Bridges for Engineering Education: Exploring ePortfolios in Engineering Education at Virginia Tech

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Abstract

One of the objectives of an engineering/education collaborative known as Bridges for Engineering Education, Virginia Tech (BEEVT) is to create a contemporary framework for undergraduate engineering pedagogy. Among the issues being studied by the collaborative is the use of ePortfolios in the education of engineers. Several BEEVT investigators and selected engineering students participated in a pilot of the Virginia Tech Electronic Portfolio (VTeP) in fall 2003. This paper presents a review of studies on the use of portfolios and summarizes the findings of the pilot. The future plans of BEEVT investigators targeted at developing guidelines for the use and evaluation of ePortfolios for improving both student learning and engineering programs are also briefly discussed.

1. Introduction

In fall 2003, a group of engineering and education faculty at Virginia Tech received a planning grant from NSF under its Bridges for Engineering Education program. A goal of this collaborative effort, known as Bridges for Engineering Education, Virginia Tech (BEEVT), is to initiate long-lasting collaborative relationships between the engineering and education faculty at Virginia Tech. In pursuit of this goal, one of the objectives is to create a framework for undergraduate engineering pedagogy based on contemporary learning theory. The use of ePortfolios in engineering education is one of the initiatives to meet this objective.

The timing of the BEEVT effort coincides with a pilot at the university exploring the use of an ePortfolio system called Virginia Tech Electronic Portfolio System (VTeP). Several BEEVT investigators, representing Engineering Fundamentals, Civil and Environmental Engineering, and Mining and Minerals Engineering, selected students to participate in the VTeP pilot. This paper presents a review of studies on the use of portfolios, summarizes the findings of the pilot, and analyzes use of the ePortfolio as a tool to improve engineering pedagogy at Virginia Tech.

Future plans targeted at developing guidelines for the use and evaluation of ePortfolios for improving both student learning and engineering programs are also briefly discussed.

2. Literature Review

Paulson, et al.[1] have defined a portfolio as a 'purposeful collection of student work that exhibits the student's efforts, progress, and achievements. The collection must include student participation in selecting contents, the criteria for selection, the criteria for judging merit, and evidence of student self-reflection.' Cambridge, et al.[2] observed that portfolios have at least four features that represent improvements in standard educational practice (see also, Hamp-Lyons and Condon[3]). These include: (i) opportunity to better represent the work, both in terms of demonstrating multiple examples and collecting work samples over time; (ii) development of context, which is part of the reflective process that students are drawn into via portfolios; (iii) shift of control to the learner in terms of selection of material for the portfolio that creates potential for a much richer self-assessment process; and (iv) evidence that learning is a process that extends over time. In this sense, portfolios are sensitive to real learning rather than "learning" that is measured in small increments of time and with discrete instruments such as classroom tests[4].

From a learning theory perspective, portfolios give the opportunity to highlight and support approaches to learning that have emerged over recent decades but are still not adequately implemented in schools. One key emphasis is the need for more reflective activity. As Norman[5] points out, much of education is concerned with experiencing various phenomena (at the extreme leading to the notion of education as entertainment), with much less time and energy devoted to reflective cognition. Experiencing tends to be relatively easy, while reflection tends to be more difficult and needing the support of others. When we create the expectation for systematic reflection via portfolios, students are potentially brought into a more healthy balance with respect to experiential and reflective cognition.

Lehtonen[6] observes that, in addition to the pedagogical benefits of portfolios, ePortfolios (i) foster active learning and motivate students; (ii) offer multiple modes of expression including visual, audio, and interactive means; and (iii) are accessible and easy to upgrade. Emmett[7] presents a detailed literature review on the use of ePortfolios along with student experiences at the Queensland University of Technology. While pointing to the need to remain competitive in a knowledge based society, he draws attention to the paradigm shift in education from the one of teacher centered to that of learner centered. The American Association for Higher Education[8] has outlined the standards and specification for ePortfolios. Leifer, et al.[9] at Stanford present a triple loop learning model within the framework of an ePortfolio for effective learning. The outer first loop of learning involves peer to peer interaction; the second intermediate loop has peer to coach interaction where the coach need not be a content expert but guides the activity; the third innermost loop has peer to management interaction creating formal knowledge at the professional level.

