

Using ePortfolios to Assess Applied and Collaborative Learning and Academic Identity in a Summer Research Program for Community College Students

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We evaluate the extent to which ePortfolios can be used to assess applied and collaborative learning and academic identity among community college students from underrepresented minority groups who participated in a summer research program. Thirty-eight students were evaluated by their research sponsor and two or three naïve faculty evaluators. Faculty sponsors evaluated students based on personal interactions and the students' ePortfolios. Naïve faculty evaluated students using only the ePortfolios. We found: (1) The rubrics designed to assess applied and collaborative learning and academic identity had good internal consistency, (2) naïve evaluators found some evidence of all learning outcomes, (3) faculty sponsors found evidence of more learning outcomes than naïve evaluators, and (4) individual ePortfolios varied in the extent to which they documented learning outcomes. We conclude that ePortfolios can be used as a reliable means of documenting applied and collaborative learning and academic identity.

Research experiences help students develop an academic identity that increases underrepresented minority (URM) student persistence in STEM disciplines (Jackson, Starobin, & Laanan, 2013). Participation in research has also been found to improve the persistence of URM women who begin their studies at community colleges (Jackson et al., 2013) and is associated with higher levels of perceived support and academic persistence among all students from underrepresented groups (Barlow & Villarejo, 2004; Maton & Hrabowski, 2004; Yelamarthi & Mawasha, 2008). The ability to document learning that occurs in the context of research experiences would be useful for both research purposes and efforts to credit prior learning. In the current paper we describe the evaluation of our efforts to use ePortfolios created during a research program to assess applied learning and academic identity in URM community college students. By comparing assessments made by faculty who worked directly with students to those made by faculty who were unfamiliar with the students, we are able to evaluate the extent to which ePortfolios document actual learning.

As more learning is taking place outside traditional higher education settings, learners need means of documenting their knowledge and skills (Travers, 2012). Portfolio review (both electronic and traditional) is commonly used by academic institutions to evaluate prior learning (Conrad & McGreal, 2012). Prior learning assessments are relatively high stakes and should afford students the opportunity to present their learning fully (Stenlund, 2013). ePortfolios allow students to include a variety of documents along with reflection, providing a rich account of the learning that has taken place (Travers, 2012). The opportunity for students to provide context for their work is especially important because many institutions review only the work products, without having any contact with the student.

We focus on assessment because we believe that this constitutes a unique contribution to the existing literature on ePortfolios. Despite reasonable theoretical justification for using ePortfolios, there is little empirical evidence for their effectiveness. In their review of the empirical literature, Bryant and Chittum (2013) found that only 15% of peer-reviewed articles addressed student outcomes, and only half of those articles assessed academic learning outcomes specifically. Bryant and Chittum (2013) argued that researchers should assess the extent to which ePortfolios are linked to student learning outcomes, especially in STEM disciplines. Rhodes, Chen, Watson, and Garrison (2014) also pointed to the need for more rigorous research on the benefits of ePortfolios.

Our examination of ePortfolio use was conducted in the context of a residential summer research program. Since 2000, Purchase College of the State University of New York has offered the Baccalaureate and Beyond program to support URM students as they transition from community colleges to four-year institutions. Each year, the program serves approximately 25 students from six community colleges. Students work full-time in small groups conducting original research in biology, chemistry, computer science, environmental science, neuroscience, or psychology.

In the current work, we elected to use the applied and collaborative learning proficiency from the Degree Qualifications Profile (DQP) as the basis for our assessment. The DQP was developed to provide a complete description of the proficiencies that students should obtain in higher education. The DQP purpose has been described as “what students should know and be able to do once they earn their degrees—at any level, in any field of study” (Adelman, Ewell, Gaston, & Geary Schneider, 2014, p. 7). As such, the DQP is well suited to assessing students who are transitioning

between community college and a four-year school. Applied and collaborative learning, one of the five areas of proficiency outlined in the DQP, includes research and creative activities that involve “innovation and fluency in addressing unscripted problems in scholarly inquiry, at work and in other settings outside the classroom” (Adelman et al., 2014, p. 6). At the bachelor’s level, applied and collaborative learning includes four areas that are present in summer research programs: (1) presents a project, (2) negotiates a strategy for group research, (3) writes a design, and (4) completes a substantial project (Adelman et al., 2014). Because applied and collaborative learning is the proficiency that is most likely to occur in non-traditional settings (Adelman et al., 2014), its assessment can present a challenge. ePortfolios have the potential to serve as a useful tool in the reliable assessment of applied and collaborative learning.

