
AC 2011-2732: ABET REPORT GENERATION

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I am an Associate Professor at Rochester Institute of Technology. My main responsibilities are scholarship, teaching and curriculum development. I have developed significant new curriculum in both the Computer and Electrical Engineering Technology departments. Courses and Labs include: Digital System Design, Principles of Electronic Design Automation, Circuit Theory I III, Electro-Optic Devices (new), Electronics I III, Electronic Principles for Design I & II, Applied Microprocessors (new) and, Advanced Electronics (new). I was the single recipient of the "2002 Richard and Virginia Eisenhart Provost's Award for Excellence in Teaching and Campus Leadership" and the first in his college to receive the "Excellence in Adjunct Teaching Award" in 1998. My scholarly activity is centered on sharing the knowledge I gain in industry, sharing my course development and successful teaching methods. I am also a Senior Electrical Engineer at Eastman Kodak. I create new printed circuit board designs, direct technicians and find electrical solutions for Kodak products like: Kodak Approval XP Digital Laser Proofer and the Kodak LED Printer. Design experience gained at Kodak is directly applied to my teaching at RIT.

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Bill Leonard is the program chair has been on faculty in the Mechanical Engineering Technology Department at Rochester Institute of Technology since 1998 teaching many core undergraduate and graduate courses from strength of materials to machine design. He has specialized in graduate courses for concept design and critical parameter management, robust design, and product innovation and commercialization. Bill has a BSME from the College of Engineering at RIT and an M.S. at RIT. Prior to RIT, Bill had worked in industry for over 25 years from tool engineering, research and development, and advanced product development at Eastman Kodak. He has several publications and patents in the area of camera shutter technology. He has his own business, WML Associates, Inc., which develops products from an idea to the commercialization of that idea. He has specialized in the rapid prototyping of products using physical modeling systems such as CNC, rubber molding, and 3D printing machines such as Fused Deposition Modeling, Selective Laser Sintering, and wax based lay up systems. Bill has also rapid prototyped products analytically using software such as 3D parametric modeling CAD, Working Model, and closed form equations via critical parameter management.

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Robert A Merrill, Rochester Institute of Technology (CAST)

Robert Merrill has been a professor in the Mechanical Engineering Technology Program at RIT for 39 years. He has also served as the Department Chair and Program Chair for Mechanical Engineering Technology for 4 and 10 year respectively. His principle teaching interests are in mechanics and mechanical design. He has been a MET Program Evaluator for ABET for 10 years. Professor Merrill has also consulted with area industry for over 30 years primarily in the area of mechanical design and reliability. He earned a BSME from Clarkson and a MSME from Northeastern.

ABET Report Generation

Abstract

A continuous improvement plan is central to the Accreditation Board for Engineering and Technology (ABET) accreditation criteria. The management of the continuous improvement process utilized by many academic programs requires the collection, compilation, dissemination, analysis and evaluation of increasingly large and complex data sets. Some of this data is numeric and some text. In addition to the assessment data normally associated with continuous improvement, there is additional information that is needed such as course outlines, assessment tools, faculty and class loading, assessment reports, etc that are needed to enable programs to operate effectively and to improve. In addition to this, the accreditation process requires programs to provide documentation that will show that their continuous improvement process is operating and effective. This is a difficult and time consuming task and so for many programs the process breaks down in the years between accreditation visits only to be re-invented as the next visit approaches. The result is sometimes sporadic instead of continuous improvement.

This paper offers programs a way to more efficiently manage and produce the documentation necessary to operate a successful continuous improvement process and for a successful accreditation visit. The approach involves the creation of a Microsoft Access database designed to produce essential operating documents like course outlines, faculty loading reports, alumni surveys and to create standardized reports for assessment tools.

Introduction

Central to the ABET criteria is the continuous improvement plan. Criterion 4, continuous improvement, states “*The program must use a documented process incorporating relevant data to regularly assess its program educational objectives and program outcome...*”¹ which at the surface does not appear to require anything more than a single page, graphic report. However, the creation of the documented process requires a living document and must be maintained during the entire accreditation cycle. The criterion continues to state “*The results of these evaluations of program educational objectives and program outcomes must be used to effect continuous improvement of the program through a documented plan.*” The goal of the documentation process is to effect continuous improvement on the program. The words continuous and improvement are co-requisites and must be used together to make a positive change to the program. Using the process to “*effect continuous improvement*” is often lost because the process is not implemented on a continuous, but rather sporadic basis.

