Gathering ABET Student Outcome Evidence Using Technology: What Happens When Results Don't Match Grant Goals and Research Takes an Unexpected Turn?

Elizabeth Freije, Indiana University-Purdue University of Indianapolis

Elizabeth Freije is a Lecturer in the Department of Engineering Technology at Purdue University, Indianapolis. She received her BS in Computer Engineering Technology with a minor in Mathematics. She received her Masters in Technology at Purdue University, Indianapolis. She teaches classes in programming languages, embedded micro-controllers, mobile devices, and programmable logic controllers.

Prof. Barbara Christe, Indiana University-Purdue University of Indianapolis

Barbara Christe is an associate professor and director of the biomedical engineering technology program in the Purdue School of Engineering and Technology at Indiana University Purdue University Indianapolis (IUPUI). She coordinates a unique academic program that prepares engineering technology graduates to support the safe and effective use of medical equipment in the clinical setting. Dr Christe has a bachelor's degree and master's degree in biomedical engineering from Marquette University and Rensselaer at Hartford respectively. Her doctorate is in higher education administration from the University of Phoenix. She conducts research in the clinical applications of radio frequency identification technologies (RFID) as well as STEM student retention.

Prof. Elaine M. Cooney, Indiana University-Purdue University of Indianapolis

Elaine Cooney is the Program Director for Electrical Engineering Technology at Indiana University Purdue University Indianapolis. She is also a Senior IDEAL Scholar with ABET, which means that she presents assessment workshops with other Senior IDEAL Scholars.

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Abstract

Small research grants can offer faculty members the opportunity to explore potential solutions to automate the collection of student outcome evidence as needed to support ABET assessment plans. This paper explores the results of two such grants that sought to utilize a student electronic portfolio to archive evidence and seamlessly aggregate the evidence for assessment purposes. In addition, the integration of an electronic portfolio, the ePDP, could promote both ABET assessment data collection as well as reflective activities to assist students in viewing the curriculum as a developmental process, aggregating evidence over the enrollment years.

However, the research activities exposed several flaws. Taskstream DRF template did not facilitate seamless integration between the instructor's ABET rubrics in Taskstream and the student assignment. Nor did Taskstream aggregate the student work in such a way that the student or the instructor could efficiently analyze its correlation to an ABET student outcome. Specifically, redundant input was required from both the students and the instructors.

Despite the disappointing limitations exposed with the grant funds, and hopeful attempts to resolve the identified flaws, the researchers found an unexpected and satisfying solution outside of the electronic portfolio. The learning management system, Canvas, features the tool: Outcomes. The tool allows mastery statements to be created and shared across courses in a program. The mastery statements can be imported into a specific course, then linked to assignment rubrics, previously created to assess student submissions. Rich information on student outcome attainment is available when the Outcome tool is used consistently by faculty.

Background

First-year students can be profoundly impacted utilizing self-reflection tools embedded in electronic portfolios to promote self-advocacy [1], [2]. Self-reflective prompts offer the first opportunity to identify and explain why students want to achieve a particular academic goal, and what specific steps they are taking to achieve the goal. When identifying the qualities associated with persisting engineering technology students, Christe [3] found strong evidence of a commitment or an attachment to their college work. Student focus fell into two areas: earning a college degree or affinity for their major. This finding was surprising given that most early learners are uncertain of academic goals [4]. Driven by this evidence, self-reflection should deepen student discipline-specific understandings.

Research activities centered on a university-specific electronic portfolio: the Personal Development Plan (ePDP), enabling students to more effectively map out and navigate their academic and co-curricular experiences, as well as their subsequent careers. The ePDP is a personalized planning process that enables students to understand, implement, and chart progress toward their degree and college goals. For more than 10 years, the university has integrated personal development planning into the curriculum. Readers can learn more about this campus

initiative here . This electronic tool has encouraged the development of hope, setting self-concordant goals, increasing self-awareness, and promoted self-authorship [5], [6]. Well established in the first year seminars, the portfolio is intended to be updated throughout the academic career. The ePDP should foster an internal foundation and academic commitment from learners. In addition, the use of an electronic portfolio can foster an improved ability to see the integration of curricular content over time, supporting improved retention.

The program-specific accrediting body associated with engineering technology programs, ETAC of ABET, sets standards and guidelines that offer a framework for the student electronic portfolio. At one Midwestern urban university, engineering technology (ET) program directors have established approximately 10 student outcomes and, associated with each outcome, a set of three or more performance indicators at multiple points throughout the curriculum. Fundamentally, these indicators are developmental milestones with performance targets escalating throughout the curriculum. The establishment and continuous utilization of the detailed assessment plan serves as solid underpinnings for the development of the proposed electronic portfolio.

ET faculty members collect the ABET performance indicator data for the specified class as a whole (for example, aggregate scores on a teamwork section of a project rubric) and report the data annually. Yearly reflection meetings of faculty members analyze the data, exploring expectations and findings. The existing data collection and analysis process serves to document the faculty value placed on the importance of the measurement of achievement throughout the curriculum.

