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The contributions of group work, utility value, and self-assessments of learning to student performance in a general education class

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Abstract: We triangulated self-assessments of learning, course grades, and course evaluations from 28 students in a general education class to examine the effects of group work and perceptions of utility on learning, investigating three hypotheses: 1) self-assessments of learning provide triangulating information that deepens interpretations of traditional assessments; 2) group experiences influence students' views of the course's utility value; 3) students who believe the course has high utility value will learn more than students who believe the course has low utility value. We found support for all hypotheses. Triangulating information about learning provided a more nuanced understanding of learning than any single source did in isolation. Group work was associated with beliefs that the class was professionally useful. Stronger academic performance was present for students who believed the class was professionally useful, or reported more different types of class utility value. We discuss the implications of these findings for teaching and assessment of student learning.

Keywords: *Assessment of Student Learning, Utility Value, Group Work, Self-Assessment*

Introduction

A survey of chief academic officers reported that most colleges have clearly articulated general education learning outcomes (Hart Research Associates, 2015). However, many institutions lack robust means of assessing learning in ways that optimally support conceptual integration (Archer, 2017). For example, many assessments do not provide students with opportunities to contextualize learning by integrating it with previous educational or life experiences (Hobbins et al., 2022). A new model of the student as a partner in assessment emerged in which student self-assessments of learning improve our understanding of traditional assessment results and encourage conceptual integration (Healey et al., 2014). Course evaluations can provide some information about students' views of their learning. However, the use of this information is limited because not all students complete course evaluations and the information is not linked directly to each student. A more promising source of information is the use of writing prompts. Writing prompts can effectively encourage both self-assessments of learning and integration of past and present learning in ePortfolios (Singer-Freeman et al., 2014, 2016) and in more traditional written assignments (Singer-Freeman & Bastone, 2017, 2019a, 2019b). Prompted self-assessments of learning have also been shown to add triangulating viewpoints when

assessing student learning (Singer-Freeman et al., 2021). Self-assessments of learning have the potential to increase the impact of learning by encouraging students to relate current and past learning and by increasing their awareness of the value of their learning to future efforts (Bourke, 2018; Dann, 2014; Zeng et al., 2018).

In addition to increasing awareness of learning, self-assessments also have the potential to increase students' interest in learning. Eccles et al. (1983) expectancy-value model proposed that an interaction between students' expectations of success and the perceived value of a task would impact academic performance. One key part of perceived task value is utility value, which can be defined as the usefulness of a task to a person's life (Eccles et al., 1983). An assignment is high in utility value when students perceive the work to have worth beyond its value within a specific course (Wigfield & Cambria, 2010). Students' perceptions of the potential value of assignments influence their efforts and interpretations of success or failure (Eccles & Wigfield, 2002). Students can view an assignment as useful in three different ways. Assignments that support students' future career goals are high in professional utility value, those that prepare them for future courses are high in academic utility value, and those that support individual goals are high in personal utility value (Wigfield & Cambria, 2010). When self-assessments of learning integrate general education concepts with personal experiences or future professional or academic goals, the high utility value of the work can deepen students' engagement (Wigfield & Cambria, 2010). Students at risk for academic difficulties, such as underrepresented minority and first-generation college students, learned more in a range of science and mathematics courses when assignments were designed to increase their awareness of the personal, professional, or academic utility value of the work (Canning & Harackiewicz, 2015; Canning et al., 2018; Harackiewicz et al., 2016; Harackiewicz et al., 2012; Hulleman & Harackiewicz, 2009; Wang et al., 2021). We hypothesized that students in general education courses might also learn more when they view the course as having utility value. Although the utility value of coursework is generally either described by the assigning faculty member or prompted by a reflective writing prompt, we hypothesized that student discussions that take place during group work might also impact students' views of the course's utility value.

