

## A Framework for General Education Assessment: Assessing Information Literacy and Quantitative Literacy with ePortfolios

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This essay presents the findings of an authentic and holistic assessment, using a random sample of one hundred student General Education ePortfolios, of two of Salt Lake Community College's (SLCC) college-wide learning outcomes: quantitative literacy (QL) and information literacy (IL). Performed by four faculty from biology, humanities, and mathematics, the assessment underscores the benefits associated with asking students to attend to the inter-connectedness of their General Education curriculum by showcasing and reflecting on their work in ePortfolios. Using ePortfolios to assess student work invites a constructivist approach to teaching, learning, and assessment. ePortfolios contain evidence (student work and reflections) of how students are experiencing the curriculum and how they are or are not achieving learning outcomes. More important, in terms of assessment, ePortfolios promise authentic and evidence-based assessment, as well as a potential for closing the loop.

### **Background: Theoretical Framework and Implementation**

Existing and emerging technologies have changed the way in which students learn and experience higher education, especially in terms of access, analysis, and use of information (Siemens, 2004). These technologies allow students to inhabit numerous co-present academic, community, and personal environments. Salt Lake Community College (SLCC), like many institutions of higher education, recognized the contributions these environments make in shaping and reshaping students' educational experiences (Tosh, Werdmuller, Chen, Penny Light, & Haywood, 2006). In 2010, SLCC implemented an ePortfolio requirement for all its general education courses in recognition of the changing educational landscape and the institution's outcomes assessment mandate (U.S. Department of Education, 2006). Students use any suitable Web 2.0 platform with which to build their ePortfolio. They own their ePortfolio and share its URL with SLCC's Banner student information system, which makes it available to the faculty via their online course rolls.

Our ePortfolio implementation is structured around the reality that learning occurs in a community (disciplinary, cultural, geographic, and/or digital), not in isolation (Senge, 2000), and that evidence-based outcomes assessment can occur only by using student work and examining that work holistically. A holistic approach to evidence-based assessment is the only place in which assessment teams can gain an insider's view of how students experience general education. SLCC student ePortfolios accumulate, to use the words of Finley (2012), "assignments designed to provide students with opportunities to demonstrate their learning for each outcome as individuals and within groups" (p. 22). Students include evidence of their varied academic and personal experiences, which they

connect to each other through intentional reflections. The types of evidence students create and then showcase include academic, real world, and co-curricular experiences and projects, all of which can be communicated through mixed media.

Research shows that ePortfolio pedagogy (showcasing skills and achievements, reflecting, and using appropriate communication modalities) encourages constructivist and connectivist approaches to teaching, learning, and meaningful assessment. Schneider and Rhodes (2011) explained the impact of portfolio pedagogy on student learning and what can be understood about that learning from an assessor's vantage point:

Significantly, the emerging evidence on portfolios of student work suggests that applying knowledge, integrating learning from multiple sources, and reflecting on the process of learning, its quality, and the outcomes—the how and the why of learning—further strengthens student learning" (p. vi). Reflection serves its own unique purposes in our ePortfolio implementation. As Cambridge (2010) wrote, "Almost without exception, scholars agree that the process of reflection that goes into composing an ePortfolio is central to its impact on learning. (p. 103)

Reflection forces students to both routinely take a step back from and return to their work, placing that work into broader personal or intellectual contexts. From a Deweyan perspective, reflection gives a learner "increased power of control" of their learning (Dewey, 1933, p. 21).

SLCC's reflective framework is based on Dewey's (1933) reflective principles, the models of Schön's (1983) reflective practice, Kolb's (1984) model of experiential learning, and mathematician

Pólya's (1957) "look back" strategy for solving problems. Faculty ask students to consider their learning processes, evaluate their own work (e.g., what they did, what went right, what went wrong, what is missing), think about their thinking and how it changed during the course, and to make connections between assignments in one course and those in other courses that the student has taken. An unanticipated benefit of student reflection is that it provides important feedback to faculty regarding the impact and effectiveness of their assignments.

