AC 2007-465: EVERYDAY PROJECT MANAGEMENT PRODUCTS ARCHIVED AS E-PORTFOLIO: EVIDENCE OF SOCIAL LEARNING IN AN ENGINEERING DESIGN CURRICULUM

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Abstract

Electronic portfolios (e-portfolios) have steadily increased in popularity in recent years as a platform for students, teachers and programs to collect, reflect on and revise their work. E-Portfolios in education are ideally student-centered and outcomes-based, i.e. students use e-portfolios to evidence learning that showcases authentic work, connections between ideas and courses over time, and culminating achievements. However, on-the-ground implementation of e-portfolios poses some practical challenges in meeting these goals. First, introducing e-portfolio typically means introducing a new platform into the curriculum. This requires new technology skills and training for students and faculty. Second, e-portfolio platforms that emphasize student learning, reflection, and assessment often marginally support the actual work of producing artifacts. The added workload and technical learning curve students and faculty face in bridging the portfolio-work tool gap can be a significant barrier to adopting new, innovative e-portfolio platforms.

The purpose of this study is to determine how student learning can be evidenced using the project management (PM) and knowledge management (KM) platforms already used in a capstone engineering design course as e-portfolio archives. Specifically, we look at the artifacts, reflections and revisions produced during the regular course of business using PM software and a group wiki for KM. We want to know how KM and PM tools perform as e-portfolios and how to improve the methods and instruments we use to assess student learning by integrating what we know from e-portfolio research with existing data from student and industrial partner assessments. In order to accomplish this, we first identify major themes in the e-portfolio literature. Next, we use a backward-design approach to analyze existing course assessment data according to these themes. Finally, we identify the strengths, areas for improvement and future research using e-portfolios in engineering design.

1. Introduction

Electronic portfolios (e-portfolio) have emerged as a hot education research topic in recent years. The ubiquity of new web-based technologies and the trend in higher education towards outcomes-based assessment of student learning has resulted in a number of institutions initiating e-portfolio projects. Many of these projects focus on the development of new e-portfolio platforms for meeting a wide range of student, faculty, and accreditation needs.[1] Others focus on the implementation of existing open-source, third-party, or in-house platforms that meet student learning and assessment objectives.[2] For these projects, the research questions tend to focus on answering: what artifacts, whose artifacts, for what purpose, and how? Our research questions stem from a reverse approach: What are the e-portfolio attributes of social, management, and communication technologies already in use in active learning environments? How can we leverage the e-portfolio attributes of these electronic archives to improve student work, learning, and assessment and to reduce faculty workload?

Among the research on student e-portfolios, the emphasis is overwhelmingly on individual e-portfolios. There are few, if any, that systematically study the nature and consequences of group e-portfolios in education. In this study, we analyze the strengths and weaknesses of two types of group e-portfolios used in the same senior capstone design course for different purposes. A project management tool, Basecamp, is used to manage everyday planning and communication. A knowledge management tool, WSU Wiki, is used for long-term knowledge sharing beyond the course of a single semester.

2. Background

The Design Clinic, as it is called by participants, is a project-based, ABET-certified program. Students work on industry-sponsored projects for one semester. They are responsible for every aspect of project management, from specification writing to product delivery. In the fall semester of 2005, two new technologies were made available to students, one for project management (PM) and the other for long-term knowledge sharing, or knowledge management (KM). From the beginning, students participated in a research project that analyzes an assessment system for KM and PM group artifacts using multiple methods.[12] Students are actively involved in the design, management, and formative assessment of the tools with which their work is summatively assessed by peers, faculty, and industry partners.

The PM tool is called Basecamp. It is a web-based tool that allows the administrator(s)-- in this case, the Design Clinic instructor—to set up working groups. Each group has a basic set of tools: overview, messages, to-dos, milestones, writeboards, chat, time, files, and people. The overview tab allows whoever is logged on to see an overview of the latest activity, including messages, recently uploaded files, and overdue notices. Messages are threaded and tagged by category. Individuals are assigned tasks using the to-dos list and important milestones can be tracked internally or externally using a version of iCalendar, which allows the user to view project milestones on a desktop computer. Writeboards are collaborative writing pages. Teams can chat with clients real-time using the chat function and log time-on-task using the time tool. Files can be uploaded and tagged into a category, and searched alphabetically, or by date. Contact information is uploaded using the people tool, including photo identification.

