Automation of Outcomes Based Assessment

Samir Y. Khoury[1], Andrew E. Jackson[2], Merwan B. Mehta[3], and Leslie R. Pagliari[4]

Abstract – Accrediting organizations require a degree program to have clearly stated outcomes and objectives, courses objectives that are tied to program outcomes and objectives, and an evaluation system to evaluate whether or not courses are achieving the course objectives and eventually the program outcomes and objectives. Also, it requires the course assessment system to have a closed feedback loop that identifies shortcomings and shows implementation of corrective actions in the course delivery and teaching mechanism. Faculty members at East Carolina University (ECU) have collaborated on the development of an automated tracking and management system, which was deployed on a pilot basis by the various degree programs in the Department of Technology Systems. The ultimate goal of this system is to allow faculty and administrators to manage and assess all the varied degree programs through a single database and provide a link between course objectives and program outcomes.

Keywords: Outcomes, Assessment, Objectives, ABET, NAIT

INTRODUCTION AND LITERATURE STUDY

After considerable debate and upheaval, academics have finally accepted that assessment of educational programs is a "political and economic inevitability [Angelo, 2]," and hence institutions of higher learning should embrace assessment first for improvement of student learning, and next for determining accountability for the quality of the learning achieved. Accrediting organizations such as the National Association of Industrial Technology (NAIT) and the Accreditation Board for Engineering and Technology (ABET) have taken this same stance and now require degree programs to have clearly stated outcomes and objectives, and also requires course objectives that are tied to program outcomes and objectives [NAIT, 4] [ABET, 1].

Furthermore, it necessitates that programs have systems to evaluate whether or not courses are achieving the course objectives and eventually the program outcomes and objectives. Another requirement is that course assessment systems have a closed feedback loop that identifies shortcoming within programs and shows implementation of corrective actions in the course delivery and teaching mechanism [NAIT, 4] [ABET, 1].

Many have noted that we have far too much assessment in some ways, but the quality and the diversity of the assessment has missed its mark [Strong, Amos, & Callahan, 5]. This can be attributed to the absence of a mechanism to conduct a holistic assessment that shows the linkages between the parts of the assessment. Developing and implementing a holistic assessment model can be difficult if we attempt to utilize manual means, without the support of a database tool. The lack of a holistic interrelated model showing linkages between course objectives, program objectives and program outcomes also makes the task of the NAIT or ABET assessors of the program difficult and arduous during accreditation visits.

[1] East Carolina University, Greenville, NC 27858, khourys@ecu.edu

[2] East Carolina University, Greenville, NC 27858, jacksona@ecu.edu

[3] East Carolina University, Greenville, NC 27858, mehatm@ecu.edu

[4] East Carolina University, Greenville, NC 27858, pagliaril@ecu.edu

To remedy this, faculty members at ECU have collaborated on the development of an automated tracking and management system. This system was deployed on a pilot basis by several degree programs in the Department of Technology Systems. The system allows faculty and administrators to manage and ultimately assess many different degree programs through a single database. Faculty and administrators are able to view the linkages between course objectives and program outcomes. Furthermore, it allows faculty and administrators to see how the course objectives are able to simultaneously satisfy program outcomes of several programs. For a department which has several programs, that should satisfy diverse requirements of various agencies for outcome assessment [Duff, 3], this is not only a good thing to have, but to do the job well it almost becomes mandatory.

An automated, holistic assessment system can handle multiple users and with a few clicks of the mouse provide a variety of reports that can be directly provided to accrediting agencies to satisfy their accreditation criteria. The reports provide instant and up-to-date information, as opposed to the need to periodically update a manual system, which has several ways in which to fall out of step with real time. In this paper, we discuss the overview of the pilot holistic assessment system that has been put in place at ECU in the Department of Technology Systems. To get a deeper understanding for the system, we discuss the system architecture, the manner in which it satisfies accreditation agencies, and the special reports that the system is capable of generating.

METHODOLOGY

Background

The Department of Technology Systems at ECU provides five undergraduate degree programs. Each degree program contains several specializations. Most of the courses taught within each degree program are assigned to that degree program. Some courses are assigned to one degree program and offered in other degree programs as electives or required courses. General education courses are taught by other departments and are not under the control of the Department of Technology Systems.