Indeed, the promise of ePortfolios is that stakeholders get authentic assessment (Cambridge, 2010) because ePortfolio pedagogy invites self-assessment for students via their reflections, curriculum assessment for faculty from student reflections, and programmatic assessment for institutions when ePortfolios are examined holistically. ePortfolios, when used as spaces for learners to shape and share the connected stories of their academic lives and when used for assessment, can play a central role in closing the loop for institutions, faculty, and learners. In their book, *The Educational Potential of E-Portfolios: Supporting Personal Development and Reflective Learning*, Stefani, Mason, and Pegler (2007) contended, "authentic assessment must be built upon authentic learning experiences. The e-portfolio can be helpful here in recording the authentic learning, by allowing students to compile different kinds of evidence of learning" (p. 75). At SLCC, faculty in all general education courses require that students showcase, in their ePortfolios, at least one signature assignment from the course accompanied by a reflection on the assignment or the course.

Signature assignments constitute real-world applications of knowledge (i.e., not exams or quizzes). To qualify as a signature assignment, an assignment or project must help students address two or more of SLCC's general education learning outcomes. Thus, a student paper on the campaign financing of incumbents and challengers in recent Congressional races would be a signature assignment that addresses SLCC's effective communication and quantitative literacy learning outcomes. If students were required to make public service announcements or informational flyers to distribute around campus instead of writing a paper on the subject of campaign financing, then the assignment would address civic engagement as well.

One of the most significant strengths of using ePortfolio for learning and outcomes assessment is that it can "create a bridge between the positivistic, strictly quantitative epistemology that underlies some conventional assessment regimes and the more complex and situated understanding of teaching and learning held by many educators and researchers" (Cambridge, 2010, p. 93). We sought to bridge that same gap and

underscore the benefits associated with asking students to attend to the inter-connectedness of their general education curriculum. At the same time, our ePortfolio implementation follows Finley's (2012) advice: "To ensure student achievement on learning outcomes that both faculty and employers value, educators need to ensure that students work on these outcomes, deliberately and frequently, across the curriculum" (p. 21). Through a collective effort by SLCC faculty who teach general education courses to help students understand the importance and meaning of the learning outcomes across the disciplines, students receive multiple opportunities to demonstrate their progress toward and achievement of the learning outcomes.

SLCC student and ePortfolio scholarship recipient, Eli Spikell, adeptly uses his ePortfolio as a platform for showing the interconnected stories of his general education experiences. Mr. Spikell uses the evidence in his assignments and reflections to demonstrate multiple achievements of each learning outcome across the general education curriculum. We ask students to list and link ePortfolio assignments in the Goals and Outcomes page of their ePortfolios. This further facilitates student reflections on their outcomes achievements and makes more concrete where and how they have addressed the learning outcomes. Mr. Spikell's Goals and Outcomes page (see <http://00dirt.weebly.com/goals-and-outcomes.html>) offers audiences hyperlinked lists of the assignments and projects that helped him achieve the outcomes, creating an interactive exploration of his work and providing a potential assessment team one occasion, among many in an ePortfolio, to interface with how he experienced general education through its learning outcomes.

The college established an assessment schedule that focuses on one or two learning outcomes per year, allowing time for deficiencies to be identified, collective steps to be taken by the faculty, and the loop to be closed. The assessment plan also works on two levels. When particular learning outcomes (e.g., quantitative and information literacy) are up for assessment, each academic program uses semi-standard rubrics to assess signature assignments that tap quantitative literacy (QL) and information literacy (IL), and the Assessment Office then conducts a meta-analysis of that data across disciplines. Meanwhile, the ePortfolio Office conducts the kind of high-level assessment of QL and IL that we report on here and that complements the more detailed assessment done in each program. Taken together, our ePortfolio program and the methodology we employed in assessing our QL and IL learning outcomes with student ePortfolios opens up, in a very real way, possibilities for the reconceptualization of teaching and learning QL and IL as communicative gestures situated within a variety of problem-solving contexts.