An electronic portfolio allows the aggregate insights gained by faculty from assessment data collection to be extended to the individual student. The electronic portfolio would offer the learner the opportunity to gather and upload performance indicators throughout the curriculum. Because best practice recommends that student outcomes are assessed at multiple points in a curriculum, the students would be able to see the future expectations associated with the individual outcome. Learners would be able to envision all of the components of their program associated with specific developmental milestones in contrast to a dizzying list of courses comprising the degree map.

In addition to the archiving of student work, integrated electronic portfolio reflective exercises would be discipline-specific, purposefully articulating the connections of skills between courses, and the advancement of those skills throughout the curriculum. While not all ET students may be capable of deep personal reflection, activities associated with this electronic portfolio would involve observations about technical skills, the extension of problem solving abilities, and readiness for capstone projects. In addition, this form of debriefing should promote focused-thinking about professional goals and the professional self – a documented indicator of success in persisting ET learners.

Research Grant: Phase I

The overarching design of the first project utilized an electronic portfolio as integral to the curriculum rather than as a reflective journaling exercise, occasionally utilized in some first year

seminar sections. Integration with degree-specific courses will promote the archival and visibility of curricular milestones – associated with clearly articulated student outcomes. Multiple student touchpoints strengthens the potential positive impact of the electronic portfolio.

Project Objectives of Phase I:
- Create the framework for an electronic portfolio for early learners to archive and reflect upon curricular milestones as identified in the program assessment plan
- Implement the electronic portfolio with a group of computer engineering technology (CpET) majors while enrolled in an introduction to engineering technology first semester course
- Evaluate the usability of the electronic portfolio as a tool for students and faculty members.

Engineering technology professors set out to collect and aggregate student work through an electronic portfolio, aligning student work evidence with specific ABET student outcomes. The research goal was to demonstrate that the electronic portfolio Taskstream Directed Response Folio (DRF) Assessment System could seamlessly gather the student work evidence associated with assessment plan performance indicators. The use of Taskstream electronic portfolio DRF could result in significant efficiencies for programs when evaluating student outcome attainment. Prior to the grant implementation, data collection was a manual process requiring substantial time and communication.

Results of Phase I

The first test implementation of the DRF assessment template exposed several flaws. The most concerning flaw was related to the link between a Canvas assignment and a Taskstream DRF assessment. The research concluded that the process to gather and analyze the key data between platforms, specifically the rubric grade, was cumbersome. This impeded the ability to seamlessly analyze student work evidence associated with specific ABET student outcomes.

Canvas is home to the student assignments, and Taskstream DRF houses the student outcome assessment criteria and the grading rubric associated with each student outcome. Even though the Taskstream DRF assignment was accessible in Canvas assignments, the student outcome assessment rubric could not be transferred back into Canvas for grading purposes.

For instructors, grading the Taskstream DRF article was cumbersome because it required multiple steps to access the artifact assignment. In addition to challenges accessing the student work, two separate assignments were needed: one tied to the grade in the class and the other associated with the targeted student outcome. Students needed to submit the work twice. Then the instructor was required to grade both the assignment in Canvas for the class assignment and the second assignment associated with Taskstream DRF for the student outcome assessment.

Another uncovered flaw was an inability to access data for a targeted exam question. Two submissions are necessary; one to evaluate the entire exam for Canvas grade, and another for Taskstream DRF student outcome assessment and rubric for the specified question.

Lastly, a serious issue was noted when students struggled to create their Taskstream DRF portfolio accounts due to technical difficulties, despite step-by-step instructions provided within Canvas assignments. As a result, the instructor lacked student evidence to analyze.

The lack of seamless integration across the Canvas and Taskstream platforms resulted in duplication of work for both instructor and students, entering information into both Taskstream DRF and Canvas. The process requiring data entry into two different systems was cumbersome, and hindered participation by both students and instructors.

Research Grant: Phase II

To address and overcome the initial flaws exposed in Phase I, a second approach was designed and implemented. The researchers sought to expand the electronic portfolio to collect and aggregate student-generated evidence associated with an additional ABET student outcome to be able to sort findings across courses and majors. The efforts in Phase II sought to address a different student group enrolled in a two different courses but sought to ensure seamless Taskstream database expansion. The project hoped to aggregate student-generated evidence associated with an ABET student outcome across multiple courses associated with students of different majors. Aggregated data could expanded knowledge of student outcome attainment and recommendations for continuous improvement based on assessment data.

Project Objectives of Phase II:
- The structure of the portfolio created in Phase I will be expanded to archive evidence from additional performance indicators associated with additional student learning outcomes across two courses at different points in the curriculum.
- Efforts will verify the alignment between the data collected in the course in phase I with data collected in two additional courses, validating the ability to sort data by student major and course.
- Analysis of the validity of aggregated data as generated through the Taskstream database.
- Work will implement the electronic portfolio longitudinally, further along the curriculum than the entry level course from Phase I with a group of students who are from multiple majors in the engineering technology courses.

