

Developing Electronic Portfolio for Assessment Based Analysis for ABET EC 2000

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Abstract: The College of Engineering at the University of Texas at Austin underwent the ABET site visit in the fall of 1998. Since the visit the College has been starting the planning process for the 2004 visit. Student electronic portfolios have been discussed and were the topic of a presentation by Dr. Gloria Rogers of Rose-Hulman College. In the spring 1999 semester I applied for and received Academic Development Funds for the fall semester to hire two undergraduate research assistants to develop a template for electronic portfolios for students in the College of Engineering. The Freshman Interest Group section of ME 302, that I would both teach and mentor, was chosen as the test group for the electronic portfolio project. The College and the Department computer technicians met with me over the summer to plan for the access to the appropriate servers, the storage of the files, and the maintenance of the files. I appointed two undergraduate students in the fall and began collecting materials from the students and researching and writing the HTML code, CGI scripts, and virtual reality routines that became the electronic portfolio. The project was completed by the end of the fall semester. On February 25, 2000 the electronic portfolio project was presented to the College of Engineering at the February Brown Bag Seminar. It is estimated that if electronic portfolios were required of every incoming freshman in the College of Engineering from the fall semester of 2000 until the ABET EC 2000 visit in the fall of 2004 the storage requirement would be less than 50 gigabytes.

A. Need for Study

The fall of 1997 and the spring of 1998 were spent collecting the homework, examinations, papers, projects, and necessary materials from each Mechanical Engineering course taught for the fall 1998 ABET visit. Meticulously the Volumes I and II were written and rewritten until the Dean's office was satisfied with their appearance and content. The summer of 1998 was spent organizing the course materials into individual volumes with accompanying syllabi, handouts, and textbooks. It was my first time to be involved with the preparation for an ABET visit. As prepared as we were for the visit there were several issues that had to be resolved after the visit commenced. For example, some course volumes were poorly organized and there were some tense moments as appropriate faculty members had to be located quickly. All the minor problems were resolved and the College of Engineering and the M. E. Department successfully demonstrated solid programs and received the anticipated 6V evaluation. It was truly an eye opening experience.

The next accreditation visit will be in the fall of 2004. The evaluation criteria for ABET's EC 2000 will require the College of Engineering to provide student work collected over a longer period of time. Instead of presenting evidence of current quality, departments will be required to provide materials that will demonstrate continuous quality improvement. The shift will require departments to show evidence to meet outcome-based accreditation standards. We will be required to demonstrate how departmental goals reflect and support the institutional objectives.

B. Objectives

The College of Engineering began discussion on preparing for the new ABET EC 2000 criteria immediately after the visit. Dr. Gloria Rogers from Rose-Hulman, was invited in the spring to give a presentation about Rose-Hulman's electronic portfolio program. Each student at Rose-Hulman creates an electronic portfolio during the four years of study. Each student is provided a WEB address for the portfolios. A group of students is assigned to each faculty member. The faculty member is responsible for supervising the students to assure the portfolios are maintained. Each freshman class at Rose-Hulman is required to purchase identical laptop computers to attend. Students at the University of Texas are not. Managing portfolios is enhanced when an entire class receives

identical computers with all the software necessary preloaded on them. None the less there was considerable discussion on the possibility of requiring future incoming classes to create electronic portfolios.

In April 1999 the College of Engineering announced a call for proposals for Academic Develop Funds for the coming year. I submitted a proposal. I requested funds to hire two undergraduate students for the fall 1999 semester to develop a model of an electronic portfolio for students in the College of Engineering at the University of Texas at Austin. In May the proposal was approved.

The University of Texas had established a retention program for incoming students called the Freshman Interest Group (FIG) in the fall 1998 semester. A Freshman Interest Group is composed of 20 - 25 freshmen all in the same major. The Mechanical Engineering FIG students were assigned to the same sections of three courses common to the M.E. freshman year: ME 302, CH 301, and M 408C sections. In addition the FIG students meet with their faculty mentor, an advisor from the Dean of Students from the College of Engineering, and an upper division M.E. student mentor in a one hour long seminar each week.

I volunteered to mentor the Mechanical Engineering FIG that fall. I was also their professor for ME 302. It was a great experience. I got to know the students better. The students got to know each other better. Apparently we were able to work together better because their grade point average was one tenth of a percent better than the grade point average of the students that did not participate in a Freshman Interest Group in Mechanical Engineering.

C. Scope of Work

I volunteered to mentor a Freshman Interest Group for the fall 1999 semester. When my proposal was funded I chose to use the students in the FIG as the pilot group for portfolio project. The weekly seminar would provide the time to work on the portfolios. The three courses they took together would provide a common core of material to organize. Less customization would be necessary since a freshman generally takes four courses the first semester.

During the summer of 1999 I held several meetings with Bob Gloyd, Susan Laronde, and Mike Young from the College of Engineering's computing facilities and Peggy Berry and David Dart from the Mechanical Engineering computing facilities to discuss the storage needs of this project. It was determined that the portfolios would reside on the M.E. network but access to the college system could be made available remotely from the M.E. network by using a program called Citrix Client. Citrix Client was installed on computers in M.E. department that would be available to the two appointed undergraduates and myself.