One of the particular challenges we faced in assessing QL was an internal debate at the college about whether QL could be demonstrated in an ePortfolio only in Math courses, or in other courses as well. The debate reflected a divide in the perceptions about the deployment of QL outside of the Math department. Part of this thinking can be directly linked to traditional assessment methods in which students are tested using multiple-choice questions or a series of calculation problems to “determine whether students have gained basic quantitative skills and understandings. This approach provides test takers with problems that explicitly call upon knowledge of quantitative concepts and tools” (Grawe, Lustky, Neil, & Tassava, 2010, p. 1). Traditional QL assessment (standardized tests) of this sort can demonstrate student achievement of an integral QL skill—the ability to apply QL when prompted and in “selected contextual domains” (1). However, if QL is important in analyzing, evaluating, and articulating data in arguments and other genres of communication, it is necessary to develop assessment methods that match the learning outcomes of the institution.

Although the use of QL varies by discipline, SLCC’s QL college-wide learning outcome transcends disciplinary boundaries. As approved by the General Education Committee, it reads as follows:

Students develop quantitative literacies necessary for their chosen field of study. This includes approaching practical problems by choosing and applying appropriate mathematical techniques; using information represented as data, graphs, tables, and schematics in a variety of disciplines; and applying mathematical theory, concepts, and methods of inquiry appropriate to program-specific problems. (SLCC, 2013b)

While there has been much research on QL assessment, most of this research has not really been conducted for a holistic assessment of student work across the curriculum, let alone with ePortfolios. Our QL assessment methods get us closer to the ideal that Cambridge (2010) encouraged, while still providing us with the quantitative data we need for external audiences.

Similarly, the literature on IL is mostly focused on librarians as the primary audience. We argue, as did Grawe et al. (2010), that student achievement and demonstration of QL can be measured in terms of transmitted knowledge via standardized tests; however, it is imperative for students to have “developed the skills necessary to deploy the capacity effectively in contexts other than those in the test” (p. 1). The same argument could and should be made for IL—it is not enough for students to transmit knowledge by finding

relevant information in online databases and in the library as well as evaluating the validity of their research. While these skills are extremely important to student learning, particularly for critical reading and thinking (Oakleaf & Kaske, 2009), it is imperative that IL extend beyond developing research skills into the realm of conversing and communicating with sources.

Grawe et al. (2010) also argued that QL might be summarized as “the habit of mind to consider the power and limitations of quantitative evidence in the evaluation, construction, and communication of arguments in personal, profession, and public life” (p. 1-2). We extend that argument to our IL assessment methods. When encouraged across the general education curriculum, IL should create a consistent “habit of mind” (De Nicolás, 2000) as students consider the power and limitations of their research and how they will deploy that research in different contexts. Habits of mind create transparency through frequent repetition. The habits become technological connections between the brain and the body that further bridge past, present, and future experiences. When students are asked repeatedly to perform critical analysis and application of information in a variety of contexts, they achieve information literacy. Thus, our assessment of IL encompasses basic indices of student research and use of sources, as well as a more holistic look at students’ ability to employ those sources to achieve a purpose or support an argument.

Both our QL and IL assessment methods required that our assessors examine how often and to what extent students employed quantitative evidence and other information from sources in their own work. Assessors also examined evidence of students’ ability to engineer ways of structuring, representing, designing, and delivering information as both a moderator and translator of that information. SLCC’s ePortfolio implementation and transmission is ideal for identifying and assessing QL and IL across the curriculum.

## Methods

### Assessment Framework

Our Institutional Research Office pulled a sample of 160 students who graduated in May 2013, and who did not transfer in any external credits for their AA or AS degrees. This ensured that we were looking at students who completed all of their general education coursework at SLCC instead of at other institutions. From that pool of 160 students, we selected the first 50 female and the first 50 male students who had ePortfolios available in our Banner system and whose ePortfolios contained at least one QL assignment. We sought a balance of male and female students because

SLCC's student body is evenly split by gender (SLCC, 2013a). While compiling the list of females, five names were passed over either because they did not have an ePortfolio in our system or because their ePortfolio did not contain at least one QL assignment. Seven names in the list of males were passed over because either they did not have an ePortfolio in our system or because their ePortfolio did not contain at least one QL assignment. This collection of 100 ePortfolios from graduating AA and AS students—out of the 2,706 students who received Associate degrees at that time—became the sample for the assessment study.