Heinricher, et al.[10] present results of testing three portfolio models (i.e., global portfolios, course-based portfolio, and departmental model) at Worchester Polytechnic Institute with a goal to determine if student portfolios could be simultaneously useful for program outcome assessment, helpful in student learning, and logistically feasible. The authors conclude that requiring students in selected courses to complete portfolios entries solves most of logistics problems associated with a large-scale portfolio plan. While commenting on the use of portfolios to assess engineering communication, Williams[11] suggests that portfolios used in engineering education should be designed to document student learning in more technical areas, such as engineering practice, experiments, design, etc., and portfolio models adopted from language arts and education fields may not offer what engineering students/faculty need. The author further emphasizes the need for more research demonstrating the benefits of portfolios over other data collection methods. Brodeur[12] provides a motivating example of ePortfolio utilization at the Massachusetts Institute of Technology in assessing student learning in their Aeronautics and Astronautics program along with a good literature review. She points to the mapping between the ABET accreditation standards (learning objectives) and their curriculum reform and the role of the ePortfolio as a measure of the student achievement in the objectives. Rogers and Williams[13] have discussed various stages of the development of an ePortfolio system at the Rose-Hulman Institute of Technology, called RosE-Portfolio, through the two and a half years of planning, design, development, testing, and improvement, leading to implementation.

Despite the numerous works cited above, the use of ePortfolios in education, especially in engineering education, is still in its infancy. In a seminar delivered at the Virginia Tech campus on October 17, 2003, Yancey[14] discussed various models, definitions, and promising directions related to electronic portfolios. She raised thought provoking questions related to portfolio development including 'Where will students do this work, and why?', 'What effects will portfolios exert?', 'Is there a relationship between electronic linking and cognitive linking?' These questions and others are among those beginning to be studied through a pilot ePortfolio program at Virginia Tech.

3. Pilot ePortfolio Project at Virginia Tech

VTeP, the new university wide Virginia Tech Electronic Portfolio system, enables students to easily create, manage, and share web-accessed electronic portfolios that document their knowledge, skills, and achievements from coursework and from extracurricular activities. Campus discussions of electronic portfolios began in 2002 as part of a special study of Virginia Tech's Core Curriculum. Out of these discussions emerged a recommendation to use electronic portfolios to support student reflection and the thoughtful accumulation of academic work over time. For this purpose, planning began in the summer of 2003 and a pilot project was launched during the fall semester. Educational Technologies and the Center for Excellence in Undergraduate Teaching (CEUT) facilitated the pilot project and recruited a study group of faculty to explore uses of electronic portfolios in their fall 2003 courses. Educational Technologies likewise began to investigate infrastructure, software, and operational requirements for a reliable, robust, and easy to use portfolio system.

Over 275 students and 12 faculty representing a variety of departments, including English, Communications, Engineering Fundamentals, Civil and Environmental Engineering, Mining and Minerals Engineering, Agricultural Economics, Interdisciplinary Studies, and the Graduate School explored uses of ePortfolios during fall 2003. Several faculty members used the ePortfolio to replace the traditional paper portfolio in their classes, hoping that students would see their progress as communicators and the integration between courses. Other pilot program participants hoped that the ePortfolio would facilitate student ability to reflect and learn within and across the curriculum. The ePortfolio was also piloted as a professional development tool for creating a teaching portfolio.

The ePortfolio software chosen was originally developed by the University of Minnesota and is now made available through the Open Source Portfolio Initiative (OSPI). Virginia Tech is a charter participant in the OSPI project and is one of the first universities in the world to successfully implement the OSPI software. The users are provided password protected accounts with 50 MB space. More information is available at http://eportfolio.vt.edu. Upon login, the user is presented the option of entering one of the three primary areas of the system, Enter, Share, or View. The Enter option allows the user to record and update portfolio entries. The Share option allows the user to share information from the portfolio with others by creating folders containing only the information that is to be shared. Multiple folders, or custom views, of the ePortfolio can be created and shared with instructors, research partners, and potential employers. The View option provides the user entry into all folders that have been shared with him/her by other VTeP users. The user also has the option of changing account information, viewing frequently asked questions, viewing an element map of all the categories and subcategories available for use, and of course logging out.

The user's portfolio is developed though the Enter option. The software provides a template with categories and subcategories into which information can be added. A typical entry may include a title, description, and one or more attached documents containing writing samples, presentations, data, or images. The portfolio software encourages links between such categories as work experience, internships, service learning experiences, and professional goals and standards. By providing a text field labeled "Description" for most elements in the ePortfolio, the software encourages reflection.

4. College of Engineering Results

4.1 Participant Profile

Five College of Engineering faculty members and 28 engineering students working with these faculty members participated in the pilot (see Table 1). Participation in the VTeP pilot was voluntary for all except 15 freshmen. These 15 first semester students were enrolled in both the first and second Introduction to Engineering courses simultaneously and were required to participate. Twenty of the 28 students that participated were honors students.