ePortfolios are useful as a means of documenting learning from non-traditional activities such as research experiences (Wang, 2009) and are hypothesized to support reflection, engagement, and active learning (Yancey, 2009). Accordingly, ePortfolio use in higher education has become increasingly prevalent (Rhodes, et al., 2014). There is evidence that ePortfolios help students and faculty evaluate growth and reflect on students’ academic achievements (Buzzetto-More, 2010). Eynon, Gambino, and Török (2014) found evidence that ePortfolio use correlates positively with student success indicators (course pass rates, GPA, and retention rates) and can help advance and support deep thinking, integration, and personal growth. The creation of ePortfolios has also been found to help students develop a sense of academic identity, future orientation, and belonging to a community of scholars (Nguyen, 2013; Singer-Freeman, Bastone, & Skrivanek, 2014).

Unfortunately, to date, much of the research examining ePortfolio use as an assessment tool has focused on student and faculty attitudes about ePortfolios rather than on the usefulness of ePortfolios as a means of reliable assessment (Rhodes et al., 2014). For example, Curtis and Wu (2012) reported that healthcare educators have become more accepting of ePortfolio use as an assessment tool. Similarly, Garrett, MacPhee, and Jackson (2013) found that nursing faculty considered ePortfolio evaluation an effective means of assessment. When ePortfolios were used as the primary means of assessment in a Child Development class, 84% of students felt they encouraged reflection, 77% felt they provided a permanent record of learning, and 87% felt their use in the class should be continued (Singer-Freeman & Bastone, 2015). Bryant and Chittum (2013) cautioned that attitudes are not necessarily a good indicator of usefulness as a learning tool.

Additional evidence for the usefulness of ePortfolios is provided by Buyarski and Landis (2014), who examined the efficacy of using ePortfolios to

assess learning in a first-year seminar. Using rubrics, along with examination of students’ narratives, trained faculty unfamiliar with the students whose work they assessed were able to provide reliable evidence of learning. We adapt Buyarski and Landis’s (2014) methodology to examine the efficacy of rubrics as a means for assessing applied and collaborative learning and academic identity in ePortfolios.

In a review of research examining the value and educational consequences of rubric use, Jonsson and Svingby (2007) found that analytic, topic-specific rubrics were most useful in assessment of student performance. In general, rubric use makes assessment by multiple evaluators more reliable. Jonsson and Svingby (2007) reported that inter-rater reliability rates ranged from 4-100%, with the majority falling in the range of 55-75%. In general, reliability rates were lower in instances in which tasks or products were not uniform. More extensive rater training was generally associated with higher levels of reliability. However, high reliability was not necessarily associated with high validity. Validity of rubrics varies widely and depends on the care with which rubrics are developed to align with a construct of interest. Rubrics also enhance learning and instruction by making expectations clear to both students and faculty. Accordingly, a good rubric that is in alignment with a construct might guide instruction to align more fully with the construct.

In the current work, we assessed whether evaluators could reliably use an ePortfolio to assess applied and collaborative learning and academic identity. We utilized two sets of evaluators, with different levels of direct knowledge of the students, in order to gain insight into the extent to which ePortfolios capture authentic learning. Faculty who directly supervised students in the research lab (faculty sponsors) evaluated students using their complete knowledge of the student from personal interactions as well as from the student’s ePortfolio. Faculty unfamiliar with the student are referred to as naïve evaluators because they assessed learning using only the ePortfolio and were naïve with regard to performance in the research lab. We hypothesized that naïve evaluators would see less evidence of learning than faculty sponsors because they had less information. However, should naïve evaluators report stronger evidence of learning than faculty sponsors, this would raise the possibility that students might be able to inflate their proficiency artificially in an ePortfolio. We hypothesized that ePortfolios would document applied and collaborative learning and academic identity, but that direct faculty knowledge of students would provide more robust evidence than ePortfolios alone. We were also interested in assessing the extent to which the created rubrics were valid and reliable measures of applied and collaborative learning and academic identity.

Method

Participants

Students. The summer research program included 22 students in 2013 and 22 students in 2014. Four students who participated in the research program in 2013 were excluded due to the death of their research sponsor, and two students were excluded due to failure to share their ePortfolios. This resulted in a sample of 38 students (29 females and 9 males). Our sample included 24 students who identified as African American, 10 who identified as Latino, two individuals who reported mixed African American and Latino ancestry, one who identified as Asian, and one who identified as Native American. Fifteen students completed research in psychology or neuroscience, 13 in biology, seven in biochemistry, and three in environmental science.