We assembled two two-person assessment teams to examine all 100 ePortfolios using QL and IL rubrics. The assessment team that looked at IL was composed of two Biology faculty members. The assessment team that looked at QL was composed of a Math faculty and a Humanities faculty. Prior to the start of their rating sessions, each team went through a norming exercise led by the ePortfolio Coordinator. Each assessment team came to a consensus rating for every ePortfolio on all of the rubric criteria for which they were responsible before moving on to the next ePortfolio. Each individual in the assessment teams received \$41.62 per hour (SLCC's adjunct hourly rate cap) in compensation for their time. The IL team spent approximately fifteen hours assessing ePortfolios, and the QL team spent approximately twenty hours on their portion of the assessment.

The QL rubric that was used by the QL team pulls criteria and language directly from the rubric for quantitative literacy (Rhodes, 2010), although it was modified to allow us to account for the number of assignments assessed. Part one of the IL rubric was also derived from a section of the AAC&U VALUE rubric for information literacy (Rhodes, 2010), while part two was developed in-house to quantify the amount of evidence pertaining to information literacy. The rubrics used in this study have been published for the college community (see Appendix).

## Findings

### Quantitative Literacy

Most colleges and universities in the United States want their students to demonstrate quantitative literacy. Our assessment team for QL examined the sampled ePortfolios with respect to three indices of quantitative literacy, namely ability to:

- Explain information presented to the student in the form of equations, graphs, diagrams, tables, words, etc. (Interpretation);

- Convert relevant information from one form—such as equations, graphs, diagrams, tables, and words—to another (Manipulation);
- Express quantitative evidence in support of the argument or purpose of the work—in terms of what evidence is used and how it is formatted, presented, and contextualized (Communication).

As Table 1 indicates, mean scores for the Interpretation and Manipulation measures of QL cluster around 2.8 out of a possible 4.0. There was no statistically significant difference between the scores of male and female students. Mean scores for Communication were somewhat lower at 2.5, and the data show greater variability among means for this measure of QL. Female students were better at Communication—expressing quantitative evidence in support of an argument or purpose of the work. Women scored on average 2.70 on the Communication index, while men scored 2.34 on average, a difference that is statistically significant at the .05 level using a Student's t test.

Another way to examine the data is to show how all the assignments fit into the different performance categories of the QL Rubric. The results shown in Table 2 indicate that three quarters of the graduates in the sample are meeting or exceeding expectations with respect to interpreting and manipulating data. That's the good news. The less-than-good news is that our confidence in this strong performance must be tempered by the fact that it is based on a rather thin number of assignments per student. On average, each ePortfolio contained 1.97 assignments that addressed QL Interpretation and 2.0 assignments that addressed QL Manipulation. Assignments from Math courses constituted the majority of the sample in both cases.

The other item to note about these results is that the scores for Interpretation and Manipulation tracked each other almost exactly for each student. This stands to reason in one sense, given that students who are good (or poor) at interpreting data would be equally good (or poor) at manipulating it. On the other hand, it could mean that the VALUE rubric (Rhodes, 2010)—as applied to collections of assignments that do not specifically fit within the rubric criteria—cannot distinguish clearly between interpreting and manipulating data. The solution to this dilemma probably lies in more nuanced assignment design and faculty sharing of QL rubrics with their students. Students could be encouraged by faculty to use the rubric as a form of self-assessment.

Table 2 also shows that, with an average of 2.6 assignments in each ePortfolio tapping the Communication criterion, nearly 50% of the assignments met or exceeded expectations. Forty percent of the assignments were below expectations,

Table 1  
*Mean Scores for Three Measures of QL in Student ePortfolios*

QL Measure	<i>M</i>	<i>SD</i>
Interpretation	2.81	.44
Manipulation	2.80	.48
Communication	2.52	.68

*Note.* *n* = 100 portfolios

Table 2  
*Percent of QL Assignments Falling into Performance Categories*

QL Measure	Performance Measures				Total
	Exceeds	Meets	Below	Well Below	
Interpretation <i>n</i> = 197 assignments	06%	72%	21%	01%	100%
Manipulation <i>n</i> = 200 assignments	05%	70%	24%	01%	100%
Communication <i>n</i> = 262 assignments	14%	35%	40%	11%	100%

and 11% were well below expectations. There were more assignments that tapped the Communication criterion (as opposed to the Interpretation and Manipulation criteria) simply because there were additional non-Math assignments in which students attempted to express quantitative evidence in support of their argument or the purpose of the work.

