Division V Assessment Project: ePortfolios in STEM Courses at BCC

Final Report 2013-14

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Purpose: The purpose of the Division V Assessment Project was to adopt electronic portfolios as an alternative assessment tool in STEM courses at the community college. Student artifacts were collected in three different STEM courses and assessed by faculty using the Quantitative Literacy and Problem Solving Valid Assessment of Learning in Undergraduate Education (VALUE) rubrics provided by Association of American Colleges and Universities (AAC&U) initiative.

Background: On college campuses throughout the United States, there has been a shift towards assessing a student's education through learning artifacts and outcomes, instead of through traditional measures, such as grades and graduation rates (AAC&U 2011). The trend is prompted in part by accrediting agencies, which are requiring evidence of learning, and by professional organizations that encourage institutions to document learning outcomes (AAC&U 2011). While there are many different approaches to assessment, ePortfolios are unique, insofar as they capture evidence of student learning over time and in multiple formats and contexts. The advantages of ePortfolios lie in the benefits they offer students. They offer a framework within which a student can personalize their educational experiences, thereby encouraging student ownership of his/her ePortfolio and contents. Another benefit is helping students to develop multimedia capabilities to represent their learning experiences for different audiences. Electronic portfolios encourage a student's own reflection on his/her learning. This type of reflection is especially important in STEM courses, which are designed to integrate concepts between and among STEM disciplines. These influences have fueled growth in student ePortfolios. In

2010, almost half of all public and private institutions used ePortfolios in some fashion on their campuses (Green 2010). This is a remarkable area of growth in an increasingly digital and media driven age.

It is also important to acknowledge the reality of a mobile student population, which is especially true for students enrolled in STEM programs at the community college. Many of these students will transfer to four-year colleges to complete their Bachelor's degrees. Indeed, most students attend multiple institutions during their academic careers. As a result, the ability to transfer evidence of learning from one institution to another is becoming increasingly important (Nguyen 2013). Electronic portfolios provide an easy means for students to transport evidence of their learning from one location to another, from one course to another and from one applied setting to another (AAC&U 2010). This allows other colleges, as well as potential employers, to see beyond the list of courses on their transcripts and to look more closely at the exhibition of the student's cumulative academic achievement. Despite the potential utility of ePortfolios, very few community colleges have adopted them and even fewer still have adopted them in STEM courses (Johnsen 2012). This may be a function of limited resources for faculty development, as well as the conventional application of ePortfolios in capstone courses/projects, which typically occur in four-year college curriculums.

In addition to issues associated with the efficacy of ePortfolios, the research supporting a guiding learning theory has been evolving over the past thirty years. According to Trent Batson in his article, *Situational Learning: A Theoretical Frame to Guide Transformational Change Using Electronic Portfolio Technology*, the concept of "situated learning" is defined as a "humanistic view of learning that envisions learning in real life, occurring constantly, outside the classroom as well as in the classroom…Using the frame of situated learning to inspire and organize electronic portfolios provides educational institutions a rational path towards transformation appropriate to our time" (Batson 2011).

This theory recognizes that experience is necessary for all learning and yet challenges the notion of teacher-centric practices and moves towards a student-centric model. Indeed, George Kuh has identified "high impact practices" which emphasizes the importance of active student learning both inside and outside the classroom (Kuh 2008). In keeping with Kuh's practices, it is reasonable to suggest that ePortfolios provide students with a dynamic and progressive platform from which they can "reflect, integrate and apply" what they have learned throughout their college careers (Kuh 2008). However, students will need the proper tools to assume responsibility for their learning. To that end, ePortfolios present a valuable tool for students to capture their experience in and out of the classroom, as well as to document and reflect on their learning.