Each program is assigned a program coordinator who is responsible for the overall program, and each course is assigned a course coordinator, who is responsible for the management of the specific course. The course coordinator, in cooperation with the program coordinator, is responsible for the selection of the textbook, development of the course objectives, training of other faculty teaching the course, and instituting a continuous course improvement plan. At least once per semester the course coordinator gathers assessment data about the course. Prior to the Assessment Database System (ADS), instructors maintained a hard copy folder for each course. Changes to the course, assessment of the objectives, examples of tests and assignments, and other course- related materials were kept within this folder.

After considerable debate over the effectiveness of the folder system to support course evaluation and management, a decision was made to create a better tracking system. The next evolutionary step in creating a better system was the creation of a computer file system. This file system would maintain all their course files in an electronic format. This provided more flexibility and centralized storage of the files, but had some drawbacks. One prominent drawback was that all hard copies of documents had to be scanned into a PDF format and placed into each of the respective course folders on the server. Changes in the course or course improvement annotations were entered into a Microsoft Word document for each course. This resulted in each course having its own course change and improvement document. During the faculty annual review process, each course owner or instructor was required to print the course change and improvement document and submit it to the department chair for each course. Another drawback was that there was no means to allow other instructors teaching the course or administrators to view all of the course changes in a centralized file.

In addition, another drawback of the computer file system was the lack of linkages between program outcomes, course objectives, and course improvements. To determine if course objectives were directly tied to program outcomes required manual viewing of separate documents that had to be spread around the conference room. This review process was cumbersome and did not provide a complete picture of the degree program's effectiveness. Under this method of course management, course objectives overlapped considerably in different courses. Also,

some program outcomes were not addressed adequately, because there was no method to identify gaps or overlaps in course objectives.

As the system architecture for the database system was developed, faculty in the department felt that it would be necessary for the system to allow multiple instructors to enter and edit course data at the same time. The system would need the means to allow each instructor not only access to their course data, but also be able to view reports of data from other courses. With this in mind, a faculty member with experience in databases volunteered to create a prototype system. The goal of the prototype system was to evaluate whether such a system could be used to automate course assessment data tracking.

The original prototype was designed for one degree program and did not allow the management of multiple degree programs. Only the courses for a specific degree program could be entered and managed within the first version of ADS. After testing the system and developing several revisions over an eight-month period, a new version of ADS was developed that allowed the integration of multiple degree programs. This process was designed to operate within one department with multiple degree programs, consistent with the current configuration of the Department of Technology Systems at ECU. A significant change was made to the system to allow a course coordinator to select multiple program outcomes for each course objective. This was important because some courses support multiple programs from different degree programs. The user interface was also redesigned to allow for quicker retrieval of reports for a specific instructor or course.

After several iterations resulting from the development process, the current version of ADS allows course coordinators to access courses based on the initial *Windows* login. The database administrator during the initial setup of the database can enter a course ID, course title, date the coordinator was assigned, course coordinator's login ID, and the name of the program to which the course is assigned. To maintain consistency, changes in these fields are performed only by the database administrator. Figure 1 provides a snapshot of the input screen used to establish the initial course data.

Figures 1 and 2 depict the only two forms that are needed by the course coordinators to enter and update data for their courses. Course coordinators are also provided with access to the *Reports Menu*, which is shown in Figure 3. The *Reports Menu* allows course coordinators to produce several reports such as the Program Outcomes Report as shown in Figure 4. The Program Outcomes Report displays each program outcome and all of the associated course objectives for that outcome. One of the major benefits of this report is that it allows course coordinators and administrators to see which program outcomes are not adequately supported by course objectives and which course objectives show overlap.

Another useful report generated from the *Reports Menu* is the Course Improvement Report, as shown in Figure 5. This report displays all of the course changes or improvements that have been made to each course. The *Reports Menu* allows a course coordinator to produce the report for one course at time, one coordinator at a time, or for all courses at one time. Dropdown menus allow coordinators to choose from a list of course coordinators or courses before generating the reports. Figure 6 outlines the ADS process used to enter initial data, evaluate course objectives, and to produce the above reports.