Faculty sponsors. Eight faculty served as research sponsors: Four of these were sponsors in both 2013 and 2014, two sponsored students only in 2013, and two sponsored students only in 2014. All sponsors had PhDs in a STEM discipline and were full-time faculty members at the college. There were five assistant professors, two associate professors, and one full professor. There were five males and three females. All faculty identified as White.

Naïve evaluators. We decided to have faculty sponsors evaluate both the students they sponsored and students with whom they were unfamiliar to ensure that similar standards would be used for both sets of evaluations. When rating unfamiliar students, faculty are referred to as *naïve evaluators*. Three additional STEM faculty who did not sponsor students served as naïve evaluators. They all had PhDs and were full-time faculty members (one lecturer, one associate professor, and one full professor). There were two females and one male, and all identified as White.

Materials and Procedure

Learning outcome and rubric development. To identify expected proficiencies, six faculty research sponsors individually created lists of learning outcomes that were then discussed in a focus group with the authors and two outside experts in rubric construction. The group reached consensus on the desired learning outcomes and the products that could be used to evaluate mastery of these outcomes. The outcomes included items associated with both applied and collaborative learning and academic identity (see Table 1). The applied and collaborative learning outcomes were brought into alignment with the applied and collaborative learning proficiency from the DQP (Adelman et al., 2014). Rubrics were developed to

clarify expectations for each of the learning outcomes. The six faculty sponsors piloted the rubrics, using them to assess 20 ePortfolios. Results of this pilot work and a focus group with the participating faculty revealed that the ePortfolios did not include sufficient information for assessment of the quality of revisions or the development of collaborative strategies. Accordingly, these learning outcomes were removed (see Figures 1 and 2).

ePortfolio creation. We instructed students to create ePortfolios that would document their summer experiences. Students were provided with the expected learning outcomes and products and shown how to create and share pages. Work on the ePortfolios occurred after the students' work day was complete. Students created their ePortfolios independently, without direct supervision from the research sponsor. Program staff held weekly workshops in which the students were required to contribute a minimum of one journal entry, one image that documented learning in some area, and one piece of writing that documented learning. Students were required to provide a caption for each image that explained how it documented learning. Additionally, students were required to respond each week to a specific written prompt (see Appendix). Students were not provided with a template. Instead, staff worked individually with students to develop content and design the ePortfolio. The ePortfolios were not graded. However, program faculty, staff, and students provided comments on the ePortfolios that individual students shared with the group.

Evaluator training. Faculty sponsors were instructed on the use of the rubrics during a faculty meeting that took place one week before the faculty were to begin evaluating. Two naïve evaluators who were not faculty sponsors attended the group instruction session. The remaining naïve evaluator who was not a faculty sponsor received individual instruction. During the training, evaluators reviewed the rubrics and discussed possible products that could be used to document proficiency. Evaluators were instructed to read reflective writing carefully as a source of information about academic identity proficiencies. The evaluators completed the rubrics by selecting from five possible ratings: *exceeds expectations*, *meets expectations*, *approaches expectations*, *does not meet expectations*, and *cannot evaluate*. All 38 students were assessed by their respective research sponsors. Twenty-one students were assessed by three naïve evaluators and 17 students were assessed by two naïve evaluators. We elected not to have faculty reach consistency on sample ePortfolios because we were interested in the rubrics' utility in a minimal training environment. Although research has established higher inter-rater reliability with practice sessions, this sort of training is

Table 1
Initial Learning Outcomes Generated by Faculty Research Sponsors

Construct	Learning outcome	Evidence
Academic identity	Identifies hopes and goals for experience Demonstrates confidence sharing ideas Engages with the research Identifies learning from experience Constructs plans for academic future Refines ideas about possible careers	Journal entries Interim and final report
Applied and collaborative learning	<u>Literature</u> Summarizes research literature Articulates contribution to existing knowledge	Annotations Interim and final report
	<u>Research Design</u> States project goals Articulates research hypothesis Describes research design	Interim and final report Journal entries
	<u>Data Collection</u> Successfully implements methodology Documents data collection	Experimental results Interim and final report Journal entries
	<u>Data Analysis</u> Organizes data Performs calculations correctly Draws appropriate conclusions Communicates results	Experimental results Interim and final report
	<u>Collaboration</u> Demonstrates collaboration skills Works with team to draft research abstract Works with team to draft final presentation	Interim and final report Journal entries
	<u>Revisions</u> Uses faculty feedback to revise work	Abstract Interim and final report Conference submissions
	<u>Oral Presentation</u> Presents work orally with confidence and clarity	Final report

not associated with improved validity (Jonsson & Svingby, 2007). Additionally, in real world applications, rubrics are frequently used by individuals who have not received reliability training.