### Information Literacy

Graduates in any field need to be capable researchers and users of information. It is incumbent upon citizens and workers to manage the flood of information that is available to us via a keystroke or a mouse click. An important way for faculty in higher education to help our students, then, is to make assignments in which students need to find information, sift through it to locate credible sources, and appropriately use and cite those sources in their work to achieve a purpose.

Our reviewers examined the sampled ePortfolios for evidence that students “gather information using technology, library resources, and/or other modalities.” They were careful to exclude simple information-gathering, such as reading course texts or other materials that instructors provided, instead noting “instances of outside-of-class resources that indicate the student relied on the library, online databases, or other modalities to do research.”

Table 3 shows that nearly 25% of the ePortfolios had little or no evidence of outside-of-class research—namely, that these ePortfolios contained zero or one artifact for which the student went to outside resources for information to complete the assignment. More encouraging is that 38% had “some” evidence, or two

to three artifacts that required outside research, and 39% of the ePortfolios had four or more artifacts that required the students to do outside research to complete the assignments.

Our assessment team also looked at the extent to which each student’s work used credible sources. As Table 3 indicates, 19% of the ePortfolios had zero signature assignments that cited credible sources. Twenty percent of the ePortfolios had one artifact that used credible sources, which was coded as “little” evidence. A positive result is that 29% of the ePortfolios had “some” evidence, meaning that two to three artifacts used credible sources, and 32% of the ePortfolios had “considerable” evidence—four or more artifacts that cited credible sources.

In addition to using credible sources, a college graduate should also properly cite those sources. Our reviewers were not interested in the type of citation format used by students; however, they did inspect student work for appropriate academic documentation (e.g., APA, MLA, or Chicago) of their sources. Table 3 reveals that 23% of the ePortfolios had no properly cited sources. Twenty-eight percent had one properly cited artifact, or little evidence. Thirty percent had two to three properly cited artifacts, or some evidence, and 19% had four or more assignments with sufficiently documented sources. Since proper citation of credible sources is at the heart of academic work, it appears that the general education program at SLCC is not providing students enough practice in this important skill.

Our 2012 general education assessment captured this same data (although with a sample of 83 ePortfolios rather than 100). The comparative data shows that there has been an improvement in the number of signature assignments that address SLCC’s

Table 3  
*Percent of ePortfolios Displaying Key Levels of Evidence for IL*

IL Measure	Levels of Evidence				Total
	Considerable (4 + artifacts)	Some (2-3 artifacts)	Little (1 artifact)	None (0 artifacts)	
Outside of Class Research	39%	38%	10%	13%	100%
Using Credible Sources	32%	29%	20%	19%	100%
Adequately Citing Sources	19%	30%	28%	23%	100%

*Note.*  $n = 100$  portfolios

criteria for information literacy. Table 4 clearly shows that the ePortfolios of graduating students in 2013 were significantly richer in evidence of students conducting outside of classroom research, using credible sources, and adequately citing those sources than were the ePortfolios of 2012 graduates. This is positive news that may indicate that SLCC faculty require more from students in their signature assignments.

We sought to investigate the extent to which our students can, in the words of the AAC&U's rubric for Information Literacy (Rhodes, 2010), "use information effectively to accomplish a specific purpose." More specifically, we were interested in whether students could do so using resources acquired outside of class, so our evaluators read each assignment, looking for the extent to which the student "communicates, organizes, and synthesizes information from sources to fully achieve a specific purpose, with clarity and depth" (see Appendix). Scores on this rubric range from 1.0 to 4.0. The mean score for all students in the sample—including those ePortfolios that contained no assignments that used out-of-class sources—was 2.35, with no statistically significant difference between female and male students. If we factor out the 13 ePortfolios in the sample with no assignments needing out-of-class resources, the mean rises to 2.74.

In the 87 ePortfolios that had assignments requiring some research outside of class materials, reviewers identified a total of 338 assignments. Table 5 breaks down the percentage of those assignments that fit into each category of the rubric. We can see that for assignments marked "well below" and "below" expectations--constituting 34% of the total--students did not use outside resources adequately to achieve their purpose. On a brighter note, 66% of the assignments demonstrate that students did achieve their purpose when using outside resources.