There has been a great deal of research examining how the size and composition of teams influence students' grades and satisfaction with the group work experience (Davies, 2009). However, there has not been an examination of how group work interactions might influence students' beliefs about course utility value. Group work has been shown to promote deep learning by allowing students to discuss ideas, debate merits, and integrate contradictory findings with a team of peers (Entwistle & Waterston, 1988). Watkins (2004) argued that group work might contribute to students' sense of identity. Dasgupta et al. (2015) found that female engineering students who worked in female-majority teams experienced less anxiety and were more likely to maintain confidence in their ability to succeed in engineering than women who worked in male-majority teams. If group work influenced students' views of themselves or the purpose of academic tasks, it might influence students' sense of a course's

utility value. Unlike other work on utility value, we did not experimentally manipulate students' views of course utility value. Instead, we examined whether students who worked together on an extended group project shared similar views of the course utility value and whether these views were associated with course outcomes.

In sum, the current work triangulated course grades, course evaluations, and a self-assessment of learning from students in a general education course to examine the effects of group work and perceptions of the course utility value on learning. Students engaged in an extended group project in which they researched and proposed solutions to a pressing world problem. Students spent time both in and out of class working with three other students. We collected self-assessments of learning by asking students to provide written responses to questions that probed their views of ways in which they had made academic progress in the course.

Research Hypotheses

In the current work, we investigate three hypotheses:

1. Self-assessment of learning provides triangulating information that deepens interpretations of traditional assessments.
2. Group experiences influence students' views of the course's utility value.
3. Students who believe the course has high utility value will learn more than students who believe the course has low utility value.

Project Overview

This project arose from discussions between the authors about the role that divisional requirements for non-major students play in sculpting their future endeavors. The first author is a plant ecologist who teaches the biology course "Plants and People," a course that satisfies the science divisional requirement. The second author is the Director of Research at the Center for the Advancement of Teaching and specializes in research examining how course structure influences student performance. In this section, we describe the course, the assignments and activities, our coding of student writing, and our planned analyses.

The course

"Plants and People" is a general education biology course that surveys ways in which people rely on and interact with plants. The course enrolls 28 students each semester, who are largely juniors and seniors with many business and communications majors. The course takes a multidisciplinary approach to real-world issues integrating history, sociology, and economics with fundamental biological principles. Learning activities include discussions, project-based learning, and laboratory activities. The final grade includes weekly laboratory reports (25%), two exams (25%), two writing assignments (20%), a presentation (15%), weekly journal reflections (10%), and classroom engagement (5%). The course student learning outcomes (SLOs) are listed in Table 1, along with summative assignments used to

evaluate each SLO, the self-assessment questions used to measure student views of their learning, and course evaluation questions that related to course SLOs.

Table 1

Student Learning Outcomes (SLOs) are Reported Along with Summative Assignments and Anonymous Course Evaluation Questions. Responses to Shown Self-Assessment of Learning Questions Were Coded to Evaluate Across All Four SLOs.

SLO	Summative Assignments	Anonymous Course Evaluations Questions	Self-Assessment Questions
1. Use scientific literature to assess evidence	1. Brief Paper	1a. I spent time... thinking, analyzing, and evaluating evidence 1b. I learned how scientists identify questions and acquire new knowledge.	<ul style="list-style-type: none"> What is one skill you improved in this course? How did the course help you improve this skill? How does this improvement change your approach to life decisions or future endeavors?
2. Describe the centrality of plants to society	2. Short-Answer Final Exam	2. I learned the relevance of this subject to real world issues.	<ul style="list-style-type: none"> What else could you do to improve this skill?
3. Apply conceptual synthesis to scientific problems	3. Brief Paper	3. I learned to connect and integrate ideas, information, or experiences."	<ul style="list-style-type: none"> What is the most important big idea you want to remember? Why do you think this idea is the most important?
4. Describe scientific concepts in lay terms	4. Weekly Lab Reports		<ul style="list-style-type: none"> Are there any ways it will change your behavior?