Results

Coding

Because our primary goal was to determine whether ePortfolios could provide reliable information that would enable ePortfolio-based assessment of prior learning and academic identity, we focused on whether

evaluators reported that a learning outcome had been met (grouping *meets expectations* and *exceeds expectations*) or not met (grouping *approaches expectations*, *does not meet expectations*, and *cannot evaluate*). We treated *cannot evaluate* as an indication that a learning outcome had not been met because this response was given in instances in which material related to an outcome was not present in the ePortfolio.

Inter-Item Reliability

To determine inter-item reliability we calculated Cronbach's alphas for ePortfolio-based assessment of

Figure 1
Academic Identity Rubrics

	Exceeds expectations	Meets expectations	Approaches expectations	Does not meet expectations
Hopes and goals	Provides a fully developed discussion of goals for experience.	Provides a good discussion of goals for experience.	Identifies some goals for experience.	Does not identify goals for experience.
Confidence sharing ideas	Demonstrates confidence in sharing intellectual ideas.	Demonstrates some confidence in sharing intellectual ideas.	Demonstrates limited confidence in sharing intellectual ideas.	Does not demonstrate confidence in sharing intellectual ideas.
Engagement with research	Notes indicate full engagement with the research process.	Notes indicate good engagement with the research process.	Notes indicate some engagement with the research process.	Notes indicate limited or no engagement with the research process.
Learning from experience	Offers fully developed insights into learning gained from experience.	Offers good insights into learning gained from experience.	Offers some insights into learning gained from experience.	Does not identify learning gained from experience.
Careers	Shares fully developed ideas about possible careers.	Shares somewhat developed ideas about possible careers.	Shares poorly developed ideas about possible careers.	Does not share ideas about possible careers.
Academic future	Shares fully developed plans for academic future.	Shares somewhat developed plans for academic future.	Shares poorly developed plans for academic future.	Does not share plans for academic future.

each construct. We only included ePortfolio-based ratings in these calculations because we were interested in the use of the rubrics as measures of proficiencies demonstrated by the ePortfolio and not as measures of proficiencies demonstrated by direct knowledge of the student. We observed alphas of .78 for applied and collaborative learning and .69 for academic identity.

Inter-Rater Reliability

To determine the level of agreement between faculty sponsors and naïve evaluators, we calculated the reliability between faculty sponsors and naïve evaluators responding to the same student. We found that the average sponsor-evaluator reliability was 0.45 ($SD = 0.19$). This low reliability score is consistent with our presupposition that sponsors would have available to them substantially more information than naïve evaluators when evaluating students.

To determine whether naïve evaluators were assessing the ePortfolios similarly, we calculated the reliability between naïve evaluators responding to the same ePortfolio. We excluded the scores provided by the single naïve evaluator with a reliability score of 0.42 because this is outside the typical reliability range

reported by Jonsson and Svingby (2007). With this naïve evaluator excluded, the remaining naïve evaluators had reliability scores of between 0.62 and .72. In instances in which there were only two naïve evaluators, reliability was 0.71 ($SD = 0.14$), with reliability scores ranging from 0.50 to 0.93. In instances in which three evaluators assessed a single ePortfolio we calculated the reliability between the two evaluators who had the highest level of agreement. We found that the average reliability was 0.86 ($SD = 0.11$), with scores ranging from 0.64 to 1.00.

Individual Learning Outcomes

Tables 2 and 3 report the number and percentage of instances in which sponsors and naïve evaluators credited each learning outcome. Because two or three naïve evaluators assessed each ePortfolio, there were a total of 90 naïve evaluator assessments. As can be seen in Tables 2 and 3, faculty sponsors were aware of learning that was not evident to naïve evaluators, explaining the low levels of sponsor-evaluator reliability reported above. Faculty sponsors credited between 47% and 87%, and naïve evaluators credited between 7% and 66%, of individual outcomes. In fact,