### Potentials of ePortfolios in Closing the Loop

We drafted a report on these findings and distributed it to all faculty and all academic administrators in July (Hubert & Lewis, 2013). The report does not limit itself merely to describing the results of the assessment. It contains specific observations and recommendations that are designed to improve the teaching and learning of QL and IL across the disciplines in general education. Our intention is to leverage the academic hierarchy and its various committees and support systems to induce positive change. We reproduce those observations and recommendations here.

#### Observations and Recommendations for Quantitative Literacy:

1. No one looking at the sampled ePortfolios could escape noticing that outside of Math courses, SLCC students are almost never formally asked to interpret or manipulate data in the form of equations, graphs, diagrams, tables, etc. This is probably a characteristic of most general education programs at community colleges around the nation, but SLCC faculty need to ask themselves whether, given the prominence and importance of QL in our learning outcomes and for the future success of our students, a concerted effort needs to be made to infuse QL across the curriculum. Surely, we are not serving our students well if faculty view fostering QL as the sole responsibility of the Math department.
2. Faculty in areas including the Social Sciences, Business, Physical and Biological Sciences, and Lifetime Wellness should make conscious efforts to design signature assignments that ask students to perform all three indices of quantitative literacy: interpret, manipulate, and

Table 4  
*Percentage of ePortfolios (2012 and 2013) Demonstrating “Some” or “Considerable”  
 Evidence of Key Dimensions of Information Literacy*

	2012 Assessment ( <i>n</i> = 83 portfolios)	2013 Assessment ( <i>n</i> = 100 portfolios)
Outside of Class Research	60%	77%
Use Credible Sources	53%	61%
Adequate Citation	37%	49%

Table 5  
*How Well Do SLCC’s Graduates “Use Information Effectively to Accomplish a Specific Purpose?”  
 Percentage of Assignments Falling into the Performance Categories*

	Performance Categories				Total
	Exceeds	Meets	Below	Well Below	
Interpretation <i>n</i> = 338 assignments	18%	48%	25%	9%	100%

communicate evidence in the form of data, graphs, diagrams, tables, etc. This might require faculty to ask students to put more than one signature assignment in the ePortfolio—one that speaks to QL in the discipline and one that speaks to other learning outcomes such as effective communication, critical thinking, or civic engagement. The point here is for students working their way through our general education program to have multiple opportunities to reinforce basic quantitative literacy outside of their Math courses. An additional recommendation is for academic schools to map QL signature assignments across their curriculum to ensure that students have such opportunities.

- As Table 2 indicates, we faculty have some work to do in helping students use quantitative data more effectively to support arguments or fulfill their purpose with respect to signature assignments. One suggestion would be to provide students with examples of how quantitative data is used in disciplinary contexts. Another would be to write assignments that explicitly ask students to use quantitative data to accomplish their purpose. Interestingly, what fails to be expressed in Table 2 are the large number of signature assignments the reviewers noticed in which student work should have employed basic data but did not (e.g., papers on AIDS in the United States or obesity as a world health concern, in which students did not even attempt to present quantitative data either to inform the reader or make a point).

- The Faculty Teaching and Learning Center (FTLC) should work with academic programs, the Assessment Office, and the ePortfolio Office to infuse QL signature assignments in appropriate general education courses outside of Math. FTLC mini-grants should be available to compensate faculty who engage in this process.

#### Observations and Recommendations for Information Literacy:

- As Table 3 indicates, in nearly a quarter of all the sampled ePortfolios, students had zero or one assignment in which they apparently were asked to use resources they obtained outside of class. Given that students take 12 or 13 courses to fulfill their general education requirements, faculty at SLCC need to decide whether these results are satisfactory. Obviously, the signature assignments in some courses necessarily rely only on in-class materials, but we argue that it should not be possible for a student to achieve an AS or AA degree without ever having the experience of locating, using, and citing credible outside-of-class sources to accomplish a specific assignment.
- Similarly, Table 3 also shows that 39% of the sampled ePortfolios had zero or one assignment in which the student used credible sources in their work, and 51% had zero or one assignment in which the sources were cited adequately. This implies that when faculty craft assignments that require outside research, they need to do a better job impressing upon students—verbally or in the

assignment itself—that they are expected to use and properly cite credible sources in their work. Faculty and Associate Deans should work collaboratively in their respective programs to ensure that students receive this message. In addition, faculty might consider having students use the research workshops available through the campus libraries and Student Writing Center.