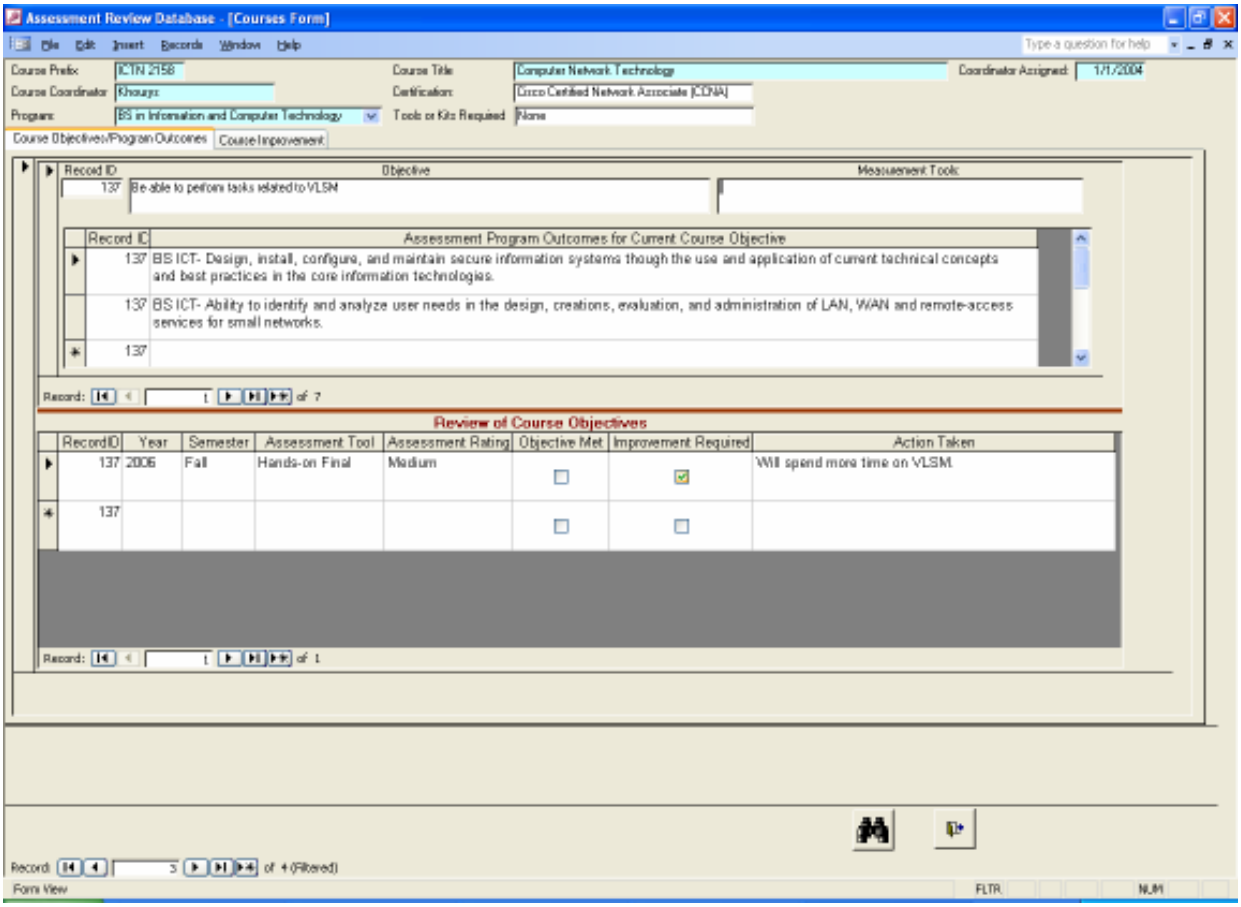

Figure 1: Course Initial Enter and Update Form (Courses Form)