Table 1: Students' major and academic level

Department	Freshman	Sophomore	Junior	Senior	Graduate
Engineering Fundamentals (EF)	23*				
Mining & Minerals Eng. (MinE)		1	2		1
Civil & Env. Eng. (CEE)			1		

* Eight students participated voluntarily

4.2 ePortfolio Assignment

Student participants in Engineering Fundamentals (EF) were provided access to the VTeP software and encouraged by faculty to explore the system and provide suggestions for possible uses. These freshman students were instructed to select at least one project from their Introduction to Engineering course to publish in their ePortfolio in addition to any other information or materials they wished to include. Two of the three EF faculty members provided no guidance on where to place the requested information and material while the third provided the students with suggested locations for the materials. Students in Mining and Minerals Engineering (MinE) were instructed to use the VTeP software as they saw fit. These students did not use the ePortfolio as part of a particular course. They received minimal guidance from the participating faculty member. The Civil and Environmental Engineering (CEE) student used the VTeP in a junior level Fluids Mechanics course. He was asked to include a specific assignment in his ePortfolio. All students were asked to share a view of their ePortfolio with their faculty member.

4.3 Feedback from Students

All students were provided with a survey (15 questions) to provide feedback. The survey questions were designed by the participating faculty to address three main issues: (i) ePortfolio software evaluation, (ii) ePortfolio development, and (iii) use of the ePortfolio to improve learning. Seventeen of the 28 students responded to survey. In the following sections a brief analysis of student responses is presented.

4.3.1 ePortfolio Software Evaluation

In evaluating the VTeP software, students were asked to indicate the amount of time they spent exploring the software and the degree of difficulty they attributed to the software. They were also asked to identify aspects of the software they particularly liked and to explicitly address the templated nature of the software. The majority of the students indicated that they spent 1-5 hours exploring the software and found it easy to use, as can be seen in Tables 2 and 3 below. The software features students liked included:

- ease of use and navigation
- the logical layout of categories which help sort and guide selection of information to include
- professional appearance

- the ability to effectively manage a wide variety of files
- being able to store all the information that one would need to provide a prospective employer
- the ability to include detailed descriptions of work experiences that cannot be included in a resume
- the expectation of adding a description of materials included in the ePortfolio
- the ability to selectively share material

Table 2: Student perceived level of difficulty of ePortfolio software.

How difficult or easy was the ePortfolio software to use?				
Very Easy	Easy	Moderately Difficult	Difficult	Very Difficult
3	9	3	1	1

Table 3: Time spent by students exploring the software.

How much time did you spend exploring the ePortfolio software?				
< 1 hour	1 – 5 hours	5 – 10 hours	10 – 20 hours	> 20 hours
2	10	4	1	0

In general, 76% of the students liked the templated structure of the VTeP software. The following student statement summarizes the typical response supporting the use of templated software:

> "Preformatted templates allow a beginner to start somewhere. Also, templates provide a readymade place for generic information. Templates convey to a greater depth the purpose of portfolio and the kinds of things should be included."

However, 23% of the students that liked the templated portfolio also either expressed concern that they had difficulty deciding where certain material should be included because it did not directly fit into any of the predefined categories, or expressed an interest in being able to add user defined elements and categories or to toggle between a templated and non-templated version of the ePortfolio. Students supporting a non-templated ePortfolio recognized that "the way a user designs his/her portfolio can say a lot about him/her to a viewer" and that "free format (e.g., non-templated) will let an individual make his/her portfolio different not only in content but also presentation."

4.3.2 Portfolio Development

The end of semester survey also included questions to evaluate the development of the student portfolios. Students were asked to describe the items they included in their ePortfolio. The students were also asked what guidance they felt they needed from their instructor in preparing the ePortfolio. In addition the students were asked what motivated them to participate in the pilot study and if they wanted to continue to use VTeP in the future.

Survey responses were received from 13 of the 23 first year engineering students who participated in the VTeP pilot. Sixty nine percent of these students included in their portfolio only what was suggested by the faculty member. This included some personal information, academic information such as classes taken, résumés for some students, a reflection on the semester for others, and for all the first year students an example of a design project from the course. The other 31%, all honors students, included additional information, e.g., newspaper articles showing active participation in high school, a link to a website created by the student showing experience in web design and publication, photos of a hobby, a sample program that illustrates the programming skills of the student, papers for other courses, and evidence of student involvement in engineering societies. Figure 1 is a combination of several screen captures showing an example of material loaded by one of the first year students.