3. Students often come to college not knowing the difference between credible and non-credible sources and not knowing how to cite their sources properly. We faculty often assume that students learned these things in high school, when in fact they did not. Or it may be the case that enough time has elapsed since they did learn about citation and credible sources that they have forgotten. In any case, departments or individual faculty should develop instructional materials that explain their disciplinary understanding of source credibility and proper citation. Students would then have something concrete to aim for when completing their work. Because many of these instructional materials will be common across various disciplines, the FTLC should coordinate this effort, and going forward, all faculty should employ these instructional materials.
4. Online resources for citation are readily and freely available from a number of places. If they have not already done so, faculty should share these resources with students in their Canvas course sites, syllabi, and/or department webpages. We need to make it easy for students to cite properly the sources they use in their work.

## Conclusion

As we noted above, there appears to be a consensus in the literature that in addition to being a potential high impact practice in colleges and universities, ePortfolio pedagogy implemented across the disciplines can put us in the enviable position of being able to authentically assess student learning as it actually happens in general education and within the major. From our experience, and drawing on the experiences of other institutions of higher education that are implementing ePortfolios, there appears to be a straightforward recipe for designing ePortfolio systems to promote simultaneously student engagement and authentic assessment. The recipe requires several years of hard work, a supportive

administrative structure, and a mixture of the following design elements:

- An ePortfolio platform that students and faculty like to use and that promotes student creativity;
- Signature assignments that directly tap multiple essential learning outcomes.
- Requiring students to reflect on their work;
- A means to examine random samples of student ePortfolios;
- A mechanism to report assessment results to faculty and academic administrators;
- An institutional culture that facilitates action on the assessment results.

Our example here illustrates the potential of ePortfolios to assess general education at a comprehensive community college. The eye-opening results communicate an important assumption most faculty make about general education: that because they are familiar with the mix of courses students are likely to take, they can infer what students are learning. However, when an ePortfolio requirement is implemented across all general education courses, it illuminates the general education program in a new light—the light of how students actually do (or do not) progress toward learning outcomes via the assignments they receive across the disciplines. In an ePortfolio, students represent their learning, but they will often simultaneously represent only what they have been required to do in the form of signature assignments and reflections.

A clear revelation here is that despite the debate on our campus about how and where students should learn quantitative literacy, in actuality they are learning it primarily in their Math courses. Another revelation is that students are not getting enough practice in finding outside sources and correctly marshaling those sources to achieve a specific purpose in a discipline-specific context. Students should experience general education, regardless of the model, as a series of disciplines connected by mutual needs and interdependency. Our assessment findings offer evidence to support this argument. When we conduct a high-level assessment of this sort—the kind of assessment that was impossible for us prior to ePortfolio—we see for the first time the strengths and weaknesses of our general education program as a tool for facilitating the quantitative and information literacy habits of mind that students will need to thrive in their continued education or career.

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Appendix  
 Rubrics Used in the General Education Assessment