Results of Phase II

Taskstream DRF did provide the evaluation of student work assigned to specific student outcome performance indicators. However, the electronic portfolio Taskstream DRF template did not facilitate seamless integration between the instructor's ABET rubrics in Taskstream and the student assignment. Nor did Taskstream DRF aggregate the student work in such a way that the student or the instructor could efficiently analyze its correlation to an ABET student outcome. Specifically, redundant input was required from both the students and the instructors. A summary of the characteristics of each option is listed in table 1.

Table 1 Feature Comparison

electronic portfolio Taskstream DRF	Canvas Outcomes Tool
Links assignments to specific student outcome performance indicators	Links assignments to specific student outcome performance indicators
Does not link student work to ABET rubrics	Links student work to ABET rubrics
Does not aggregate student work to evaluate attainment of student outcome	Aggregates student work to evaluate attainment of a specific performance indicator
Required instructors to evaluate a student submission multiple times: • the course grade and • the assessment plan	Student submissions are evaluated once for both grading and assessment
Rubric must be used in total for every target assignment; cannot embed in assignment grading rubric	Faculty can select relevant performance indicators and embed in assignment grading rubric
Collect data from multiple courses	Collect data from multiple courses

Surprise Research Findings

Phase II findings associated with Taskstream were disappointing. However, despite the disappointing limitations exposed with the Taskstream DRF, and hopeful attempts to resolve the identified flaws, the researchers found an unexpected and satisfying solution. The learning management system, Canvas, features the tool: *Outcomes*. According to the Canvas User Guide [7], the Outcomes Tool can be used to perform a variety of functions including:
- Encourage students to focus on the most important activities in a course,
- Correlate Quizzes and Assignments to various kinds of mastery,
- Evaluate student progress, and
- Track student progress on a specific course outcome in the Gradebook.

Most powerfully, the Outcome tool aligns with the objectives of the project including:
- Generate reports at the account-level about student evidence of outcome mastery and
- Align accreditation standards to programs of study, courses, or student assessments.

The Canvas definition of Outcome is different than the a-k student outcomes (SOs) of ABET. The Canvas operating definition of Outcome for this project is actually closer to the ABET definition of performance indicator. According to Gloria Rogers, author of ABET training materials, "Performance indicators indicate what concrete actions the student should be able to perform as a result of participation in the program [8]."

The Canvas Outcome tool allows mastery statements to be created and shared across courses in a program. Faculty members who use Canvas can view a video that illustrates the Outcomes tool and describes how to generate the Student Competency Report [9]. For example, a collection of outcomes (essentially ABET performance indicators) can be created to measure written communication skills at the program level. The Canvas Outcomes can be imported into a specific course, then linked to assignment rubrics that were created to assess student submissions. The instructor has the option to use the *Outcomes* as part of their assignment

grading scheme, or only for program assessment purposes. At the end of the semester, aggregated *Outcome* data can be retrieved in the form of a Student Competency Report without extra steps. A spreadsheet application can be used to evaluate the data. The report includes student identifiers, including program major, helpful to separate program data when a course and assessments are shared among multiple majors. The key to the success of this arrangement is to create *Outcomes* and criteria descriptions that are understandable and can be clearly associated with student coursework requirements. Rich information on student outcome attainment is available when the *Outcome* tool is used consistently by faculty.

Lessons Learned:

The creation of portfolios can improve students' critical thinking and meta-cognition. Learners can curate a portfolio as part of a capstone experience for review, extending the grading performed by instructors during the original course submission. Student-centric work during an academic career is archived in one location for overarching review. This research project, funded by the electronic portfolio team, was designed to extend the use of the individual portfolio, using Taskstream to collect and archive data from many students for program assessment purposes. The group had high expectations associated with ABET student outcome evidence as well as potential connections between reflective activities and student evidence. The technical support staff assigned to the project were confident that Taskstream would be an effective method to collect and evaluate data for program assessment – it would be "easy" for students and faculty to use.

In hindsight, the challenge of this research project stems from the misalignment of the authors' definition of program assessment and the electronic portfolio campus group who provided the funding. The project sought to streamline data collection from the assignments of many students within multiple courses with no additional steps for students or instructors. Two attempts to "force" the tool Taskstream to meet the assessment needs of the programs were funded and researched. Because of the expectations of the grantor and the promises of the technical staff, the researchers spent months investigating Taskstream capabilities rather than looking for solutions to the problem of data collection and evaluation. While trying to align technical capabilities with expectations, one of the authors discovered a solution outside of Taskstream while researching effective use of rubrics in Canvas. A Canvas video was created in 2013 that simply and easily performed the functions so challenging in Taskstream. While it is unfortunate that a better solution was discovered after so much effort had been put into a less than effective tool, without the ePortfolio grant the researchers might not have worked so diligently to identify a more seamless process to collect and aggregate assessment data.

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