Figure 2
Applied and Collaborative Learning Rubrics

	Exceeds expectations	Meets expectations	Approaches expectations	Does not meet expectations
Understands literature	Demonstrates an excellent understanding of the literature.	Demonstrates a good understanding of the literature.	Demonstrates some understanding of the literature.	Does not demonstrate understanding of the literature.
Analyzes literature	Very effectively analyzes literature.	Effectively analyzes literature.	Offers limited analysis of literature.	Does not analyze literature.
Project goals	Demonstrates excellent understanding of the project significance.	Demonstrates a good understanding of the project significance.	Demonstrates some understanding of the project significance.	Does not demonstrate understanding of the project significance.
Project hypothesis	Demonstrates an excellent understanding of the research hypothesis.	Demonstrates a good understanding of the research hypothesis.	Demonstrates some understanding of the research hypothesis.	Does not demonstrate understanding of the research hypothesis.
Research design	Demonstrates an excellent understanding of the project research design.	Demonstrates a good understanding of the project research design.	Demonstrates some understanding of the project research design.	Does not demonstrate understanding of the project research design.
Data collection	Collects and records data with no errors.	Collects and records data with very few errors.	Collects and records data with some errors.	Does not collect and record data.
Data analysis	Fully understands the analyses.	Generally understands the analyses.	Understands some of the analyses.	Does not understand the analyses.
Draws conclusions	Fully understands the relation between results and hypothesis.	Generally understands the relation between results and hypothesis.	Understands some of the relation between results and hypothesis.	Does not understand the relation between results and hypothesis.

Table 2
Evaluations Crediting Academic Identity Outcomes

Learning outcome	Faculty sponsor		Naïve evaluator	
	<i>n</i>	%	<i>n</i>	%
Hopes and goals	18	47%	27	30%
Confidence sharing ideas	31	82%	59	66%
Academic future	31	82%	43	48%
Careers	33	87%	50	56%
Learning from experience	27	71%	43	56%
Engagement with research	32	84%	50	56%

Note. Faculty sponsor *n* = 38. Naïve evaluator *n* = 90.

for all outcomes assessed, faculty sponsors reported higher rates of acquisition than naïve evaluators. Differences between faculty sponsor and naïve evaluator assessments of individual learning outcomes ranged from 15% (learning from experience) to 69% (data collection).

The naïve evaluators reported that ePortfolios included evidence of academic identity outcomes

between 27% and 59% of the time and included evidence of applied and collaborative learning outcomes between 7% and 41% of the time. Although the evidence for individual applied and collaborative learning outcomes was low, because there were eight unique outcomes, students could show evidence of applied and collaborative learning without having provided evidence of every learning outcome. Naïve

Table 3
Evaluations Crediting Applied and Collaborative Learning Outcomes

Learning outcome	Faculty sponsor		Naïve evaluator	
	<i>n</i>	%	<i>n</i>	%
Understands literature	25	66%	20	22%
Analyzes literature	21	55%	15	17%
Project goals	32	84%	37	41%
Project hypothesis	33	87%	32	36%
Research design	29	76%	29	32%
Data collection	29	76%	6	7%
Data analysis	22	58%	22	24%
Draws conclusions	20	53%	20	22%

Note. Faculty sponsor *n* = 38. Naïve evaluator *n* = 90.

evaluators agreed that five (13%) of the 38 ePortfolios failed to show evidence of any applied and collaborative learning. However, the faculty sponsors of these students reported evidence of between four and eight of the applied and collaborative learning outcomes. We conclude that these five students demonstrated applied and collaborative learning but failed to document mastery in their ePortfolios.

ePortfolio Capture Rates

To determine the extent to which naïve evaluators were aware of students' mastery of learning outcomes, we limited our sample for each learning outcome to students who had been credited by their faculty sponsor. These numbers are reported in Tables 4 and 5. We then calculated the number of times at least one naïve evaluator credited each of these students in order to determine the percentage of times naïve evaluators credited learning that had been credited by sponsors. We believe that these percentages are the best measure of the extent to which naïve evaluators were able to see evidence of actual learning. We will refer to this measure as *ePortfolio capture*.

As can be seen in Table 4, the ePortfolio capture rates for academic identity outcomes were excellent, with rates ranging from 67%-87%. However, as can be seen in Table 5, ePortfolio capture rates for applied and collaborative learning outcomes were lower, ranging from 14%-67%. Capture rates were over 50% for project goals, project hypothesis, and research design. Capture rates ranging from 30%-40% were observed for understands literature, analyzes literature, data analysis, and draws conclusions. The lowest capture rate of 14% was observed for data collection.