“You don’t have to see the whole staircase, just take the first step.”
- **Martin Luther King, Jr.**

A common issue that ABET Program Evaluators and Team Chairs have observed is that many programs have difficulty making the process continuous and not a flurry of activity just prior to an accreditation visit. The intended outcome of the criterion is to encourage colleges to access and evaluate the program outcomes regularly, which should be interpreted as each and every

time a course is offered. By waiting until the end of the cycle to assess and evaluate the course, the task becomes overwhelming and in the end, is perceived to produce little or no improvement. Without any apparent value, how can faculty be criticized for seeing accreditation as nothing more than busy work? The problem can be solved by implementing the documented process one step at a time so that assessment results are presented to faculty on a consistent and timely basis. Thus analysis, and evaluation can occur and corrective actions developed, implemented and their effect assessed on an ongoing basis. This can make the process both more manageable and effective.

The Data Management System

There are several options available to manage assessment data. As Microsoft explains Excel just lacks the power necessary to manage the relationships often found in data, such as the all important relationships between Program Educational Objectives (PEOs) and Program Outcomes (POs) that support them.

“Excel is not a database management system. It is spreadsheet software, and it stores units of information in rows and columns of cells, called **worksheets**. The most common task performed in Excel is the management of lists such as telephone numbers and personnel data. In comparison, Access stores data in **tables** that look much the same as worksheets but are designed for complex querying in relation to data stored in other tables and locations, and even in fields in other tables.”²

Learning management systems (LMS) like Angel, Moodle, Sakai, Blackboard, Desire2Learn offer an excellent file repository but little ability to generate reports based on data it stores. Databases like Microsoft Access, FoxPro, SQL Server and Oracle offer the best solution with varying levels of effort because of their ability to keep all the data and assessment tools together. Databases like FoxPro and SQL Server require higher levels of program skills to create and manage while providing more advanced functionality, larger data volumes and larger user groups. Microsoft Access's offers a more simplistic functionality and is geared toward the everyday users. However, the functionality it provides more than exceeds the assessment and evaluation needs of academic programs. Since it is included in Microsoft Office Professional, it is often available to administrators and faculty with little or no capital expenditure.

Microsoft Access is designed for ease of use while including many powerful functions found in higher end databases like SQL Server. The real advantage of Microsoft Access is the synergy created between administrators, faculty and administrative assistants. Numerous self-paced, on-line training sites like Microsoft³ and others⁴ provide free Access tutorials at many user levels helping professors and administrative assistants to effectively use a relational database. If preferred, many training courses are offered at local training facilities, like New Horizons⁵ in Rochester, NY, enabling users to start working with Access in two days or less. Administrators create Access' Excel like tables, import data from sources like Excel and create and edit forms for data entry or reports for printing all from the same data source. While administrative assistants are working at the data entry level, concurrently professor can design queries to filter data to create student performance graphs, program outcome summaries and alumni survey reports for evaluation and demonstration of their continuous improvement plan. The database can be placed on a shared server and accessed by any one person at any given time. There are also several options that allow multiple users to use the database simultaneously.

Microsoft Access allows the advanced programmer the ability to develop a web front end for data entry, queries and reports. Microsoft Access alternatively offers a wizard that splits the database into a front end for forms, queries and reports and a back end containing just raw data in tables. Each user would have to use a custom frontend that is linked to the single backend data source stored on a shared server. An option including capital expenditure is to purchase Microsoft's Sharepoint software that enables users to work on any office document simultaneously. The example discussed in this paper is used by one administrator and three faculty members that routinely share documents on a server and can work around one another.

The four basic objects in Access are tables, queries, forms and the fruit of the database: the report. The following discussion will provide a sample demonstration of the creation of data tables, management through forms and reporting a course outline. Reports created to survey alumni or students, or tables capturing the assessment data are easy extensions once the basic database design is created.

Tables are very similar to worksheets in Excel with emphasis placed on the rows and columns, not the individual cells. Each row in a table is called a **record**. For example, the faculty member in the first row of in figure 1 is a record. Each column in a table is called a **field**. For example, LastName is a field in table 1. Spaces are not recommended in field names or object names. Both table names start with “tbl” following the Leszynski naming convention⁶. The most important field is the **primary key**. The primary key is required in each record and cannot be duplicated. The faculty ID number is used as the primary key in figure 1 and the course number in the figure 2 as they are not likely to change. The table shows some of the different data types that can be held by a field including numbers, text, yes/no and can even include a file attachment like a resume.

