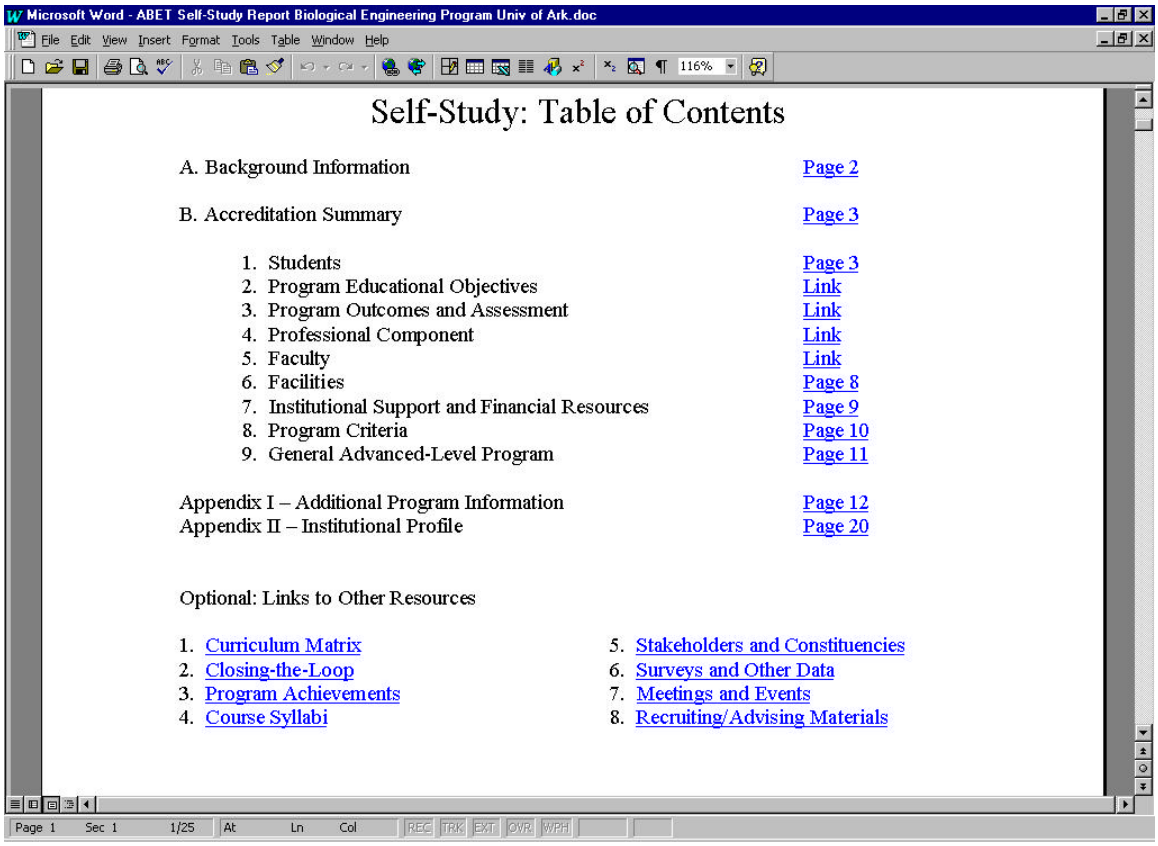


Figure 2. Sample from the Program Outcomes sub-document showing the types of information and links that are included.