Differences in Sponsor and Naïve Evaluator Ratings

Another way to determine whether naïve evaluators can reliably assess student learning is to compare the frequency with which faculty sponsors

credited students with learning that the majority of naïve evaluators did not to the frequency with which the majority of naïve evaluators credited a student with learning that the faculty sponsors did not. Because the faculty sponsors had the benefit of both ePortfolio review and personal knowledge, we expected there would be more instances in which sponsors credited learning than the reverse. We found that there were far more instances in which sponsors credited students with learning when the naïve evaluators did not (18%-58%) than there were instances in which naïve evaluators credited students with learning when the sponsors did not (0%-11%). The most common applied and collaborative learning outcomes credited by naïve evaluators but not sponsors were draws conclusions (11%), project goals (8%), and research design (8%). The most common academic identity outcomes that were credited by naïve evaluators but not faculty sponsors were confidence sharing ideas (11%) and plans for academic future (8%).

Differences between Students

Although all of the students who participate in our program are enrolled in community colleges when they apply, some students enter our program ready to attend a 4-year school while others plan to return to community college. We divided our sample into students who would be attending a 4-year institution after completion of the summer program (*n* = 16) and students who would be returning to their two-year institution (*n* = 22). We hypothesized that more advanced students might have been better able than less advanced students to master (or document) applied and collaborative learning at the bachelor's level. Table 6 reports the average number of learning outcomes associated with applied and collaborative learning and academic identity as a function of academic status and evaluator.

To investigate the effects of academic status and evaluator on applied and collaborative learning we

Table 4

Academic Identity Outcomes: Frequency of Naïve Evaluator Credit for Outcomes Credited by Faculty Sponsor

Learning outcome	Number credited by sponsor	No. and % credited by naïve evaluator
Hopes and goals	18	12 (67%)
Confidence sharing ideas	31	27 (87%)
Academic future	31	21 (68%)
Careers	33	23 (70%)
Learning from experience	27	20 (74%)
Engagement with research	32	27 (84%)

Table 5

Applied and Collaborative Learning: Frequency of Naïve Evaluator Credit for Outcomes Credited by Faculty Sponsor

Learning outcome	Number credited by sponsor	No. and % credited by naïve evaluator
Understands literature	25	10 (40%)
Analyzes literature	21	8 (38%)
Project goals	32	20 (63%)
Project hypothesis	33	22 (67%)
Research design	29	15 (52%)
Data collection	29	4 (14%)
Data analysis	22	8 (36%)
Draws conclusions	20	6 (30%)

Table 6

Average Number of Learning Outcomes Associated with Applied and Collaborative Learning and Academic Identity Reported as a Function of Academic Status and Evaluator

Learning outcome	Evaluator	Community college students	4-year college students	All students
		<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)
Applied and collaborative learning (8 items)	Faculty sponsor	5.41 (2.40)	5.75 (2.05)	5.58 (0.35)
	Naïve evaluators	1.61 (1.82)	2.77 (2.57)	2.19 (0.24)
Academic identity (6 items)	Faculty sponsor	4.23 (0.37)	4.94 (0.44)	4.02 (0.27)
	Naïve evaluators	2.98 (0.23)	3.01 (0.32)	3.61 (0.22)

calculated a 2 (academic status: 2-year school, 4-year school) x 2 (Evaluator: faculty sponsor, naïve evaluator) ANOVA on the total number of learning outcomes credited. We observed a significant and strong effect of evaluator, $F(1, 127) = 63.11, p < .001, \eta_p^2 = .33$, such that faculty sponsors reported more evidence of learning ($M = 5.58$) than naïve evaluators ($M = 2.19$). We also observed a marginally significant effect of academic status, $F(1, 127) = 3.11, p = .08, \eta_p^2 = .03$, such that more advanced students were credited with higher levels of applied and collaborative learning ($m = 4.26$) than less advanced students ($m = 3.51$). We failed to observe an interaction.

To investigate the effects of Academic Status and Evaluator on Academic Identity we calculated a 2 (Academic Status: 2-year school, 4-year school) x 2 (Evaluator: faculty sponsor, naïve evaluator) ANOVA on the total number of academic identity outcomes

credited. We observed a significant effect of Evaluator, $F(1, 127) = 19.74, p < .001, \eta_p^2 = .14$, such that faculty sponsors reported more evidence of identity ($M = 4.58$) than naïve evaluators ($M = 3.04$). We failed to observe an effect of academic status or an interaction between academic status and evaluator.