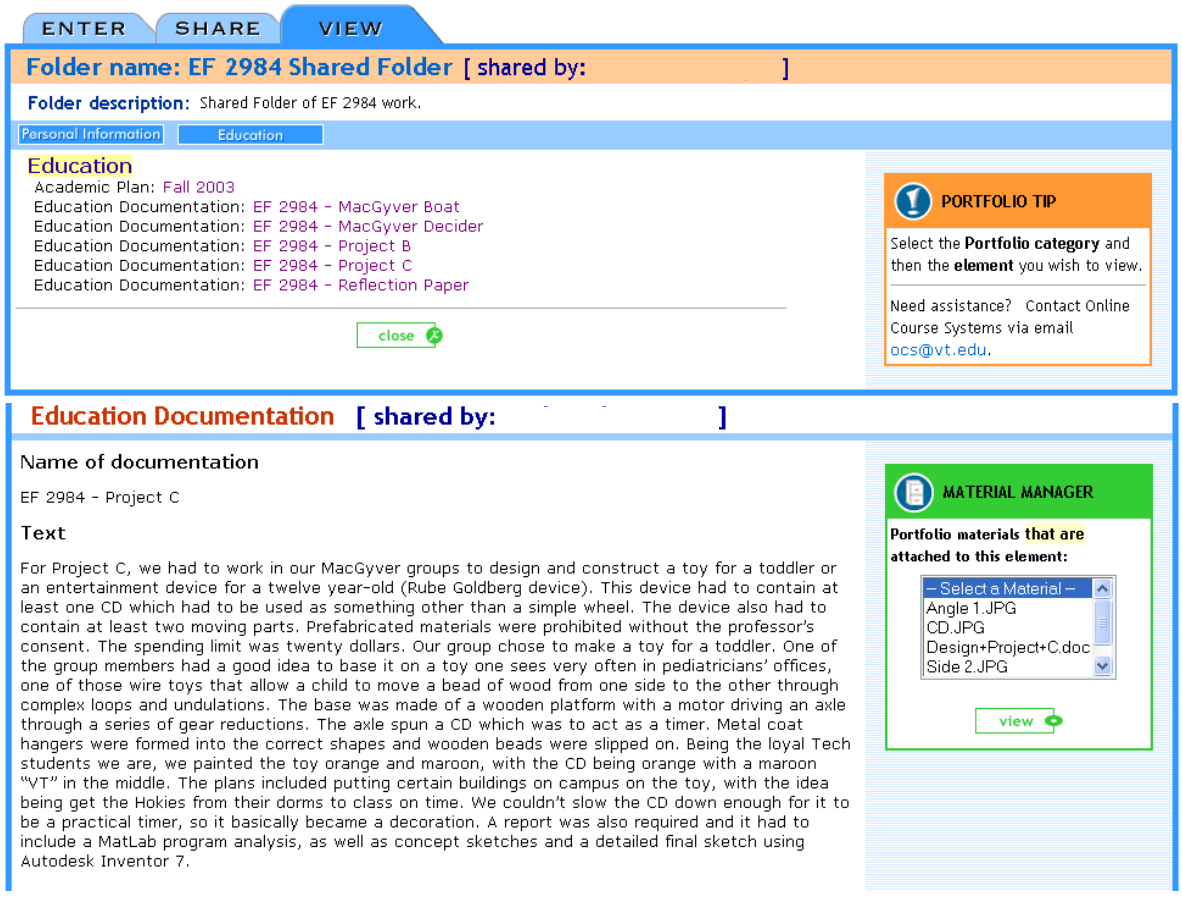

Figure 1: View of a first year student's ePortfolio shared with instructor.

The upper-level students (two juniors and one graduate student) from Mining and Minerals Engineering who had more work experience used the software to produce extended résumés. An example of one student's use of the software for employment documentation is shown in Figure 2. Generally these students used the software to document employment and/or coursework

history, and to showcase particular items of coursework that exemplified important skills or talents. The sophomore MinE student used the software to document her achievements in course work over a semester, archiving writing assignments generated throughout the semester in several courses.