A central piece of the course was a semester-long project in which teams of students developed plant- or environment-based solutions to address a global problem. After four weeks of exposure to possible topics, students indicated their general interests and individual strengths when working on group projects by describing themselves as typically filling the role of an organizer, reality checker, optimist, and/or innovator. Using this information, the professor created teams of four students that

represented a range of strengths in their approach to group work. During the semester of the study, every team had at least one organizer, six teams included one reality checker, one optimist, and/or one innovator. Students spent 30 minutes of class time for ten weeks working together. Additionally, teams spent approximately three hours working out of class, resulting in an estimated total of eight hours of group work. Teams identified a topic and built foundational knowledge through reading. They then debated the causes and effects of the problem and identified knowledge gaps. In the ninth week of the semester, each student critically analyzed a past attempt to address their challenge using scholarly and popular literature to support their analysis in a one-page, single-spaced paper. The paper was evaluated with a rubric with categories for critical analysis, assessing evidence, organization, and editorial accuracy. These individual papers were used as the basis for a team presentation and final team paper on the topic.

Lab reports

Students wrote one-page, single-spaced syntheses of weekly laboratory activities that highlighted key scientific concepts and provided critical analysis. The rubric included categories for linkages of the topic to society, clear communication of complex information, analysis, and logical organization. The instructions and evaluation rubric were the same every week, so students could improve their writing throughout the semester. To evaluate improvement over the course of the semester, we calculated a score for each student that compared the student's average score on the first three lab reports to their average score on the final three lab reports (one student is excluded from all lab improvement analyses due to incomplete work).

Self-assessment of learning

During the final laboratory session of the semester, students responded to seven ungraded self-assessment of learning questions (See Table 1). Each question was asked sequentially, allowing a few minutes for students to type each response. The entire exercise took approximately 20-25 minutes.

Course evaluations

Four questions from course evaluations investigated students' views of their learning that relate to SLOs by asking students to complete Likert-style ratings (See Table 1). Questions 1a and 1b, shown in Table 1, were used to evaluate students' views of improvements in their ability to assess evidence. Question 2 was used to evaluate students' views of improvements in their awareness of the centrality of plants, and question 3 was used to evaluate students' views of improvements in their ability to engage in conceptual synthesis.

Table 2

Coding Categories for Self-Assessments of Learning

Coding Category	Definition: Student describes:	Sample from student writing
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Assess evidence	Ability to critically evaluate ideas by seeking scientific sources	I know that there are many studies out there that could be conflicting and so taking the time to dissect various pieces of information is crucial.
Centrality of plants	Awareness of importance of plants to areas of human life	I learned that almost everything we do and use involves plants.... It's easy to overlook, but my perspective has shifted to where I can perceive the world in a different lens.
Conceptual Synthesis	Awareness of the complexity of environmental challenges	Everything is interconnected and all systems are interconnected and related. Changing and acting in one system will ultimately influence the systems around it.
Describe in lay terms	Ability to write concisely and clearly about scientific topics	I am typically incredibly wordy and like to add a lot of fluff to my writing, but I have learned a lot about how to write concisely and just include information necessary.
Personal Utility Value	A way in which the course will help them in their personal life.	In my personal life, this will help me to always question the status quo and find my own way, or stick with the "normal" way but only after I have tested it myself.
Professional Utility Value	A way in which the course will help them in their professional life.	Legal writing is very structured and I have a feeling that learning to follow a strict rubric, like I did in this class, will make me a good law student and even better lawyer
Academic Utility Value	A way in which the course will help them in future courses.	Working on being more concise has also helped my writing in other classes.

Data Analysis

Qualitative Coding

We followed a deductive approach to coding by creating categories that reflected course SLOs and three types of utility value. This resulted in seven coding categories shown in Table 2 along with sample student statements for each category. We then engaged in content analysis of students' responses to

the self assessment questions. Coding was completed using MAXQDA. All responses were coded by the second author and 20% of the responses were independently coded by the first author. The selection of 20% of the sample for multiple coding falls within typical practices for reliability calculations (O'Connor & Joffe, 2020). Intercoder reliability was calculated by dividing the number of agreements by the total number of agreements plus disagreements. This resulted in an intercoder reliability of 84%. Disagreements were resolved through discussion.

Mapping of Course Measurements to Research Hypotheses

To evaluate Hypothesis 1, we triangulated evidence of SLO attainment from self-assessments of learning, summative assignments, and anonymous course evaluations. To evaluate Hypothesis 2, we analyzed differences in the types of utility value described in self-assessments of learning by members of different teams. To evaluate Hypothesis 3, we examined differences in grades among students who described different types of utility value in self-assessments of learning.