Discussion

In the current work, we describe our use of rubrics to assess applied and collaborative learning and academic identity in ePortfolios that were created during a summer research program for community college students from underserved groups. Faculty sponsors evaluated individual students using their knowledge from personal interactions as well as the student's ePortfolio. Naïve evaluators evaluated students using only the ePortfolio. As hypothesized, we

found evidence that ePortfolios document applied and collaborative learning and academic identity. We also found that the rubrics we designed to assess these constructs appear to be reliable measures of the constructs under investigation.

The rubrics were developed following practices that support their validity. Experienced mentors who were familiar with the research program and its goals worked with assessment experts to develop and refine the rubrics over a year during which they used them to assess students. Construct reliability is supported by the adequate levels of inter-item similarity obtained for each measure. We observed variations in the quality of individual naïve evaluators' work. The range of quality was demonstrated by the improvement in inter-evaluator reliability when three evaluators assessed a single student and the two with the highest levels of agreement were included in the calculation. Nonetheless, the observed levels of inter-rater reliability are well within the range of reliability generally seen with rubric use (Jonsson & Svingby, 2007). We conclude that these rubrics are valid and reliable tools that might be used in the assessment of student ePortfolios.

As expected, faculty sponsors credited students with more learning outcomes than naïve evaluators. We believe that this level of disagreement should be interpreted as evidence of the rubrics' sensitivity. An effective rubric should differentiate between the learning evidenced in an ePortfolio alone and the learning evidenced in many hours of shared work in addition to an ePortfolio. This interpretation is supported by the finding that, for every measured learning outcome, faculty sponsors gave credit more frequently than naïve evaluators. Similarly, faculty sponsors gave credit when naïve evaluators did not more frequently than naïve evaluators gave credit when faculty sponsors did not.

The few instances in which naïve evaluators gave credit when faculty sponsors did not may provide insight into the standards employed by the two types of evaluators. It is possible that faculty sponsors have higher standards of proof than naïve evaluators. We believe this is likely to have affected the evaluation of the applied and collaborative learning outcomes. The applied and collaborative learning outcomes that were most often credited by naïve evaluators but not faculty sponsors were draws conclusions, project goals, and research design. For each of these learning outcomes, two or three students received credit from naïve evaluators but not faculty sponsors. These three outcomes are the most conceptually difficult applied and collaborative learning outcomes and the most specific to the individual research group. Accordingly, faculty sponsors may have been somewhat less lenient than naïve evaluators in crediting these outcomes.

We were primarily interested in determining the extent to which actual learning could be assessed via ePortfolios. Naïve evaluators credited individual students with 2.19 outcomes on average (out of eight possible). On the basis of this finding we conclude that, in general, naïve evaluators require a high standard of proof before credit is awarded. Additionally, when we limited our sample for each learning outcome to students who had been credited with the outcome by their faculty sponsor, we observed relatively high ePortfolio capture rates (30%-67%) for all individual learning outcomes except data collection (14%). We believe that high ePortfolio capture rates indicate that naïve evaluators were able to credit actual learning.

Individual ePortfolios varied in their quality and completeness. We found that there was a trend in which students who were ready to transfer to four-year schools demonstrated evidence of more applied and collaborative learning outcomes than students who were planning on returning to community colleges. Given that we assessed applied and collaborative learning at the bachelor's level, it is not surprising that students who were prepared to transfer demonstrated more proficiency than those who were not yet ready to transfer. This finding can be interpreted in several ways. It is possible that more advanced students learned more than less advanced students. However, it is also possible that students who were about to transfer to a 4-year school were more able or more motivated to document their learning than students returning to community college.

We found that, regardless of academic level, students were similarly able to document academic identity in their ePortfolios. We believe that this is an important finding. In previous work we have argued that the development of academic identity in summer research programs may be a central element that leads to increased academic persistence (Singer-Freeman et al., 2014). Students with an enhanced sense of academic identity who return to community college may be more likely to transfer to a four-year school in the future and those who go on to four-year schools may be more likely to complete their bachelor's degrees.

Limitations and Implications

This research occurred in an applied setting. Consequently, it was subject to lower levels of control than a more structured experiment would be. We elected to provide relatively little training to our evaluators. By examining the use of the rubrics without extensive training we were able to determine the extent to which the rubrics themselves enabled reliable evaluations. We found that levels of inter-rater reliability were within ranges reported elsewhere.

Nonetheless, if these rubrics were to be used with the purpose of crediting prior learning, training on sample ePortfolios would be advisable. If such training is not conducted, using three naïve evaluators would be preferable to using two.