A collaborative website, WSU Wiki, is used for KM. WSU Wiki was put into production fall 2005 at Washington State University by WSU's Center for Teaching, Learning and Technology. It uses the same open-source software, MediaWiki, that powers online encyclopedia Wikipedia[14]. The wiki is organized into individual "article" pages, each of which is put into one or more category. Category pages automatically index articles within that category. Every article page has a discussion page "behind" it for discussion and feedback. Article pages also have history pages with an archived list of contributors and versions. Users can search their contributions across articles and versions can be compared using the *dif* function. WSU Wiki uses an editor that functions much like a word processor, but requires "wiki markup" language for formatting. For example, "*" creates a bulleted item or "==" creates a new section. Users can also create User Pages, which are publicly viewable but can only be edited by the user.

3. Literature Review

E-portfolio definitions in the research are diverse and contextual. Six major themes were surfaced in a review of recent studies regarding e-portfolios in education. Each theme represents a strand of questioning and/or research focus:

- **Purpose/ownership**: student, teaching, institutional portfolio[1,2,5,7]

- **Function**: working, learning, assessment, and integrated[1,4,5,6,9,10]

- **Process**: reflective learning, critical thinking, and collaboration[1,3,4,10]

- **Structure**: storage, information management, connections, communication and development. [1,2,3,5]

- **Environment**: distribution, centrality, portability, learning spaces. [2,3,9]

- **Affect**: engagement, workload, technical barriers. [1,5,8,9]

These themes are useful for both defining what is to be accomplished, and for determining a level of success after implementation. That is, they can help guide the development of assessment instruments that leverage e-portfolio affordances. In a review of qualitative data and group artifacts from previous assessment studies[13], we investigate how Design Clinic stakeholders answer these questions in their own words, using student-centered instruments.

4. Methodology

This is an exploratory study. We use a backward design approach to identify the benefit-cost attributes of WSU wiki and Basecamp e-portfolios.[12] The advantages of this methodology are that we can use the information we already have as a starting point—student qualitative data and e-portfolio archives—for unearthing attributes, strengths and weaknesses and making connections between these results and the latest in e-portfolio research.

5. Findings

Students

Student feedback was a catalyst for this study. Students talked easily about the technical, social and educational affordances of the Design Clinic e-portfolios. These students have "grown up digital"[8] and we were struck by their ability to see through new technology to the underlying principles of learning and getting the job done. Looking across focus group data and mid-term feedback results from the past three semesters, students address major themes from the e-portfolio literature:

- **Purpose/ownership:** The KM and PM tools used in the Design Clinic are different (not redundant), complementary, and useful.

- **Function**: The KM and PM tools serve different functions. PM is used for short-term, day-to-day communication, planning, documentation and sharing. KM is used for long-term sharing of lessons learned and resources.

- **Linear Processes:** The PM process is linear. "Projects have to move forward—you've got to finish on time and on target." "Of course you're constantly looking back to the spec and why things happened, but time is ticking."

- **Cyclical Processes**: The KM process is cyclical. "It is useful as a resource in the beginning, when we're just getting started." "We have more to share, later, when we have project experience."

- **Chronological structure:** The PM architecture reflects the linear process. Activities are tracked chronologically, with to-do lists and milestones. The final product is output at the end.

- **Horizontal and vertical structures:** The KM architecture has horizontal (scope) and vertical (depth) dimensions. Over time, the final product floats to the top.

- **Affective:** the facilitator observed in focus group interviews, over the course of three semesters that "high achievers" were the least satisfied with collaborative work. These were the students who suggested most often that the wiki work be divided up into individual tasks for the semester, rather than have it be a collaborative, consensus-based effort. They were also the most likely to express dissatisfaction with having no grades, as project activities are assessed throughout the semester, but not graded.

Students in our assessment study appeared to be keenly aware of the purpose, function, and usefulness of different technologies, and the need for optimization.

Faculty

We identified the following e-portfolio objectives at the beginning of this project: 1) to reduce, rather than add to faculty workload, 2) to leverage the flexible technology skills students bring and support their working independently, and 3) to create archives easily readable by external reviewers.

After three semesters, we have determined that both the wiki and Basecamp significantly reduced faculty workload and support students working independently, with relatively steep and manageable start-up costs (time, energy, and money). Getting started involved, first, prioritizing a technology wish list based on educational objectives and basic functionality. We did not look for a one-size-fit-all technology to satisfy our high-priority requirements. The first priority was project management. After a quick, one-hour online search, Basecamp was selected because it is relatively inexpensive, it does not require any training to use, and supports team communication and collaboration for a project. It takes the site administrator, in this case the Clinic director approximately 2 hours to upload new student and project sponsor contact information and photo identification into project workspaces each semester.