Statistical Analyses

A mixed-methods embedded design was employed in which qualitative data enhanced quantitative findings to provide a more complete understanding (Yauch & Steudel, 2003). Our analysis included data from three sources: graded assignments, self-assessments of learning, and course evaluations. We provide descriptive information without statistical analyses to address Hypothesis 1 by triangulating responses to graded assignments, self-assessments of learning, and Likert-scale ratings of learning in course evaluations. We used Fisher's exact tests to address Hypothesis 2 by examining the impact of team membership on views of course utility value. We use 1-tailed independent samples *t*-tests to address Hypothesis 3 by examining differences in grades between students with different views of course utility value. All statistical tests were conducted using SPSS.

Results

We address three areas of inquiry in these results. First, we explore whether different patterns of mastery emerge when triangulating responses to graded assignments, self-assessments of learning, and course evaluations. Second, we investigate whether students' perceptions of course utility were influenced by team membership. Finally, we examine whether students' views of the personal, professional, or academic utility value of the course were associated with differences in overall grades or improvement in grades.

Hypothesis 1 - Self-assessment of learning provides triangulating information that deepens interpretations of traditional assessments.

Table 3 reports the percentage of students who reported improvement in course evaluations, demonstrated mastery in graded assignments, and reported improvement in self-assessments. Grades of 70% or higher on summative assignments were interpreted as evidence of mastery. As can be seen in Table 3, there were four questions in course evaluations that related to course SLOs. With 26 of the

28 enrolled students of the course completing evaluations, 96%-100% of students agreed or strongly agreed they had improved in ways that aligned with course SLOs.

Table 3

Percentage of Students Demonstrating Mastery in Graded Assignments or Agreeing With SLO-Related Items in Course Evaluations, and Reporting Improvement in Self-Assessments of Learning

Source	SLO			
	Assess evidence	Centrality of plants	Conceptual synthesis	Describe in lay terms
Course Evaluation Items	96% "I spent time... thinking, analyzing and evaluating evidence" 100% "I learned how scientists identify questions and acquire new knowledge."	100% "I learned the relevance of this subject to real world issues."	100% "I learned to connect and integrate ideas, information, or experiences."	No Measurement
Graded Work	86%	75%	86%	86%
Self-Assessments	39%	61%	64%	43%

The prompts in the course evaluation do not align directly with course SLOs but provide some supporting evidence that students believed they improved in ways that align with course outcomes. In response to prompts asking students to self-assess learning, many students discussed course SLOs. We were interested in whether students' self-assessments of their learning would be similar to the professor's assessments of mastery using graded assignments. It is interesting to note that although 75%-86% of students were judged by the professor to have demonstrated mastery of each learning outcome, only 39%-64% wrote about improving in any outcome. However, this is not surprising given that students were asked to write about a single area in which they improved during the semester. Accordingly, students who entered the course proficient in a learning outcome might not have chosen

to discuss this outcome in their self-assessment. The most frequent area of improvement that was described by students was an improved ability to engage in conceptual synthesis which was described by 61% (17) of students.

Hypothesis 2 - Group experiences will influence students' views of the course's value.

Students spent significant amounts of time working with a team of other students during the course. Many students mentioned important ways in which the team work influenced their learning in the course. For example, one student wrote, "the team project helped me become better at analyzing problems and finding a variety of solutions and picking the best one." Another wrote, "I have found that I can shift well when other people give me feedback, therefore I am going to make an active effort to have people look at my work and see where I can improve!" A third student wrote, "The group project definitely helped because I had to trust my other team members to do their part, and even when I didn't agree 100%." Over half of the students (17) wrote about ways in which skills they developed through group work would support professional goals. For example, one student wrote that the course was useful to him because, "Going into the workforce, I will need to collaborate with my coworkers constantly. Being in consulting requires me to be able to stay on my feet, adapt quickly, and work with the interests of other people."