Process: Over the course of an academic year, three faculty members from Division V volunteered to assess the efficacy and implementation of e-portfolios in their STEM courses, which were as follows: EGR103 - *Computer Skills for Engineering & Technicians*, BIO239 - *Elements of Microbiology*, MTH 128 - *Mathematics for Elementary School Teachers II*, MTH243 - *Discrete Structures I* and MTH253 - *Calculus III*. In addition, the use of ePortfolios in STEM courses was the subject of a Presidential Fellowship for 2013-14. As a result, the four faculty members collaborated by meeting every other week over the course of an academic year (over 20 one hour meetings) to discuss how to integrate e-portfolios in their curriculum using Digication software. Digication provides a web-based e-Portfolio and assessment management system to colleges, K-12 schools, and professional organizations. The web-based software allows faculty members to create and manage course content, as well as share and view student contributions. Digication was first launched in 2004 at Rhode Island School of Design (RISD) for the sharing of rich media works by the students. Since then, several colleges and universities have adopted the software and it has continued to gain steam as the premier ePortfolio platform in higher education (Reese, 2009).

Before we could begin creating ePortfolios, we had to address a number of issues and/or questions in order to keep us grounded as we progressed with the assessment project. First, we had to define what the *learning outcomes* would be for this project. The Team wanted to make sure that the outcomes were aligned with the "high impact practices" (Kuh 2009) that promote student success. In order to do this, the Team needed to address some basic questions: What is the purpose of the ePortfolio? What are we hoping students will gain by using ePortfolios as an alternate assessment tool? The faculty felt the student artifacts posted on their ePortfolios would provide the outcome we would assess using two of the VALUE rubrics (Problem Solving and Quantitative Literacy). We hoped students would have a digital platform by which they could display their academic achievements in their STEM courses and continue to develop their portfolios with multiple examples of their accomplishments in other courses and other contexts. We also had to explore how comfortable STEM students are with new technologies. After a brief discussion, it was agreed that most students are far savvier with technology than many of their faculty. That said, the Team recognized the additional "layer" of work students would have to undertake in order to develop their ePortfolios. In addition, the faculty Team had to imagine how to design assignments which would go into the ePortfolio and how many student artifacts would be necessary for the assessment project. Finally, the Team would need to reflect on the effectiveness of ePortfolios as an alternate assessment in their STEM courses.

With the invaluable assistance from the college's Instructional Technology Specialist and the Dean of Lash Center for Teaching and Learning, the Team began by examining the VALUE rubrics to determine which of them would be best suited for assignments generated in STEM courses. They selected Quantitative Literacy and Problem Solving. The next step in the process revolved around conversations about how ePortfolios could be used as an assessment tool in the faculty's existing STEM curriculum. Questions developed about which assignments would be best suited for this platform, as well as how those assignments would align with f the selected VALUE rubrics. In addition, the practical

matter of implementing Digication in the classroom became a source of concern for the faculty, who had little or no prior experience with the software. The Instructional Technology Specialist demonstrated how to create ePortfolios in Digication. The Team agreed to pilot the ePortfolios in the fall semester to develop their skills with the software before integrating them in the spring semester. During this time, discussions ranged from whether or not to generate a single template for specific courses and/or departments, to discussions about developing assignments that would present most effectively in the ePortfolio. Another significant concern raised by the Team was how much class time would have to be dedicated to instructing students on how to create an ePortfolio and what, if any, additional support for students could be offered through the college's Center for Instructional Technology Expertise (CITE) lab. For several months, the Team practiced using Digication to upload images, create text, apply mathematical notation, capture real-time events and navigate the integration of other software packages (e.g. CAD and Solid Works). The feedback the Team provided during the bi-weekly meetings was invaluable in determining the efficacy of Digication and ePortfolios in their classrooms as an alternate assessment tool.

As the Team became more familiar with developing ePortfolios in Digication, it became clear that there were several technical hurdles with the software. From the start, it became apparent that Digication was limited in many capacities. The software was cumbersome in its compatibility (or lack thereof) with discipline specific STEM software, such as CAD and Solid Works, as well as importing mathematical notation. Several Team faculty resolved to take "snapshots" of student work and upload the images. In the Biology course (BIO 239), concerns around using cameras (phones or digital cameras) to capture live results during lab experiments became problematic due to the required sterile lab setting. The log-in and privacy settings (set by students when creating their ePortfolios) often limited access to the college community, including professionals in the CITE lab who were enlisted by students seeking technical support for their ePortfolios. Team members also noted the lack of integration with

Angel's eLearning system. In most cases, Digication required a duplication of existing course spaces within eLearning, thus increasing the time, effort, and often frustration of the faculty Team. In addition, the Assessment Management Software (AMS) the Team was planning to use for the assessment of student artifacts was too unwieldy to use. In an effort to resolve some of the technical inefficiencies, the college contacted Digication and met with a member of the software support staff. Unfortunately, they were unable to correct the problems with the AMS component. As a result, the Team assessed student artifacts with pen and paper.