FacID	LastName	FirstName	Prog	Position	Tenured
12345-6789	A	Prof	EEET	Associate	<input checked="" type="checkbox"/>

Figure 1

SemCrsID	Course	FacCoordinatorID	CourseDiscription	CourseGoal	CreditHc
EEET-232	Electronics II Lab	Clover	Provides experience in the design, prototyping, measurement and analysis	This course teaches students to design, analyze, fabricate, troubleshoot and measure operational amplifier circuits.	
EEET-231	Electronics I Lab	Clover	Provides experience in the design, prototyping, measurement and analysis	The student, upon completion, should be able to design, analyze, build and troubleshoot typical diode circuits, binolar and field effect	

Figure 2

One of the elements that differentiate a relational database, like Access, from a flat system like Excel, is Access' ability to manage relationships. Microsoft provides a very clear explanation of what a relationship is.⁷ “In a relational database, relationships enable you to prevent redundant data.” For example, the table called tblSemCrsMain stores information about each course, such as the course number, course name, and course description. Information about the responsible

faculty may also be needed, however storing more than the last name would create a duplicated set of records for each faculty member for each course they managed.

The support page at Microsoft continues to describe the types of relations used in building a database. “A relationship works by matching data in key columns, usually columns with the same name in both tables. In most cases, the relationship matches the primary key from one table, which provides a unique identifier for each row, with an entry in the foreign key in the other table.”⁷ For example, FacCoordinatorID, last name only, can be associated with all the details about a faculty member in the tblFaculty table by creating a relationship between the FacID column in the tblFaculty table (the primary key) and the FacCoordinatorID column in the tblSemCrsMain table (the foreign key). Additionally, changes to the professor’s last name in faculty table are automatically cascaded to the course table.

Most relationships are one-to-many as shown in Figure 3. The infinity sign signifies the “many” side of the relationship. Figure 3 shows relationships between three tables linking a faculty member (FacID in tblFaculty) to the courses he teaches (FacCoordinatorID in tblSemCrsMain) and the course (SemCrsID in tblSemCrsMain) to its intended learning outcomes (SemCrsId_ILOs in tblILOs). A similar relationship (not shown) would exist between each program educational objectives and the many program outcomes that support the program educational objectives or ABET’s famous a-k criteria and the many program outcomes that are used to demonstrate a-k. Once the relationships are created, mapping faculty to the courses they are responsible for is easy and data integrity is improved because data relating to each table is kept in its own table.

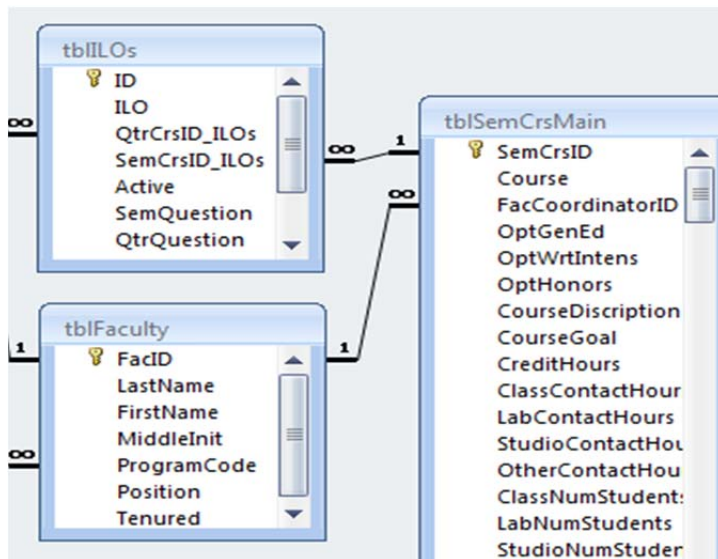


Figure 3

Tables like tblSemCrsMain in figure 1 can become very large, listing all the important elements of a class. Entering data directly into the tables is useful when a field must be changed in all the outlines. If the curriculum committee decides the course descriptions should be more exciting, all

the course description are listed in a single column and can easily be referenced. Data from any field can easily be imported or exported to Excel or other sources as shown in figure 4. A quick tip, when entering data in a table: “ctrl ;” copies the data from the record above in the selected field.