We were interested in evaluating the effects of group work on students' perceptions of course utility value. The overall percentages of students expressing each type of utility value are presented for each of the seven student teams in Table 4, along with the topic the team was investigating. We calculated Fisher's exact tests to determine if there was a significant association between team membership and student views. As can be seen in Table 4, there was a significant association between team membership and the belief that the course had professional utility value ($p = .005$). This result indicates that members of some teams were more likely to believe the course had professional utility value than members of other teams. This effect was driven by the fact that every student in three teams described the course as professionally useful, and no students in one team described the course as professionally useful. However, team membership was not significantly related to any other expressed beliefs about the course.

Table 4

Percentage of Students in Each Team that Report Each Type of Course Value and Results of Fisher's Exact Test

Team Project Topic								
Utility Value	Pollinator Decline	Diet	Athletes Health	Sustainable Textiles	Diet and ADHD	Food Security	Food Waste	Fisher Exact Test

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Professional	50%	0	100%	100%	100%	50%	25%	$p = .005$
Personal	75%	75%	25%	50%	50%	25%	100%	$p = .42$
Academic	0	25%	50%	25%	0	0	25%	$p = .78$

Hypothesis 3 - Students who believe the course has high utility value will learn more than students who believe the course has low utility value.

We hypothesized that students who viewed the course as having more academic, professional, or personal utility value would learn more than students who viewed the course as less useful. The numbers of students who described each type of utility value in their self-assessment of learning are reported in Table 5, along with their average final grades, average lab improvement scores, and t -tests. As can be seen in Table 5, the largest number of students described ways in which the course would help them professionally or personally. To investigate the extent to which different types of perceived utility value were associated with higher performance, we calculated 1-tailed independent samples t -tests comparing the final grades and lab improvement scores of the students who described each different type of utility value to students who did not describe this type of value. We failed to observe any association between personal or academic utility value and academic performance. However, we observed a significant effect with a large effect size of the perception of professional utility value on final grades such that the students who viewed the course as professionally useful received higher final grades than those who did not view the course as professionally useful. We were also interested in whether students who described more types of utility value might perform differently in the course. To explore this, we calculated 1-tailed independent samples t -tests comparing the final grades and lab improvement scores of students who described two or three different types of utility value to students who did not report any or reported only one type of utility value. We found that both final grades and lab improvement scores were significantly higher for those who described two or more types of utility value than those who described one or fewer types of utility value.

Table 5

Average Student Grades and Lab Improvement Scores Disaggregated by Perceived Course Utility Value.

Professional Utility		Personal Utility		Academic Utility		Total Utility	
Present n = 17	Absent n = 11	Present n = 16	Absent n = 12	Present n = 5	Absent n = 23	2 or 3 n = 12	0 or 1 n = 16

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Final Grade	87.9	77.9	86.1	81.2	82.5	84.3	88.9	80.3
<i>t-test</i>	$t(26) = 2.29$, $p = .02$ Cohen's $d = .88$		$t(18.3) = .99$, $p = .17$		$t(26) = .30$, $p = .38$		$t(22) = 2.12$, $p = .03$ Cohen's $d = .77$	
Lab Improvement	6.9	3.1	5.7	4.8	10	4.3	8.82	2.56
<i>t-test</i>	$t(25) = 1.29$, $p = .15$		$t(25) = .27$, $p = .39$		$t(25) = 1.29$, $p = .11$		$t(25) = 1.87$, $p = .04$ Cohen's $d = .34$	

Note: Total Utility represents the number of different types of utility (professional, personal, or academic) that each student described.

Discussion

This study used course grades, course evaluations, and self-assessments of learning to examine the impact of group work and student views on learning in a general education course. When reviewing different measures of learning, we found that each source of information provided a different perspective on student performance.

Course evaluations revealed that nearly all students felt they improved in areas related to three of the four course SLOs. Graded summative assignments revealed that between 75%-86% of students demonstrated mastery of the four SLOs and indicated the greatest need for improvement in students' ability to describe the centrality of plants to society for which only 75% showed mastery. These results might encourage a professor to spend more class time exploring the centrality of plants.

In contrast, self-assessments revealed that the centrality of plants was the most important thing students reported learning with mention in 64% of responses. Although this were fewer students than were credited with mastery in summative assessments, these students selected this area of learning as being most important, indicating that this course material was central and memorable for many students. Self-assessments revealed that only 39% of students described the ability to assess evidence, and only 43% described the ability to describe scientific concepts in lay terms as areas of improvement. Given the fact that 86% of students demonstrated these abilities in summative assessments, it is clear that most students have or obtained these skills.