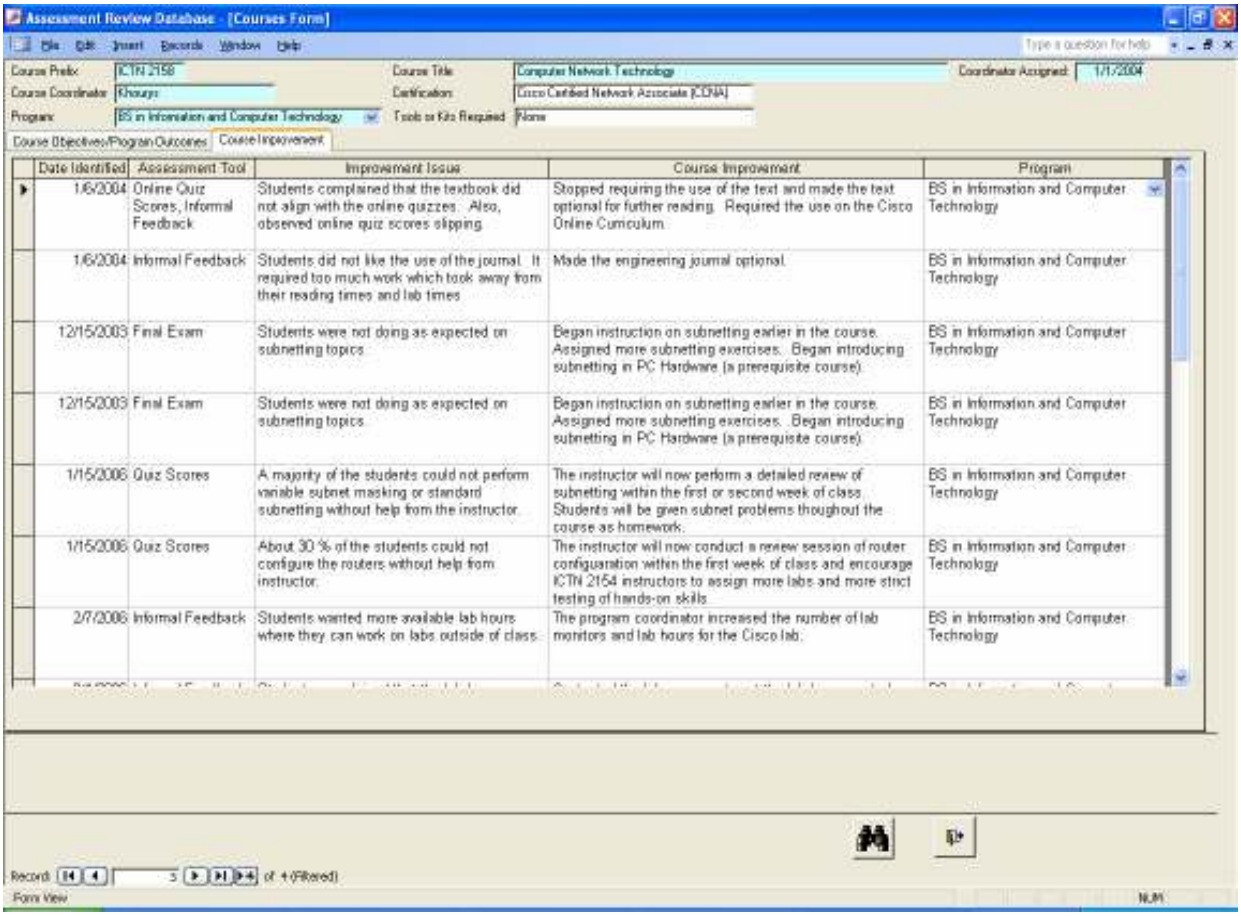

Figure 2: Course Changes Tab within the Courses Form

Figure 3: Reports Menu

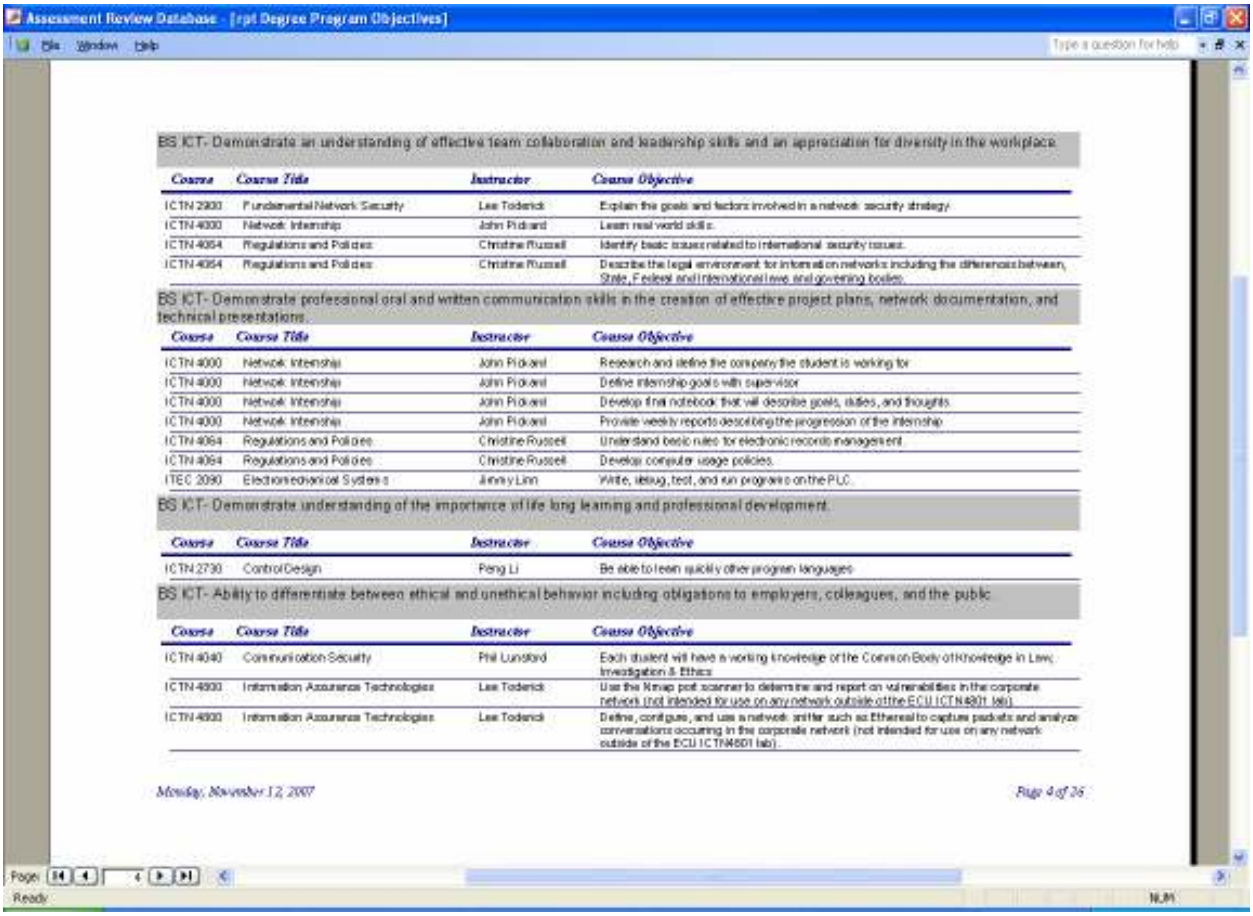

Figure 4: Program Outcomes Report

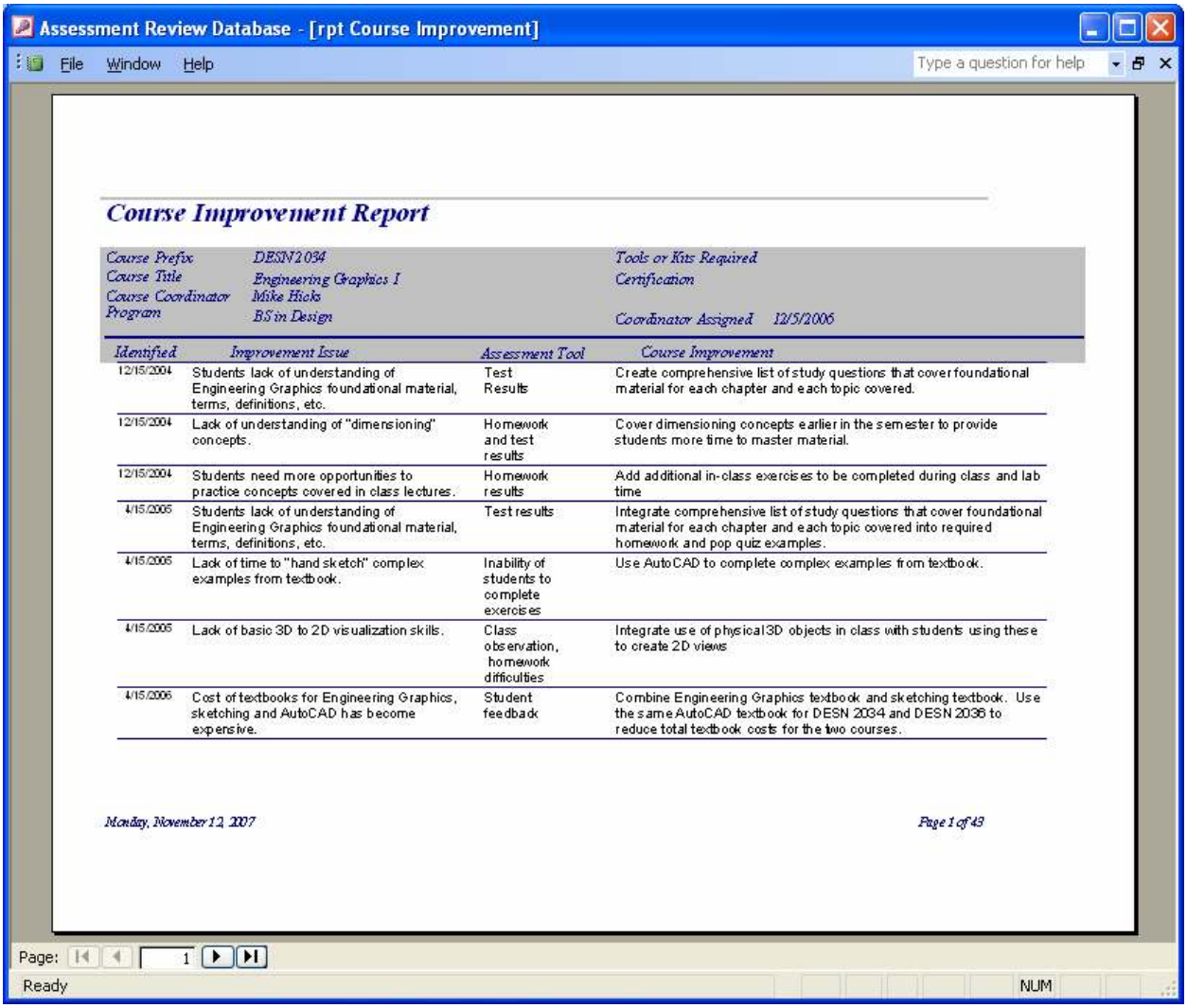

Figure 5: Course Improvement Report

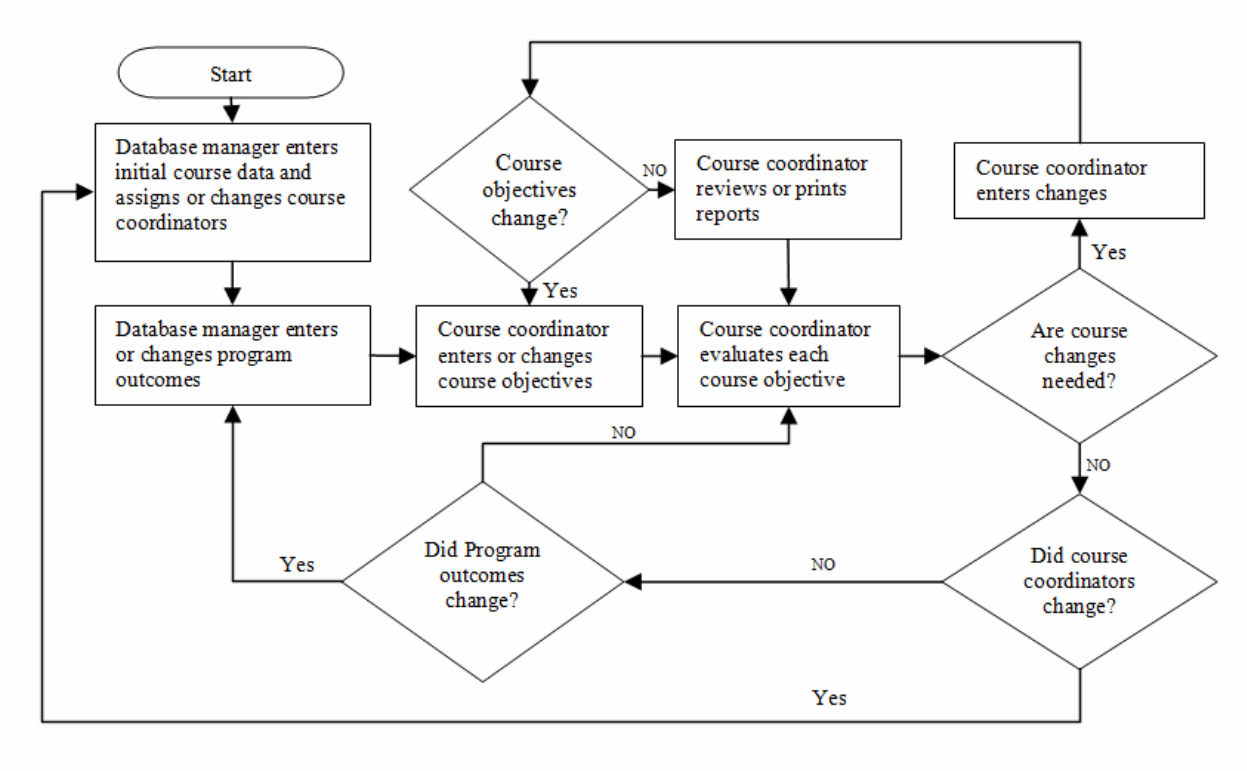

Figure 6: The ADS Data Entry and Update Process

The structure of ADS consists of several related tables in a *Microsoft Access* database that resides on a network server which is accessible to all course coordinators within the department. The rest of the objects in ADS (queries, forms, reports, etc) are stored in a separate front-end database installed on the coordinators' computers within the department. A link has been established between the front-end and back-end database to tie the two separate databases together. This creates a centralized location for all data and eliminates database locking errors. Also, the centralized sharing of the data ensures that everyone is looking at the latest updated information. Another benefit of the centralized location of the data is the ability to backup the data from one location. Since the data tables are stored on a network server, the data is automatically backed-up every night.