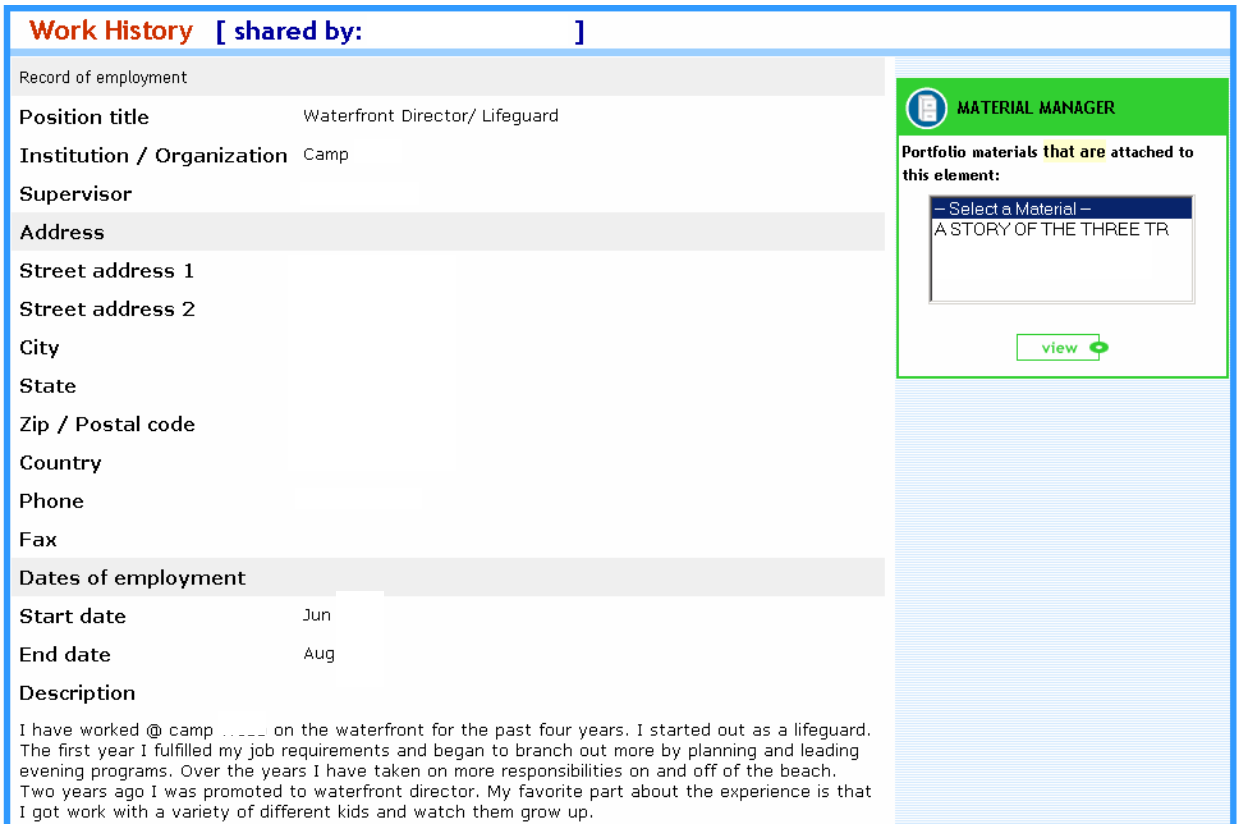

Figure 2: The use of ePortfolio software for employment history documentation. (Some information has been purposefully hidden to protect student privacy.)

Knowing that the students had been provided with very few guidelines for developing their ePortfolios, they were asked what guidelines they expected from an instructor. The students that were provided with guidelines for the location of required elements indicated that they expected this, but that this was all that was needed. The students who were instructed to explore and use the software as they wished, on the other hand, indicated that they wouldn't expect any guidelines since the ePortfolio should be a reflection of the person creating it. The graduate student participant however recognized that when the ePortfolio is integrated into the curriculum there may be a need for some detailed guidelines.

The students who voluntarily selected to participate in the VTeP pilot gave several reasons for doing so. Six students explicitly expressed a desire to have a means to create a record of achievements in a professional format. They recognized the value of organizing this information

and being able to share it with perspective employers. Two students indicated that they participated because they enjoy being involved in novel projects and those associated with engineering and technology. One student indicated that she had created a portfolio in high school and was intrigued by creating an online portfolio.

Eighty-eight percent of the engineering students who participated in the fall 2003 VTeP pilot expressed satisfaction in the experience and a desire to continue to develop their ePortfolio. They cite an advantage in being able to keep a record of achievements and job experience and feel that the ePortfolio will benefit them in future job searches. In addition, four students expressed a desire to delve deeper into the system than they had time to do during the semester. Only two of the participating students indicated that they did not wish to continue in the pilot. One felt that the software was too difficult to manage and the other did not feel that the VTeP software provided any benefit over course management software or email.

4.3.3. Student Learning Experiences

To address the issue of improving learning, students were asked if they felt they had produced anything during the semester that they wanted to include in their portfolio, how they thought the ePortfolio could be used in their curriculum to improve learning, and if they thought all students should be required to develop and maintain an ePortfolio.

Students enrolled in the Introduction to Engineering courses were proud of their design projects and felt that it was worthwhile to post not only the final report itself but also photos and video of both the design process in action and the final product. While they were expected by their instructors to include the project report in the ePortfolio, the students felt it was also important to document the process leading to the report. These students also felt that examples of their CAD work and programming from the semester were worthy of including. As mentioned previously the second year MinE student chose to document her progress in an elective course and felt that it was important to include papers written throughout the semester. The MinE graduate student felt that it was important to showcase major labs and reports from the semester.