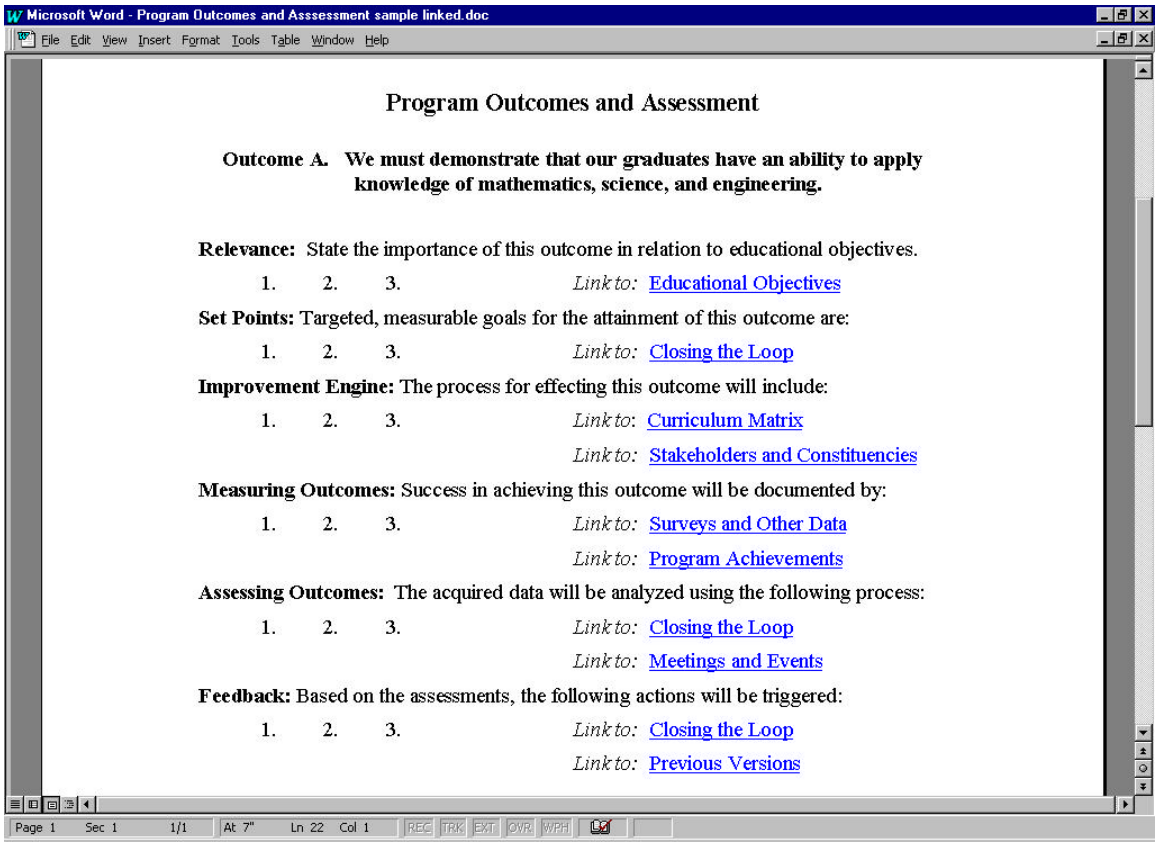


Figure 3. Sample from the Curriculum Matrix sub-document showing the types of information and links that are included. Note that a comment is being viewed in cell E41.