Results: The Team met in March, 2014 to assess the student artifacts collected from three STEM courses (see below). The three STEM faculty Team members used the Quantitative Literacy and Problem Solving VALUE rubrics to determine if the student met the criteria outlined in the rubric for the Benchmark standard (level 1), the Milestone standard (level 2 and 3), or the Capstone standard (level 4), which denotes the highest achievement within each rubric (see Appendix 3 for complete VALUE rubrics). In general terms, Problem Solving is defined as "the process of designing, evaluating and implementing a strategy to answer an open-ended question or achieve a desired goal" and Quantitative Literacy is defined as "the ability to reason and solve quantitative problems from a wide array of authentic contexts and everyday life situations" (AAC&U 2011). Two Team members assessed the other Team member's student artifacts. The names of the students were redacted and each artifact was assigned an alphanumeric to ensure accuracy when scoring.

Note: The artifacts collected in BIO239 did not contain quantitative analyses and therefore, it was determined they were not applicable ("NA") for receiving a score for Quantitative Literacy.

1A through 9J corresponds to artifacts gathered from BIO239- Elements of Microbiology

Artifact	1A	2B	3C	4D	5E	6F	7H	8I	9J
Quantitative Literacy-	NA	NA	NA	NA	NA	NA	NA	NA	NA

Faculty 1									
Quantitative Literacy- Faculty 2	NA	NA	NA	NA	NA	NA	NA	NA	NA
Problem Solving- Faculty 1	2	1-2	2	2-3	1-2	1-2	2	2-3	2-3
Problem Solving- Faculty 2	2	2	3	4	3	3	2	3	4

10K through 19T corresponds to artifacts gathered from EGR103 - Computer Skills for Engineering & Technicians

Artifact	10K	11L	13N	14O	15P	16Q	17R	18S	19T
Quantitative Literacy- Faculty 1	1	2	3	2	3	3	3	2	1
Quantitative Literacy- Faculty 2	1	2	3	1	4	4	3	2	3
Problem Solving- Faculty 1	1	2	3	3	4	4	3	2	2
Problem Solving- Faculty 2	1	2	3	2	4	4	4	3	3

20U through 29D corresponds to artifacts gathered from MTH128 - Mathematics for Elementary School Teachers II

Artifact	20U	21V	22W	23X	24Y	25Z	26A	27B	28C	29D
Quantitative Literacy- Faculty 1	4	1	3	2	4	3	3	3	4	3
Quantitative Literacy- Faculty 2	1-2	2	2	2	2	2	1	1-2	2	2
Problem Solving- Faculty 1	4	1	3	2	4	3	3	3	4	3
Problem Solving- Faculty 2	1	2	2	2	2	2	1-2	1	2	2

Student Responses: A survey of five questions was given to a small sample of students who completed the Research Involving Human Subjects Informed Consent Form. The questions were designed to ascertain the students experience with ePortfolios (for a complete list of student responses, see Appendix 1). The student responses revealed the impact of the ePortfolio. For example, when they were asked about the process of creating the e-portfolio, they typical response was as follows:

> *"Overall it was pretty self-explanatory. I like the fact that it allows for advanced creativity as well with the use of CSS and how easily it can be used to organize various topics."*

Another question on the survey asked students if creating the e-portfolio encouraged them to reflect on their learning in their STEM courses. Most students simply did not see the connection directly, but rather indirectly. A typical response was:

> *"In a certain way…The reflective paragraphs made me reflect about the work. "*

In addition, when students were asked if the e-portfolio helped them to see how their coursework connects to other STEM courses at the College or to their professional goals, most students responded by stating;