Collectively the students provided several suggestions for using the ePortfolio to aid in the learning process. Most students felt that it was helpful to include important projects with several students specifically mentioning that the structure of the ePortfolio encouraged them to reflect on the project, which they found beneficial. Some examples of students' observations are:

> "I think that using an ePortfolio for a class could help aid in the learning process because it encourages students to reflect upon their work and their overall experiences with and in the class."

> "It would give you an opportunity to look back and reflect on what you did earlier in your college career, or even the semester you're in, and try to improve your next assignment."

Sharing ePortfolio elements and receiving feedback within the ePortfolio on projects, assignments, and other items was another way one student felt the ePortfolio would aid in the

learning process. And in design classes the ePortfolio was suggested as a means to facilitate the design process, using it as a medium to share ideas with part of the ePortfolio space being used as a log book from which team members could view other team member's ideas. However, one student also expressed that she does not see the ePortfolio as a tool to help within a class, rather a way to show off coursework later, a way to organize and document important projects before they get lost.

The students provided a mixed reaction to the idea of a mandatory ePortfolio for all students. Sixty two percent of the students felt that the ePortfolio should be mandatory, primarily citing the benefit of maintaining a record of their progression that they might not otherwise have. Only 18% of the students felt that using VTeP was too time consuming, difficult, and not worthwhile, and 2 students did not want to see a mandatory ePortfolio because it would take away the advantage they gained by choosing to maintain the portfolio.

4.4 Feedback from Faculty

The five College of Engineering faculty participants in the VTeP pilot began the semester having no more experience with ePortfolios than their students. Through exploration of the software by both their students and themselves they hoped to identify possible uses of the ePortfolio specifically to support student learning in and across the curriculum and to support the assessment of engineering programs. They met regularly as a group, with the director of the Center for Excellence in Undergraduate Teaching, an educational psychologist, to share ideas and findings.

Following Mourtos[15], students in the junior level Fluid Mechanics class CEE 3304 were offered assignment options designed to demonstrate student achievement. The students were required to formulate and solve a problem of their choice illustrating the principle of momentum balance. The problem was graded for creativity, complexity, comprehensiveness, and presentation. One student was asked to create an ePortfolio entry for the assignment. Use of the ePortfolio in this assignment represented a minor addition in time required to complete the assignment and was found to be a successful medium for presentation. The assignment itself provides an opportunity for improved student learning; the use of the ePortfolio as the medium for delivery provides additional opportunity for improving learning through feedback and reflection and through showcasing the student work. Figure 3 includes a portion of the student's ePortfolio entry.

In reviewing the ePortfolio views shared by the students, the faculty noted that even with the templated software, and for some students guidance on categories to use for specific material, the students maintained the ability to "customize" their ePortfolio through how they chose to organize and present their portfolios. In addition, without specific instructions, different students chose to use or not use certain features of the software, specifically those providing the student the opportunity to describe and reflect on the materials included. This highlights the need to provide the students with guidance and to develop rubrics for evaluation of the ePortfolio if it is to be used as a tool for developing the reflective learner. Surprisingly, among the pilot participants, there does not appear to be correlation between academic level and apparent

academic maturity as evidenced by the selection of material to include in the ePortfolio or the style of the entries.

In using the ePortfolio for himself, one faculty member found that the software could be used as a secure repository for all course assessment data collected for the past five years. This and other possibilities for program assessment will be explored in the continuing pilot.