The lower observed levels of self-assessments than instructor evaluation might result from a number of different situations. Some students may have been competent in these areas prior to the course; in

this case, success on summative assessments might reflect prior learning. Others might not be aware they improved in these areas or might not value these skills. If awareness of competence is important, the faculty member might increase discussions with students about these areas of learning and ways in which these skills are important in other academic and professional domains. Taken together, we conclude that there is a benefit to triangulating multiple sources of information to understand students' learning in general education courses. In future work, it would be interesting to explicitly ask students to self-assess learning for each SLO in order to understand the extent to which students are aware of learning relating to each SLO.

Our second area of interest was whether group work might influence students' views of the course's value. Interestingly, we only saw a relation between team membership and the tendency to view the course as professionally useful. This is intriguing because students who found the course to be professionally useful also received higher grades and showed more improvement throughout the semester. Although preliminary, we hypothesize that team interactions might be associated with perceptions of course value which influence overall course performance. Because these findings were not the result of experimental research, it is impossible to make causal interpretations. However, we believe this observation is worthy of further exploration under more controlled conditions.

Our final question was whether students' views about the usefulness of the course might be associated with overall performance or improvement. Because non-science majors report little interest in taking required general education science courses, it is not uncommon for general education courses to try to engage students by focusing on applications of science to broader issues. We were interested in learning whether students' views of course usefulness might be associated with stronger performance. We observed higher grades and more improvement in students who reported the course to be more professionally useful or reported two or more different types of utility value than in students who viewed the course as less useful. The finding that students who reported professional value in the course performed better than those who did not replicates and extends other research that has found awareness of personal utility value to support academic performance (Canning & Harackiewicz, 2015, Canning et al., 2018; Harackiewicz et al., 2016; Harackiewicz et al., 2012; Hulleman & Harackiewicz, 2009, Wang et al., 2021).

Much of the previous work has examined courses that enroll predominantly first or second-year students and are required for student majors. The current course enrolled primarily juniors and seniors and was not required for student majors. These differences might explain why very few students viewed the course as having academic utility and why the perception of professional but not personal usefulness was associated with stronger performance. Many students shared ways in which they personally valued the course that involved addressing an environmental problem. Valuing this applied aspect of the course might create a strong desire to change behavior outside of the course without encouraging more effort on the academic tasks in the course. In contrast, students who viewed the

course as professionally useful wrote specifically about the ways in which graded tasks, such as writing concisely, integrating conflicting evidence, and reaching a consensus with peers would help them in their future careers. For students who viewed these tasks as professionally useful, it would make sense that they would put more effort into improvement. However, given the observational nature of this finding, the causal direction of influence is unclear; it is also possible that students who put more effort into their work improved in ways that resulted in them viewing the course as professionally useful. In future work, it would be informative to experimentally manipulate messages about professional utility value in general education courses to learn whether these messages increase student efforts.

There is a strong need to evaluate our assessment practices and increase student awareness of their learning in general education courses in which topics often seem farther from their primary academic interests. Based on the current work, we believe that the use of self-assessments of learning can be a powerful tool to achieve both of these goals. Although the current findings are limited by their observational nature, they present promising areas for further exploration of the ways in which self-assessment and intensive group work on an authentic project might be used to increase student mastery of SLOs in general education courses.

In conclusion, through our examination of grades, course evaluations, and self-assessments of learning, we found valuable triangulating information that enhanced our interpretation of the findings from traditional assessments of student learning. Our results support our hypothesis that team experiences might indirectly influence course performance by influencing students' views of the course's value. We also found support for our hypothesis that students' beliefs about the value of a general education course are related to their overall grades and their improvement in grades over the span of the course. We encourage educators and assessment professionals to move beyond traditional measures of student learning, to consider self-assessments and beliefs about course value to promote a more nuanced understanding of student learning. Further, if group work can enhance perceptions of course value, group activities might be tailored to nurture positive attitudes towards courses taken to fulfill divisional requirements.

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