> *"Not very much. The only thing that I could say connected me to professional goals was the introduction of the idea of an online portfolio."*

It seems as if students recognize the utility of the ePortfolio, although they have not actualized its full potential. To that end, when students were asked if the e-portfolio could provide a mechanism for them to showcase their knowledge and skills for future internships, employment opportunities and/or continued education, most responses look like the following:

> *"I do believe that the e-portfolio could be a good mechanism to showcase previous work as long as meaningful material is present. I did not present my portfolio but it was nice to know the possibility was there."*

Finally, the students were asked if they had any recommendations to improve the use of ePortfolios. Student responses included statements like;

> "*Start sooner*" and *"Functionality, functionality, functionality. Streamline the features and make it more intuitive to use."*

However, there were thoughtful suggestions as well, like the following*:*

> *"I would say that using the e-portfolios for more relevant work would be a good idea. So for instance if I was a computer science student, I would post work that I did related to computer science in my portfolio."*

This response suggests that the student recognizes the content of an ePortfolio should demonstrate his or her most successful projects in their major field of study, thereby supporting student ownership and responsibility for his/her learning.

Summary: As both a product and a process, ePortfolios can promote deep learning and the transfer of knowledge by fostering the student's ability to make connections between his or her learning experiences in a variety of classroom, workplace and community settings. It is essential that students see the integration of their learning throughout their academic career. The ePortfolios as an alternate assessment tool encourages students to document and demonstrate their their own abilities over time and within a broader landscape. For faculty, ePortfolios offer insight into the process by which students learn, rather than just an end product. Consider the limited nature of a college transcript, which only lists courses and grades and how much more detail and richness the ePortfolio offers in contrast. As a result, transcripts are of limited use for employers in evaluating prospective employees' potential to success (Peter D. Hart Research Associates 2008).

After completing the implementation of ePortfolios as an alternate assessment tool in STEM courses at the college, several lessons can be learned: first, the software selection needs to be robust to

manage the complex “language” associated with STEM curricula. Secondly, faculty would require training and support for implementing ePortolios in their courses. Students would also require an early introduction to ePortfolios, perhaps as early as the enrollment in the College Success Seminar (CSS 101). It is also essential to note that supplemental support for developing student ePortfolios is required through collaboration with faculty in specific STEM disciplines, as well as technical support through the CITE lab. The Team suggested that specific programs and/or departments were best suited to adopt this assessment tool, thus making it customizable to individual programs of study. Finally, the major limitation of the ePortfolio assessment project was Digication itself. Both students and faculty agreed that the interface was cumbersome and often frustrating. That said, most students surveyed did see the potential value and diverse audience (faculty, admissions officers, employers, etc.) for their ePortfolio. This suggests that ePortfolios have the capacity to document student achievement in and out of the classroom during the course of a student’s academic career. This is especially true for community college students who have employment experience and often accumulate academic credits over the course of several years. The ePortfolio provides a dynamic, multimedia platform for students to collect authentic evidence of their academic accomplishments.

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Appendix 1

Student Responses

1. What was the process of creating the e-portfolio like for you?

“Easy because I had all the work done and only needed to upload each project.”

“It wasn't too bad. I thought that it was pretty easy to write my material on the website and save it directly into my portfolio. “

“It was somewhat exhausting because I had to reformat every document. However it was a great way to showcase my coursework “

“For some courses, it made sense to create an e-portfolio, these were the CAD courses, where it would be beneficial to use in the future to showcase what had been accomplished during my school training when presented during an interview so I am prepared for the work world. For others, it was a complete waste of time and seemed very inconvenient and unnecessary. “

“for me, the e-portofolio wasn't bad process at all. I think it's awesome “

“The process was very easy “

“Arduous, tedious, and other synonyms. Specifically, the digication system had a terrible interface. If not used daily, then every use was a learning experience in using digication. “

“Relatively simple, but occasionally the functionality of certain aspects were relatively vague. “

“time consuming, sometimes confusing, and work didn't always format properly. “

“Overall it was pretty self-explanatory. I like the fact that it allows for advanced creativity as well with the use of CSS and how easily it can be used to organize various topics. “

2. Did creating the e-portfolio encourage you to reflect on your learning in your STEM course?

“Yes. It made us become hands on with math”.