**Quantitative Literacy Rubric**

	<b>Exceeds Expectations</b>	<b>Meets Expectations</b>	<b>Below Expectations</b>	<b>Well Below Expectations</b>
<p><b>Interpretation</b>  <i>Ability to explain information presented to the student in the form of equations, graphs, diagrams, tables, words, etc.</i></p> <p><i>Total # Assignments</i>                      _____</p> <p><i>Mean Score</i>                      _____</p>	<p>Provides accurate explanations of information presented in mathematical forms. Makes appropriate inferences based on that information.</p> <p># of Assignments                      _____</p>	<p>Provides accurate explanations of information presented in mathematical forms.</p> <p># of Assignments                      _____</p>	<p>Provides somewhat accurate explanations of information presented in mathematical forms, but occasionally makes minor errors related to computations or units.</p> <p># of Assignments                      _____</p>	<p>Attempts to explain information presented in mathematical forms, but draws incorrect conclusions about what the information means.</p> <p># of Assignments                      _____</p>
<p><b>Manipulation</b>  <i>Ability of the student to convert relevant information from one form—such as equations, graphs, diagrams, tables, words—to another.</i></p> <p><i>Total # Assignments</i>                      _____</p> <p><i>Mean Score</i>                      _____</p>	<p>Skillfully converts relevant information into an insightful mathematical portrayal in a way that contributes to a further or deeper understanding.</p> <p># of Assignments                      _____</p>	<p>Competently converts relevant information into an appropriate and desired mathematical portrayal.</p> <p># of Assignments                      _____</p>	<p>Completes conversion of information but resulting mathematical portrayal is only partially appropriate or accurate.</p> <p># of Assignments                      _____</p>	<p>Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate.</p> <p># of Assignments                      _____</p>
<p><b>Communication</b>  <i>Ability of the student to express quantitative evidence in support of the argument or purpose of the work (in terms of what evidence is used and how it is formatted, presented, and contextualized)</i></p> <p><i>Total # Assignments</i>                      _____</p> <p><i>Mean Score</i>                      _____</p>	<p>Uses quantitative information in connection with the argument or purpose of the work, presents it in an effective format, and explicates it with consistently high quality.</p> <p># of Assignments                      _____</p>	<p>Uses quantitative information in connection with the argument or purpose of the work, though data may be presented in a less than completely effective format or some parts of the explication may be uneven.</p> <p># of Assignments                      _____</p>	<p>Uses quantitative information, but does not effectively connect it to the argument or purpose of the work.</p> <p># of Assignments                      _____</p>	<p>Presents an argument for which quantitative evidence is pertinent, but does not provide adequate explicit numerical support. (May use quasi-quantitative words such as “many,” “few,” “increasing,” “small,” and the like in place of actual quantities.)</p> <p># of Assignments                      _____</p>

**Information Literacy Rubric**

<b>Part I</b>	<b>Exceeds Expectations</b>	<b>Meets Expectations</b>	<b>Below Expectations</b>	<b>Well Below Expectations</b>
<p><i>Uses information effectively to accomplish a specific purpose.</i></p> <p><i>Total # Assignments</i> _____</p> <p><i>Mean Score</i> _____</p>	<p>Communicates, organizes, and synthesizes information from sources to fully achieve a specific purpose, with clarity and depth.</p> <p># of Assignments _____</p>	<p>Communicates, organizes and synthesizes information from sources. Intended purpose is achieved.</p> <p># of Assignments _____</p>	<p>Communicates and organizes information from sources. The information is not yet synthesized, so the intended purpose is not fully achieved.</p> <p># of Assignments _____</p>	<p>Communicates information from sources. The information is fragmented and/or used inappropriately (misquoted, taken out of context, or incorrectly paraphrased, etc.), so the intended purpose is not achieved.</p> <p># of Assignments _____</p>

<b>Part II</b>	<b>Considerable Evidence</b>	<b>Sufficient Evidence</b>	<b>Little Evidence</b>	<b>No Evidence</b>
<p><i>A. The student gathers information using technology, library resources and other modalities.</i></p>	<p>Four or more artifacts indicate the use of sources that required research outside of class.</p>	<p>Two or three artifacts indicate the use of sources that required research outside of class.</p>	<p>One artifact indicates the use of sources that required research outside of class.</p>	<p>No outside-of-class resources appear to have been used by this student.</p>
<p><i>B. The student uses credible sources in their work.</i></p>	<p>Four or more artifacts indicate the use of credible sources that required research outside of class.</p>	<p>Two or three artifacts indicate the use of credible sources that required research outside of class.</p>	<p>One artifact indicates the use of credible sources that required research outside of class.</p>	<p>Credible sources appear not to have been used by this student.</p>
<p><i>C. The student appropriately cites his/her sources.</i></p>	<p>Four or more artifacts indicate the use of sufficiently documented sources.</p>	<p>Two or three artifacts indicate the use of sufficiently documented sources.</p>	<p>One artifact indicates the use of sufficiently documented sources.</p>	<p>Sources appear not to have been documented by this student.</p>