The next priority was to implement a long-term knowledge management system. Student-created websites in past years had been difficult to maintain, as there was semester turnover and the project generally relied on the one or two students who had programming skills. When the university launched an institutional wiki in the fall of 2005, the collaborative authoring capabilities were an exciting and practicable solution to our problem. This is a free, open-source platform, so it is less expensive than Basecamp, but the open structure and mark-up language does require more getting-started help than Basecamp. Most students found the activity prompts and supplemental materials helpful, such as editing help and case study writing tips. A Design Clinic volunteer spent approximately five hours preparing paper and on-line versions of help documents for getting started and initial "getting acquainted" activity prompts. While some students expressed dissatisfaction with having to take the time to learn wiki markup—this was especially true for students who were familiar with other what-you-see-is-what-you-get (WYSIWYG) editors that don't require markup—most agreed that learning to use the wiki was relatively simple and that the benefits outweighed any inconvenience in the beginning.

Industry partners

The third goal was achieved by inviting project sponsors and College advisory board members to evaluate the wiki and Basecamp archives using a professional skills rubric. This process is described in detail in another conference paper by the authors.[13] The wiki archives are available online to the public and consist of an organized network of hyperlinked pages created by students.[15] The topics cover a wide range of professional, social, and team skill information and resources. This is a cumulative resource. It not only provides an overview of student learning, but of organizational learning as well. Many students work in small groups of 2-3 for wiki work. Individual contributions are not tracked, as typically only one person will post the group's contribution. The e-portfolio is evaluated by external-raters as a group artifact.

Basecamp has several archive outputs that can be looked at in different ways and for different purposes. First, the entire semester-long session, including communication, contacts, and work products, is archived with a click of a button at the end of the semester. Second, the important work products, i.e. word documents, spreadsheets, animations, videos, and part files, are downloaded from Basecamp at the end of each semester. A read-me file is created for the downloaded archive, and burned to a disc for project sponsors. A new online version of the downloaded Basecamp archives (non-proprietary projects) is available on the wiki. The Basecamp e-portfolios are posted on the Design Clinic director's user page, which only he can edit.[16]

Looking across focus group data and written comments from the past three semesters, external-raters address major themes from the e-portfolio literature:

- **Purpose/ownership**: most external-raters identified the organizational learning aspect of the wiki— "a legacy of learning," "value-added knowledge," or "tribal knowledge;" — as a major strength. However, some raters indicated that they were uncomfortable with not being able to judge individual contributions, or "who to give the most credit to."

- **Function**: the wiki is for peer communication and "consensus editing;" A benefit is that much of the advice is in "student speak."

- **Process**: "Change is easy. Improvement is difficult." A theme raised by external-raters was the need to emphasize "authentic work," "real design," and "addressing specific problems" related to projects.

- **Structure and Environment**: flexible, multi-purpose systems that can be accessed anytime, anywhere.

- **Affect**: most concerns and areas for improvement fell into this category. Prompting students to engage more deeply in topics, such as safety, conflict resolution, or "questioning colleagues about advice on solutions to specific problems," or documenting lessons learned at the project end. Motivating students to contribute without grades as an incentive—"what will motivate seniors to leave their knowledge behind?" Disseminating this technology. "This should be introduced to freshman and sophomores so they can see what they have to look forward to. They would benefit from interacting with upperclassmen."

6. Discussion and Conclusion

A benefit of analyzing management, communication and social technologies using a framework established from e-portfolio research is that it provides a mechanism for evaluating what students, faculty, and industry partners might agree, or disagree, are the purposes and usefulness of these technologies as e-portfolios. From this initial study, we found that there is substantial agreement among stakeholders that

- e-portfolio archives have multiple, overlapping and complementary purposes.
- the primary function should be communication, project work, and organizational learning, with the added benefit that work can be shared with a wider audience for assessment and showcasing.
- the affective component—such as addressing student motivation, workload requirements, and overcoming technical barriers—is a key factor for success.

Tensions exist regarding beliefs about

- what motivates students—intrinsic versus extrinsic motivation.
- individual versus group evaluations.
- grading (evaluation) versus assessment.

It is our belief that for engineering students and faculty alike, the most important issue involving e-portfolio implementation is time management of the e-portfolio process itself. Both engineering faculty and students are overloaded and will not accept an additional level of quality inspection that requires increased time commitment. The demonstrated e-portfolio method using both KM and PM software lets users develop an e-portfolio quickly out of already-developed work products that match learning outcomes specified by the class requirements. As such, it is easily implemented and easily transferred to other classes and learning environments. Analyzing

tools that work in engineering design using a thematic framework from e-portfolio research provides insights and direction for how to improve the use of KM and PM tools as learning e-portfolios.

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