Several steps were taken to prevent course coordinators from accidentally deleting data belonging to other course coordinators. One of these steps is the use of input forms that display data for the course coordinator currently logged in to the computer and prevents course coordinators from accessing and changing data that belongs to other coordinators. Another measure taken to protect critical data in the ADS system required the development of a user interface that hides the database window and underlying objects.

Current Assessment Plan

The current assessment plan in the department is designed to incorporate the use of ADS by all course coordinators as part of a continuous improvement process. The department chair and program coordinators monitor the process to ensure all course coordinators are performing the necessary data input within ADS. Course coordinators are required to submit a printout of their courses to the department chair during the annual review of the assessment process. Electronic folders of course materials such as exams and handouts are maintained for each course on a shared file server.

All degree program and course assessment data are maintained in a centralized file server within the Technology Systems Department. Every course coordinator has access to their course folders and their courses within ADS. Other instructors are provided with read permissions only. Since course coordinators are responsible for their assigned courses, they will be evaluating their courses every semester to determine if students met the assigned course objectives. While each course objective is analyzed, an entry will be made in ADS indicating whether or not the course objective was met by the students completing the course. A rating of low, medium, or high will be entered for each course objective. All low and medium ratings will require an annotation of the corrective action taken to improve the course objective rating. Course coordinators are also required to coordinate with other instructors who are teaching additional sections of their assigned courses to ensure all sections of a particular course are evaluated on a consistent basis.

Maintaining a history of student performance and corrective actions taken for every course objective tied directly to a program outcome, will allow course coordinators and administrators to effectively manage their courses and programs. Preparation for ABET, NAIT, or other accreditation reviews will be an ongoing process that incorporates the steps outlined above.

CONCLUSION AND FURTHER WORK

The assessment of a program involves use of various sources of information. It is the authors' desire that the implemented system for course objectives' assessment at the Department of Technology Systems at ECU captures the means by which all course objectives are being achieved to help fulfill program objectives and outcomes. An automated system, structured around a database seems to be serving this function very well, based on six-months of activity. The authors believe that the final verdict on the efficacy of the system will not be available until the system has been in use for three to four years.