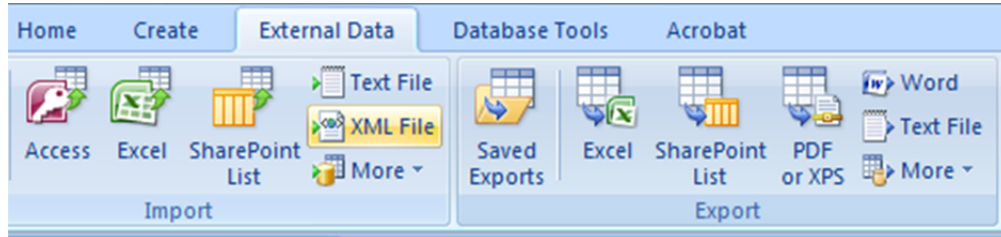


Figure 4

Forms and sub forms can also be used for data entry into tables. Forms are simple to create (wizard available) and, as in figure 5, allow an administrator or faculty member to easily select a course and enter data into it.

Course Outline Input Form

Select A Course EEET-426

2.0 Course Information

Course: Control Systems I

Credit hours: 4

Prerequisite Course Number: EEET-320

Requisite C or Better Req'd

Requisite Course Names: Signals, Systems and

Co-requisite Course Number:

Co-requisite Course Names: None

Course proposed by: Hochgraf

Effective Date: 12/15/2010

	Contact Hours	Recommended students/section
Classroom	3	32
Lab	1	16
Studio		
Other (specify)		

13.0 a. This prop
Staffing
Budget
Facilities
Other

b. Have all de
 Check if

If yes provide
Date:

c. Is this a req
certificates,

Figure 5

When a course has multiple items associated with it like learning outcomes or prerequisites, a sub form can be created and inserted in the form shown in figure 5. Forms can also be used to call macros that, for example, make a print preview of one of two course outlines, with and without a given section as shown in figure 6.

Figure 6

A successful ABET visit is obtained by moving the visit to the front of the faculty and administration's mind, carefully managing the assessment data on a regular basis, so improvements can be obtained, and value perceived by all. ABET's Criterion 4 requires a continuous improvement plan to help strengthen programs. When the assessment and evaluation processes are managed properly, the process can become more continuous. Use of an Access database can become an integral part of a department's continuous improvement as well as aiding administrative assistants in their day to day tasks, lightening their load and creating an more efficient work place. Long term, the use of a database will help accurately create the needed display materials and self study, allowing for a smoother, successful ABET visit. With a multitude of free resources available on the web and in class training at all levels Access is easily learned. Access is readily available on all department computers, providing an inexpensive powerful tool that can be beneficial to the department on many levels.

Future

The goal of continuous improvement in the Engineering Technology programs at Rochester Institute of Technology is to infuse the process into day to day operations. This can be effectively enabled by the creation of a data management system such as described in this paper. However, the development of such a system is time consuming and cannot be accomplished instantaneously, but instead over a period of time. At this point time, the course outline generation tool is operational. Plans are in place to automate several of the assessments that are currently managed using Microsoft Excel. These include Intended Learning Outcomes Assessment, Co-op Assessment, and various other direct measurements. The Co-op Assessment data offers a unique opportunity to discover relationships and correlations through this system as it can relate employer evaluations of student performance with student feedback regarding their experience. Since most of this data relates directly to ABET Criteria, it will provide valuable information to support the accreditation process as well as affect improvement.

Conclusion

The effort to create a data management system to support the continuous improvement processes for the Engineering Technology programs at RIT is an evolutionary work in progress. As such, it is considered to be in a “continuous improvement phase”. While some parts of it are operational and proving to be effective, much more needs to be accomplished. Fortunately, due to its flexibility, it can easily be adapted to meet the needs of multiple programs, to change as programs change and to grow as assessment methods improve. It is the intent for this system to become the “backbone” of the continuous improvement process.

¹ ABET CRITERIA FOR ACCREDITING ENGINEERING TECHNOLOGY PROGRAMS, Effective for Evaluations During the,2010-2011 Accreditation Cycle

² Microsoft, <http://office.microsoft.com/en-us/access-help/using-access-or-excel-to-manage-your-data-HA001042918.aspx> (Emma Nelson)²

³ Get to know Access, <http://office.microsoft.com/en-us/training/get-to-know-access-RZ006118141.aspx>

⁴ Microsoft Access 2007 Tutorial, <http://cisnet.baruch.cuny.edu/holowczak/classes/2200/access/accessall2007.html>

⁵ <http://www.newhorizons.com/content/index.aspx>

⁶ http://en.wikipedia.org/wiki/Leszynski_naming_convention

⁷ <http://support.microsoft.com/kb/304466>