In September 1999 I appointed Chris Matthews and Brenda Mijares as undergraduate research students to develop the electronic portfolios. Brenda started developing a WEB page format for the portfolios. A WEB site for each student was created. A format for each WEB site was established and a common biographical format was established to identify each student to a reviewer. Chris started organizing the materials the students generated in ME 302. The FIG students in the ME 302 course spent half their class time in a CADD lab. Using AutoCAD the students spent three weeks creating two-dimensional engineering drawings as .dwg files. The rest of the semester was spent creating and analyzing solid models using AutoCAD. Chris began developing virtual reality routines for manipulating the solid models created by the class. I met regularly with Brenda and Chris to monitor their progress on the project and to make decisions when necessary.

As the project progressed, the undergraduate research assistants and I tried to expand the project to include information that would facilitate the posting of the student's materials on the WEB. We also attempted to address the problems that will be potentially encountered if an electronic portfolio project of this magnitude is begun in the fall 2000 semester. Special care was taken to make the portfolio project interactive. Standardizing the assignments in terms of adopting a common naming nomenclature proved to be extremely beneficial. Coding warning and error messages were also beneficial to tracking the portfolio progress.

After the initial start up on the project we came together for a meeting to look at the pieces of the portfolio project that we had created and to bring them together into a complete package. It was decided that the portfolios had to be organized around the Mechanical Engineering flow chart. We have an AutoCAD drawing that I generated showing all of the classes a student a Mechanical Engineering student has to take to complete the requirements of the BSME degree. The flowchart is organized into eight semesters. Each semester is divided into five to six boxes

with each box representing a course. The boxes are connected by arrows to indicate which courses have prerequisites and which courses have co-requisites. We scanned the flowchart and converted it into an electronic flowchart. A CGI-script was written in Perl to create an Update Form for E-Flowchart so the students could interact with the flowchart and update it from the World Wide Web. The Update Form contains all the courses in a list form and organized into Basic Sequence courses, Supporting courses, and Major Sequence courses. Each course listed has a set of three radial buttons to indicate if the student is taking the course in the fall, spring, or summer. Once the student indicates the courses they have enrolled in the flowchart is updated by coloring the corresponding box on the flowchart yellow as if the student had colored it with a yellow highlighter.

The CGI script further updates the flowchart to make the colored boxes a hot link to a Web page displaying the student's work in that course. It is the student's responsibility to post their course materials on that Web page as they are generated. In courses like the calculus course (M 408C) or the chemistry course (CH 301) a student would generate homework and exams. The student would have to scan their homework and exams and post them on the Web page. Since an ABET evaluator normally doesn't see materials from the courses taken outside the engineering department it was decided that a student could post a representative example of their work in these courses. For example they could scan in the exam they made the highest grade on in the chemistry course or a few representative homework examples. Where we found that the electronic portfolio could be the most useful was in courses where the students did original or creative work. ME 302 was the course that was best suited for the electronic portfolio project.

In ME 302 the students learn various techniques for creating solid models. Each student builds several models from instruction of different engineering products. For example each student creates a solid model of a rack gear as would be used in rack and pinion steering in the automotive industry. The gear is produced by first drawing the profile of the linear gear. The profile is then extruded into the third dimension. The corresponding T shape is then drawn, extruded, and subtracted from the gear to accommodate the T-bar that the rack will be mounted on. The solid models that were produced by the students were imported into a Quicktime VR authoring studio on a Macintosh computer to generate a virtual reality window that could be manipulated by a viewer to see the model from any direction. Other AutoCAD drawings, such as the two dimensional drawing files can be saved as a TIFF files and saved on the Web page also.

All students in ME 302 are organized into teams and assigned a reverse engineering project. The students perform a mechanical dissection of the product they are assigned to reverse engineer and select three to five parts from a subassembly to build a solid model of in the AutoCAD lab. The students then convert the solid model to an STL or stereo lithography file and use the JP5 prototyping system to build a physical solid model of these parts by rapid prototyping. This gives them an excellent vehicle to apply the modeling techniques they have learned by the CADD lab instruction exercises. It also provides the students with original project materials to place in their electronic portfolios. With the use of a digital camera the students can photograph the rapid prototype models and place them in their portfolios as JPEG images.

D. Benefits and Products Expected

At the end of the fall 1999 semester we have our Web site in place and located on the Mechanical Engineering server. The computers that are employed as the servers in Mechanical Engineering had more than enough memory to accommodate the 24 electronic portfolios that we created. Courses that are not design courses create a minimum amount of data. In fact the data that courses similar to the calculus and chemistry courses generated, only homework assignments and examinations, are negligible when compared to the data the design course created. Students taking non design oriented courses will need less than one megabyte of storage space per semester. ME 302 on the other hand needed five megabytes of storage space. It is estimated that the 4000 to 5000 undergraduates students in the College of Engineering could store the electronic portfolios over four years of student work in less than 50 gigabytes of computer storage space. Ten or more years ago this might have been a problem but today 50 gigabytes is easily attained with just a couple of desk top computers.

On February 25, 2000 I was the guest speaker at the February Brown Bag luncheon Seminar in the Dean of Engineering's large conference room. At the luncheon I presented the model of the electronic portfolio that the students had created. You can view the portfolio project at <http://www.me.utexas.edu/~billy>.

It was my recommendation that the College of Engineering adopt electronic portfolios as the method of choice for documenting continuous quality improvement and to show evidence of meeting outcome-based accreditation standards. However, if the College of Engineering adopts my recommendation it must be aware that the electronic portfolios will not create themselves. Students will have to be assigned to faculty for supervision and the faculty will have to monitor the students progress. This will place additional burdens on faculty and students. Regardless of the amount of additional work and hassles that will inevitably be encountered, I still feel that electronic portfolios are the appropriate solution to the ABET EC 2000 requirements we will all have to meet in the near future.