Because this research was conducted in the context of a summer research program, we compared the ratings of faculty sponsors to naïve evaluators. In addition to having more knowledge of the student's abilities, faculty sponsors also had a personal relationship with the student. A more controlled evaluation would compare the ratings of two sets of naïve evaluators: one that reviewed only the ePortfolio and a second that reviewed the student's work over the entire program. We hypothesized and found that for most outcomes, faculty sponsors credited students with greater learning than naïve evaluators. We interpreted this to reflect the fact that faculty sponsors had more genuine knowledge of students' abilities. However, it is also possible that faculty sponsors credited more learning because of the influence of having a personal relationship with the student. We believe that this interpretation is unlikely for several reasons. First, faculty sponsors were not sharing their evaluations with the student. This should reduce faculty sponsors' focus on their personal relationship with their students. Second, faculty sponsors also served as naïve evaluators. Serving as a naïve evaluator should help the faculty sponsor take a neutral perspective when considering the work of his/her own students. Third, faculty sponsors knew that their students were also being assessed by naïve evaluators. This knowledge should encourage impartiality. Finally, the few instances in which faculty sponsors did not credit learning that was credited by naïve evaluators involved outcomes that were the most conceptually difficult. This suggests that in these instances faculty sponsors used their more extensive knowledge of the student to determine that the evidence in the ePortfolio was not sufficient to document mastery. It seems unlikely that if faculty were biased to credit students because of a personal relationship they would exhibit this bias only for the less difficult learning outcomes.

To give students a sense of autonomy in the creation of their ePortfolios, we allowed students to create their ePortfolios without using a template. We believe that this may have increased the extent to which students documented and developed academic identity by encouraging them to fully engage with the ePortfolio as a creative project. However, students' different organizational choices likely made it difficult for some evaluators to locate evidence of individual learning outcomes. We hypothesize that inter-rater reliability was impeded by the unstructured nature of the students' ePortfolios. Were students creating ePortfolios for the purpose of receiving credit for prior learning, it would

be advisable to develop a template that was organized by learning outcome and specified the products to be included to demonstrate mastery. In contrast, for those using ePortfolios as a means of developing and documenting academic identity, it may be important to allow students more independence in the creation of their ePortfolios.

Miller and Morgaine (2009) found that the reflective practices embedded in ePortfolio creation helped students to develop academic identity as they engaged in complex projects. The use of writing prompts (see Appendix) appeared to encourage expressions of academic identity in student ePortfolios. Our current evidence of academic identity in student ePortfolios replicates Singer-Freeman et al. (2014). The rubrics tested in this work appear to be a reliable means of assessing academic identity. The construct of academic identity is similar to those of academic self-efficacy and academic goals, which have been found to be moderately related to academic persistence (Robbins et al., 2004). We believe that academic identity should be a central element of student ePortfolios and that the evaluation of academic identity in student ePortfolios is an important area for future research.

We found evidence to support our hypothesis that ePortfolios would be useful in the evaluation of academic identity and applied and collaborative learning at the bachelor's level. As expected, direct faculty knowledge of students provided more robust evidence of learning and identity than ePortfolios alone. Nonetheless, ePortfolio assessment did provide evidence of prior learning and identity in the current study. Proficiencies similar to those evidenced by our students are likely to be present in other high-impact activities (e.g., internships, global learning, learning communities). The use of rubric-based assessment of ePortfolios by trained evaluators in these contexts could have similar value.

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Appendix
Reflective Writing Prompts

1. List your favorite 5 “I am” statements (they do not have to match your original ones). Write your goals for the summer, the next several years, and the next 10 years. Write about the ways in which the last week has been similar to and/or different from other weeks of your life.
2. List the personal values that you hold. Describe an experience in your life that made you proud of yourself and your values. Reflect on the reason that the experience made you proud of your values. Discuss how your values fit with the values of the scientific community.
3. You are now half way done with your summer experience. Please take a look at your goals for the summer that you created during the first week. Describe the progress you have made in meeting your goals. Propose ways you could increase your progress towards meeting your goals.
4. Write a reflection on your thoughts about your ideal career. Be sure to address the following questions in your response: What skills do you currently have that you think make you well suited for this career? What skills might you need to develop further to succeed in this career? Have your thoughts about your ideal career changed as the summer has progressed?
5. Write a reflection on ways that you have and have not changed over the past 5 weeks. If you could do the summer program again, what would you do differently and what would you keep the same?