“Not very much. It made me reflect on the specific problems that we did for the portfolio, but not as much about what we learned for the course itself. “

“In a certain way. The reflective paragraphs made me reflect about the work. “

“I don't think it would encourage me to reflect, more like a useful tool for CAD design “

“yes it did”

“yes it did “

“Negative. Relating the exercises in the courses to real world applications carries much more weight on my learning. “

“Not particularly, but I did believe it was neat to be able to save things in one place that at some point I would be able to possibly present to a potential employer or educational group.”

“No”

“I'm not sure if it directly made me want to reflect on the work, but by putting the work up on the portfolio, I ended up reviewing it anyways. “

3. Did creating the e-portfolio help you see how your coursework connects to other STEM courses at the College or to your professional goals?

“No”

“Not very much. The only thing that I could say connected me to professional goals was the introduction of the idea of an online portfolio.”

“Not really.”

“nothing more than a useful tool for CAD design”

“yes, it helped me a lot “

“yes”

“Nope. Courses that use the learning from other classes help see how the coursework connects. For example, using calculus in physics and chemistry. Likewise, using physics in chemistry. Also, using mathematics, specifically discrete structures, in computer programming courses, or vice versa. “

“No. I did not see much of a connection through my limited use of the e-portfolio. “

“not at all “

“I saw just as much value in it as a regular portfolio, just more convenient. “

4. Did creating the e-portfolio provide a mechanism for you to showcase your knowledge and skills for future internships, employment opportunities and/or continued education?

“Currently no, but I am transferring and plan on using it to show what i have done in the past.”

“I don't think so. It made me think about how I could set up a portfolio, so that was a good thing about it. I wouldn't show anyone the information in that portfolio because I don't think it is very relevant. “

“Definitely!”

“very much so, especially for CAD courses”

“yes “

“yes”

“No. Learning to make a basic webpage in CIS122 Internet Developer, or learning resume writing in ENG215 Tech. Writing provided a better mechanism.”

“I do believe that the e-portfolio could be a good mechanism to showcase previous work as long as meaningful material is present. I did not present my portfolio but it was nice to know the possibility was there. The functionality of sharing it did seem overly complex though.”

“could be useful that way, but not for me personally.”

“I definitely believe it could be of use.”

5. What improvements would you make to improve the use of e-portfolios?

“Start sooner”.

“I would say that using the e-portfolios for more relevant work would be a good idea. So for instance if I was a computer science student, I would post work that I did related to computer science in my portfolio.”

“Improve and simplify the interface, especially in the customize section. Implement a better word processor, one that doesn't require the student to attach images. “

“only require it for courses that actually could use it(CAD!!!!), other than that, powerpoint or prezi are easier to use and are headache-proof when transferring to the Professors “

“it doesn't really need any improvement since it's great process, but it needs more tools like Microsoft office to make life easy on the students when they post their assignment in e-portofolio “

“I think it was fairly easy but when you copy and paste you have to adjust it and I think that is where a lot of people had an issue. “

“I would add more in class real world applications. Or, as larger projects much like the portfolio project, I would extend certain topics that have real world applications. Although not all students in a particular class have the same major, so a range of real world applications could be available to choose from. However, I personally felt that the portfolio assignments were unneccessarily increasing my workload. I am not the same as every other student though, and I routinely take more credits than other students. Moreover, the reflection process does nothing for me, at least the assigned reflection doesn't. Again, I feel I am not the average student in this respect, and everything I do I reflect on, or learn from. As one last aside, I did not enjoy an english assignment in a math class, I thought I had finished all my english courses.”

“Functionality, functionality, functionality. Streamline the features and make it more intuitive to use. “

“they shouldn't be a requirement “

“To me, it appeared that the biggest problem students had was finding the motivation to use it over paper. The benefits of e-portfolios should be better explained in the future.”

Appendix 2

Example Student ePortfolios

In STEM Courses at the Community College

Appendix 3

Quantitative Literacy VALUE Rubric &

Problem Solving VALUE Rubric