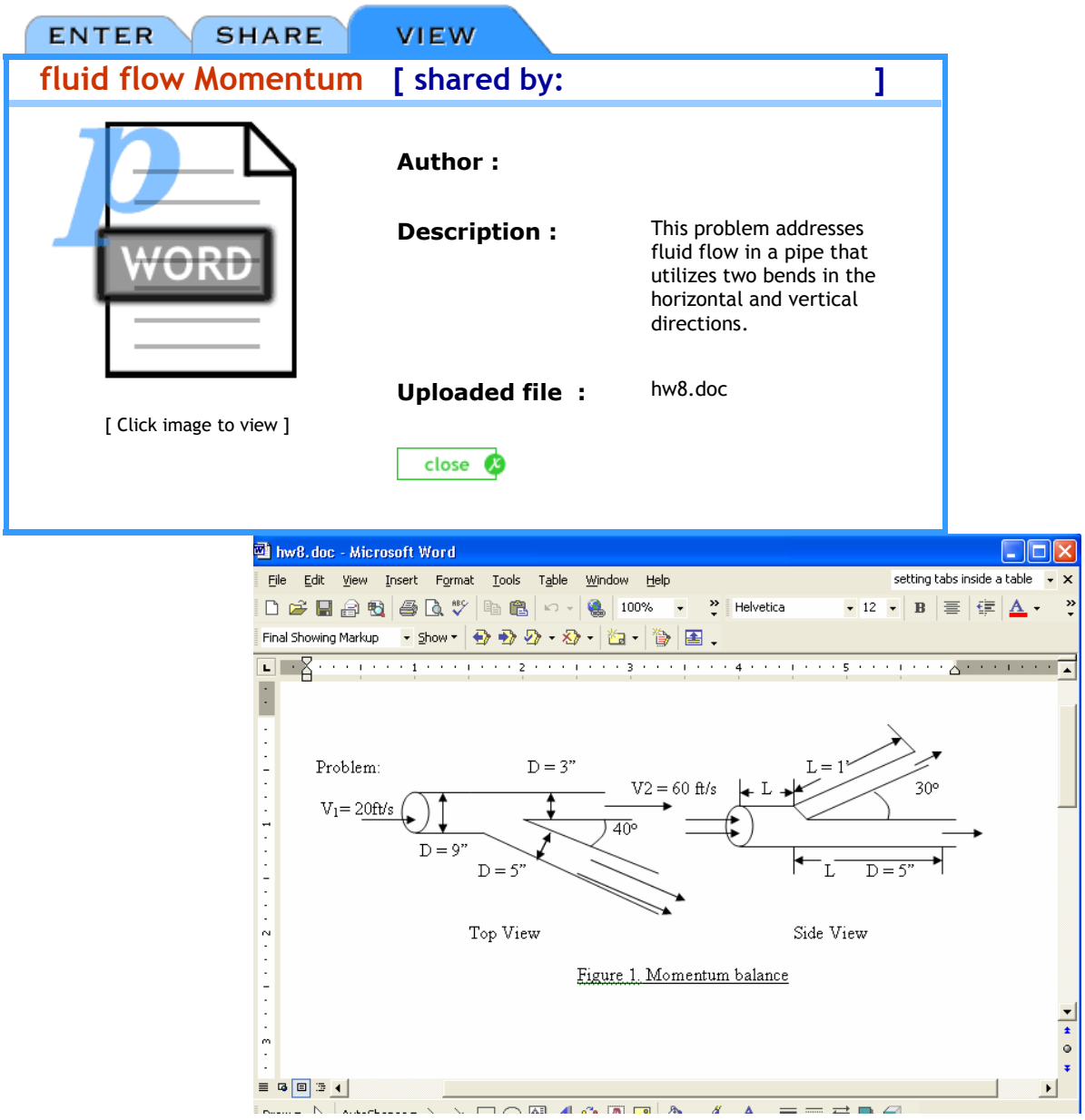

Figure 3: An example of the use of ePortfolios in increasing student learning – one student's solution for the principle of momentum balance.

5. The Next Step

The VTeP pilot project will continue in the spring 2004 semester. Additional faculty, from various colleges and departments across the university, have been recruited to participate. A multidisciplinary group of these faculty will meet throughout the semester to discuss the use of the portfolio as both a learning and an assessment tool, and to work with the University's Educational Technologies division that is providing the infrastructure for the ePortfolio system.

Within the College of Engineering, in addition to the current participants, a faculty member in Materials Science and Engineering will also pilot the software. We will involve a larger number of engineering students. In this next phase of the pilot the ePortfolio will be used in documenting improvements in student writing skills over the course of a semester, and in aiding with program assessment as discussed below.

5.1 Improving Student Writing and Communication Skills

Laboratory courses are generally quite useful for addressing student writing skills. This is particularly true for those courses at Virginia Tech that have been designated as Writing Intensive. During the spring semester of 2004, students in a senior level Mining and Minerals Engineering laboratory course, will use the ePortfolio software to submit laboratory reports and obtain instructor feedback. Since feedback is provided by two instructors, one who addresses the technical issues of the report and one who addresses the communications issues, on-line submission will allow both instructors to assess the reports at the same time, making the feedback process more efficient. The ePortfolio software will also provide each student with a record of all their laboratory reports so that they can learn from past mistakes and view their progress throughout the semester. Finally, the ePortfolio software will be used by the instructor to post those reports that are judged to be exceptional as a means of improving writing skills in all the students taking the course.

In Engineering Fundamentals, the majority of the first year students will take an engineering design class in the spring. This course involves a semester long design project and students are required to document their work by submitting a design report. Students in one section of the course will use the ePortfolio for submission of their design reports. The quality of the reports submitted through the ePortfolio system will be compared with those submitted on paper.

In a junior level Materials Science and Engineering communications course, the potential of the ePortfolio to offer new mechanisms for assessing both the product, or document, and process of preparing the document for a particular audience and purpose will be evaluated. Success of the pilot will be evaluated based on ease of use, types and quality of information captured, and correlations between students' reflections and the success on subsequent assignments.