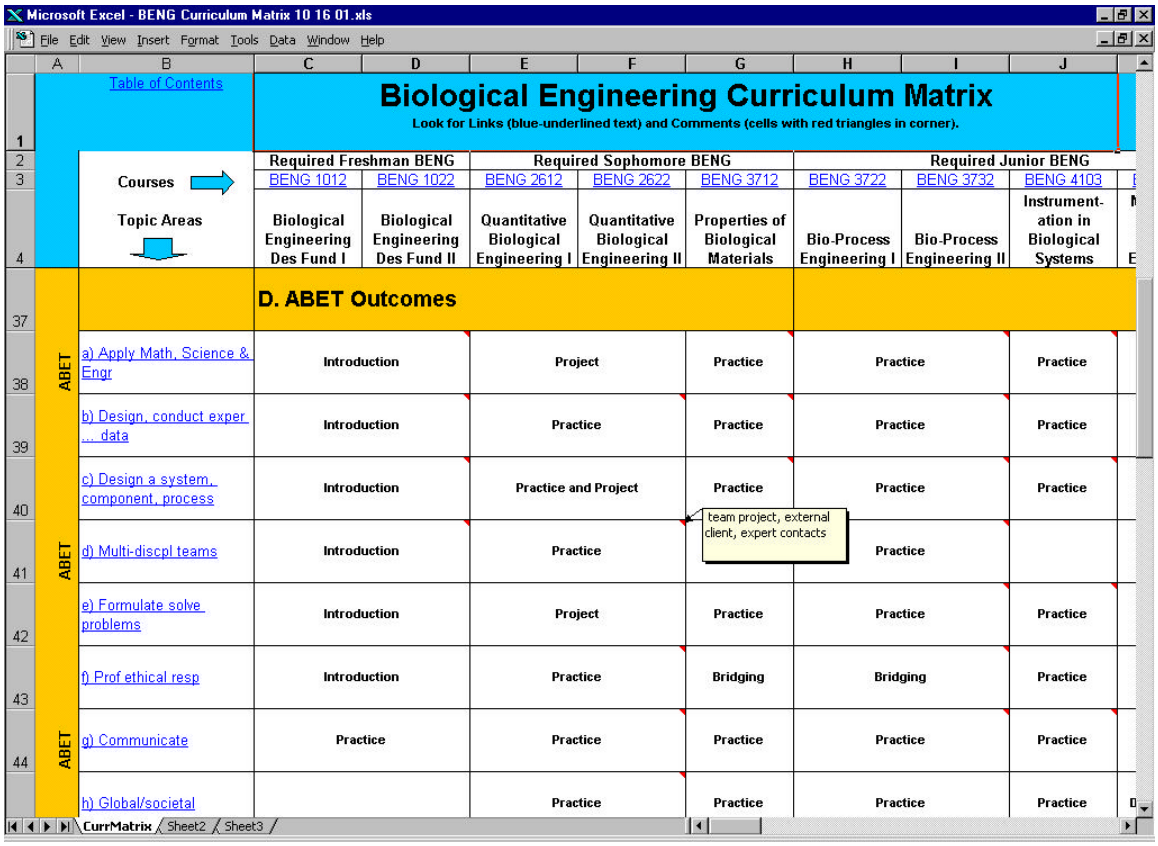
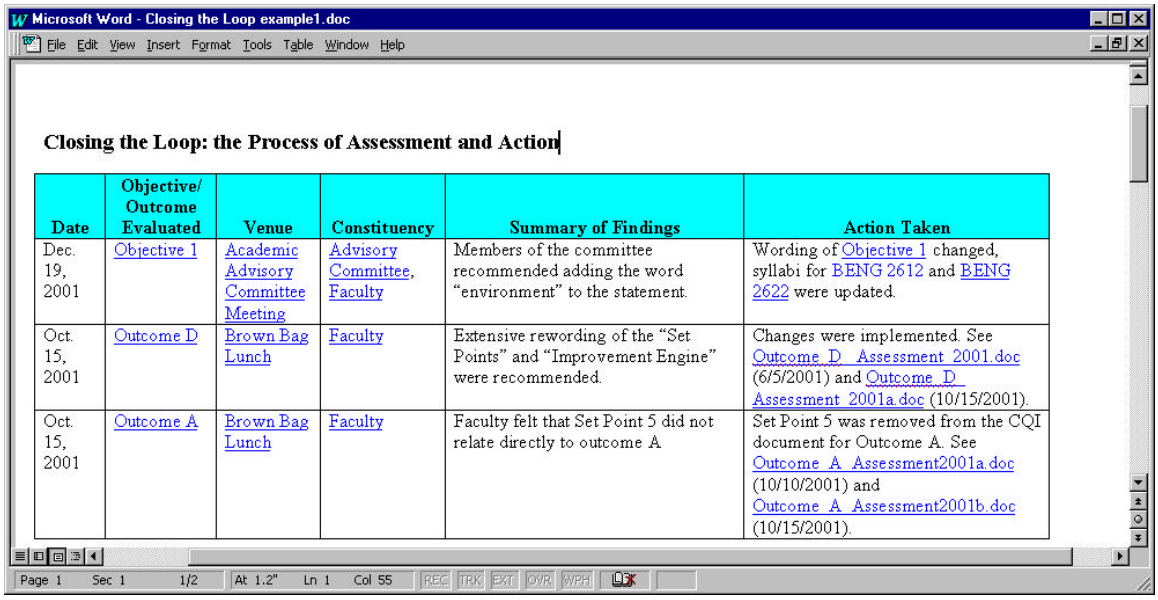


Figure 4. Sample from the Closing-the-Loop sub-document showing the types of information and links that are included.



Closing the Loop: the Process of Assessment and Action

Date	Objective/ Outcome Evaluated	Venue	Constituency	Summary of Findings	Action Taken
Dec. 19, 2001	Objective 1	Academic Advisory Committee Meeting	Advisory Committee, Faculty	Members of the committee recommended adding the word "environment" to the statement.	Wording of Objective 1 changed, syllabi for BENG 2612 and BENG 2622 were updated.
Oct. 15, 2001	Outcome D	Brown Bag Lunch	Faculty	Extensive rewording of the "Set Points" and "Improvement Engine" were recommended.	Changes were implemented. See Outcome_D_Assessment_2001.doc (6/5/2001) and Outcome_D_Assessment_2001a.doc (10/15/2001).
Oct. 15, 2001	Outcome A	Brown Bag Lunch	Faculty	Faculty felt that Set Point 5 did not relate directly to outcome A.	Set Point 5 was removed from the CQI document for Outcome A. See Outcome_A_Assessment2001a.doc (10/10/2001) and Outcome_A_Assessment2001b.doc (10/15/2001).