Technology provides a good resource to implement a holistic model that allows multiple faculty members to collect information and store it in a central place. However, with the realization that the mere presence of technological tools does not guarantee a systems solution, we are in the process of instituting initial and recurring faculty training methodologies to emphasize the need to constantly maintain and update the database with the latest course assessment information. By stressing the importance of on-going assessment and the need for an automated tracking tool such as ADS, we believe all faculty members will be more responsive to continuous process improvement activities across the curriculum. To that end, we have instituted a pilot assessment program using the new ADS-enhanced assessment tool. With six months of data now in the system - covering one full academic semester - we are confident that the program assessment process will meet our needs for the foreseeable future.

Assessment of program objectives through the evaluation of course objectives is only part of the overall assessment model. An additional step being analyzed is how ADS can be expanded to include assessment data from other sources and integrate them into the overall model. Some of these other sources include alumni and employer surveys, exit surveys of graduates, on-going student surveys, and informal feedback from students and alumni.

With encouragement and positive comments received from a team of recent NAIT evaluators who witnessed the ADS in operation within the Department of Technology Systems, we believe we are on the right track to create a robust, centralized system to conduct an overall assessment for all of our academic programs. At the same time, we believe that technology in itself is not the answer, since a system will only be as good as the people who are ready to exercise discipline in implementing the underlying processes. The combined efforts of the departmental faculty members and other subject matter experts are required to improve and sustain high-technology database systems such as ADS. The reward for these combined efforts will be the integration of a powerful and user-friendly assessment tool as we continue to improve our program assessment processes.

REFERENCES

[1] ABET Technology Accreditation Commission, *Criteria for Accrediting Engineering Technology Programs, Effective for Evaluations During the 2006-2007 Accreditation Cycle*, pages 5-8.

[2] Angelo, Thomas, "Doing Assessment As If Learning Matters Most," American Association for Higher Education Bulletin, May 1999. Available Online: http://aahebulletin.com/public/archive/angelomay99.asp.

[3] Duff, Jon, "*Outcomes Assessment Across Multiple Accreditation Agencies,* Journal of Industrial Technology, Volume 20, Number 4, September – December 2004.

[4] NAIT, *National Association of Industrial Technology 2006 Accreditation Handbook*, pages 1-3.

[5] Strong, S, Amos, S, and Callahan, N. "*Effective Assessment: A Model for Industrial Technology Programs,* Journal of Industrial Technology, Volume 19, Number 3, May – July 2003.

Samir Y. Khoury

Mr. Samir Khoury is a faculty member within the Technology Systems Department at ECU. He has over 10 years of teaching experience in the information technology field and almost 20 years of database design experience. He holds several industry certifications and is the small business owner and consultant of Samir Systems. His clients include academic institutions, small and medium sized businesses, and non-profit organizations.

Andrew E. Jackson

Dr. Andrew E. Jackson is a Professor and Chair of the Technology Systems Department at ECU. He has a wide range of experience with academic program assessments, including the Council on Aviation Accreditation (CAA), the Accreditation Board for Engineering and Technology (ABET, Inc.), and the National Association of Industrial Technology (NAIT). He has served on numerous projects dealing with database integration and analyses covering more than 30 years in industry and academia. His research focus is in distance education, human factors, process improvement, and integration of large-scale of high-technology systems to enhance and support of organizational objectives. He holds a Professional Engineer (PE) license from the State of Texas and is a Certified Senior Industrial Technologist (CSIT).

Merwan B. Mehta

Dr. Merwan B. Mehta is an Associate Professor and Coordinator of the Industrial Engineering Technology program at ECU. He has over twenty years of experience in business and industry working as an industrial engineer, machine tool design engineer, manufacturing engineer, manager, project manager, project director, vice-president and consultant. His present research interests are enhancing manufacturing and business processes through lean principles and theory of constraints, and the pursuit of quality and variation control through six-sigma. He is an ASQ Certified Six-Sigma Black Belt and a SME Certified Manufacturing Engineer.

Leslie R. Pagliari

Leslie Pagliari is an Assistant Professor and Program Coordinator of the Distribution and Logistics Program at ECU. She received her PhD in Engineering Management and her MS degree in Occupational Safety. She is a National Association of Industrial Technology (NAIT) Certified Evaluator and has been on numerous visits. Dr. Pagliari is Past President of the Eastern Carolina APICS Chapter and is a member of the Institute for Supply Management and other numerous organizations. Dr. Pagliari is a Certified Senior Industrial Technologist (CSIT).