5.2 Assessment of Engineering Programs

The assessment of programs in meeting objectives a-k of ABET Criterion 3 can be a time consuming process that requires a significant investment of valuable faculty resources. As a

result, most programs continue to look for ways to make this process less intrusive on faculty time so that broader faculty participation can be achieved. We propose to explore the potential of the VTeP software to collect departmental assessment data. For example, in the Department of Mining and Minerals Engineering, two applications of the ePortfolio software are being tested as a means of aiding in the assessment process. In the first case, the software is being used as a secure repository for all course assessment data collected for the past five years. At this time, only learning objective survey data have been posted, however, it is envisioned that other information, including samples of student work, will be available on this site. Those faculty members responsible for a given course are provided with access privileges to the information for that course. In addition, members of the department curriculum committee are given access to all information on the site. By having course assessment information available at the click of a mouse, it is hoped that more faculty members will go back and look at the assessment history of their courses when considering course changes and improvements. In the second case, the ePortfolio software will be used as a traditional portfolio for each student to create during their time in the program. However, in this case, the faculty will identify specific items (assignments, papers, etc.) that each student is to load into the portfolio as they advance through the curriculum. The items to be loaded will be selected in such a way to document achievements in each of the ABET a-k criteria.

6. Summary and Future Work

The College of Engineering participation in the VTeP pilot in fall 2003 was a successful endeavor. Eighty-eight percent of student participants want to continue to use the software, recognizing the benefit in keeping samples of academic work and a record of academic progress. While some students see the ePortfolio primarily as a repository for information, others recognize the benefit of the reflection supported by the ePortfolio. As a result of their involvement in the pilot, the faculty participants have a better idea of the potential of the ePortfolio in the learning process. They recognize a need to teach students to use the ePortfolio as an aid in learning and self evaluation. They have also begun to identify uses of the ePortfolio in program evaluation.

As ePortfolios are integrated into the engineering program at Virginia Tech there remain a number of issues that must be addressed. We are fortunate that the university as a whole is committed to the use of ePortfolios and that we have a dedicated Educational Technologies division working on both developing the software to meet the needs of the university community and providing the infrastructure to support the system. For students in programs such as Architecture and Engineering the 50 MB provided for each portfolio at the present time will easily be exceeded if the ePortfolio is used throughout the student's undergraduate career. Although the possibility of increasing the amount of storage space available to each student is being investigated, at some point there will necessarily be a limit to the amount of space that can be provided. As we develop our plans for the use of the ePortfolio throughout the engineering curricula we must be aware of the amount of space that will be needed for our intended purposes of assessment and improving student learning, and identify methods to work within the limits. To support our desire for the ePortfolio to function as an aid for student learning we must develop methods to guide our students to develop the ability to learn though reflection. We must

provide them with guidance for selecting materials to include in their portfolio, and when the time comes, for selecting materials that must be removed due to space constraints. We must also develop rubrics for evaluating the value of the ePortfolio in this process. The collaboration with our colleagues in the school of education, that was begin with an NSF Bridges for Engineering Education planning grant, is a critical aspect of this initiative. A team of engineering and educational faculty is currently working on these issues. Finally, to support our desire for the ePortfolio to aid in program assessment we must likewise develop guidelines, procedures and evaluation rubrics. Presently a team of engineering faculty is working with the assessment coordinator for the University to address these issues. And already, the possibility of providing an ePortfolio for each of the 1500 entering freshman engineering students at Virginia Tech fall 2004 is being broached.

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In fall 2003, a group of engineering and education faculty at Virginia Tech received a planning grant from NSF under its Bridges for Engineering Education program. A goal of this collaborative effort, known as Bridges for Engineering Education, Virginia Tech (BEEVT), is to initiate long-lasting collaborative relationships between the engineering and education faculty at Virginia Tech.Â The timing of the BEEVT effort coincides with a pilot at the university exploring the use of an ePortfolio system called Virginia Tech Electronic Portfolio System (VTeP). Several BEEVT investigators, representing Engineering Fundamentals, Civil and Environmental Engineering, and Mining and Minerals Engineering, selected students to participate in the VTeP pilot. Current Virginia Tech undergraduate students who wish to change to a degree-granting engineering major need to apply through the Change of Major application. This process only happens three times per year. Find out more about the change of major application and process on the Department of Engineering Educationâ€™s Change of Major website. Prospective students should visit the Office of Undergraduate Admissionâ€™s website to learn about the admissions process for Virginia Techâ€™s College of Engineering and are encouraged to attend a College of Engineering Information Session which are held Monday-F...Â Related majors outside the College of Engineering at Virginia Tech: Biotechnology. Environmental.