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Transparent Problem-Based Learning Across the Disciplines in the Community College Context: Issues and Impacts

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This paper will focus on findings related to Queensborough Community College's (QCC) participation in the Advancing Underserved Student Success through Faculty Intentionality in Problem-Based Learning project of the Association of American Colleges & Universities. Issues and impacts of simultaneous implementation of transparent methods across the disciplines will also be explored.

Study Purpose

Research reveals that students benefit from high-impact practices (HIPs), transparent teaching-learning methods, and problem-based curricula (Finley and McNair 2013). These benefits appear to be particularly profound for traditionally underserved students (Winkelmes 2013). This study investigates the issues and impacts of implementing HIPs, transparent teaching-learning methods, and problem-based curricula in tandem and across the disciplines to encourage traditionally underserved students' academic engagement and performance in the community college context.

Theoretical Framework

According to Schneider (2008, 1), HIPs are those courses that "are correlated with positive educational results for students from widely varying backgrounds." Kuh's research (2008) used the large datasets of the National Survey of Student Engagement (NSSE) and other indirect measures to draw connections between HIPs and student learning. The HIPs that Kuh included in his research were: (1) first-year experiences/seminars; (2) common intellectual experiences; (3) collaborative assignments and projects; (4) diversity/global learning; (5) service-learning/community-based learning; (6) learning communities; (7) writing-intensive courses; (8) internships; and (9) undergraduate research. Kuh's research, which examined students' self-reports of their learning, reveals that the use of HIPs instilled in students the willingness to seek challenges and to persist. Moreover, Kuh (2005) concluded that these HIPs have a pronounced effect on the experiences of traditionally underserved college students.

Finley and McNair's (2013) follow-up study on the impact of HIPs on college students' academic performance involved traditionally underserved populations among NSSE survey respondents and included student responses in focus groups aimed at qualifying the impact of

HIPs from the students' perspectives. Their study used a mixed-methods approach to examine the relationship between participation in HIPs and traditionally underserved students' success and learning. According to Finley and McNair (ibid), students who participated in a HIP perceived their learning to be significantly enhanced as compared to students who did not participate in that particular HIP. Likewise, these students also reported gains in general education, practical competence, and personal and social development.

Yet, traditionally underserved college students' learning gains might be mediated by another element of their course-based experiences: the extent to which their instructors employ transparent teaching-learning methods designed to help them understand *how* and *why* they are learning course content in specific ways (like through HIPs, for example). Winkelmes (in Berrett 2015) argues that instructors who employ transparent teaching-learning methods consistently consider the following three questions as they create and explain assignments and learning activities for students: "What am I asking students to do in this assignment or activity?" "Why am I asking students to do it?" And, "how will students' work on this assignment or activity be evaluated?" Building on the work of Dunlosky and Metcalfe (2008) and Gynnald, Holstad, and Myrhaug (2008), Winkelmes' (2013) Transparency in Teaching and Learning in Higher Education project reveals that transparent teaching-learning methods are particularly effective for traditionally underserved students enrolled in early or introductory college-level work, as they are often unfamiliar with the strategies assumed by course curricula and required for college success.

Significantly, problem-based curricula are often used to enliven HIPs, and to make transparent the relevance and utility of course content. As a result, traditionally underserved college students' learning gains might also be impacted by the extent to which they are exposed

to problem-based curricula that encourage their collaborative investigation and resolution of one or more structured real-world problems (Francom and Gardner 2013). Rooted in the work of Dewey (1944) and most typically employed in STEM disciplines, problem-based curricula have been correlated with improvements in students' long-term retention of course content, skill development, and general satisfaction in their coursework (Strobel and van Barneveld 2009). Again, these gains appear to be particularly profound for traditionally underserved students in specific disciplines (Dong and Chen 2014) and at specific educational levels (Gordon 2001).

At the time of this writing, little is known about the ways in which high-impact practices, transparent teaching-learning methods, and problem-based curricula intertwine and/or work in tandem across the disciplines at an institution of higher education that educates a disproportionate percentage of traditionally underserved undergraduates: the American community college.

Research Questions

In light of the aforementioned gap in the literature, the following questions ground this study:

1. What issues arise when an interdisciplinary group of community college instructors implements transparent teaching-learning methods and problem-based assignments towards student engagement and benefit in HIP courses?

2. To what extent do students perceive their instructors' efforts to employ transparent teaching-learning methods, and does this perception impact their depth of problem-based learning in HIP courses in the community college context?

3. Do problem-based assignments in HIP courses across the disciplines result in learning gains for community college students?

Data and Methods

Instructional Setting

This study was conducted at Queensborough Community College (QCC), one of the seven community colleges of the City University of New York (CUNY). QCC is a minority-serving institution with over 16,000 students who originate from approximately 140 countries and more than a third speak a language other than English. A majority of QCC's students (more than 70 percent) transfer to senior colleges or universities, and others obtain the necessary skills for career advancement. To prepare students for success, the college offers the following seven HIPs in each of its five Academies (Science, Technology, Engineering and Math; Liberal Arts; Visual and Performing Arts; Health Related Sciences; and Business): writing-intensive courses; academic service-learning; learning communities; collaborative assignments and projects; common intellectual experiences; undergraduate research; and global and diversity learning.

In the 2014-2015 academic year, QCC was one of seven colleges selected to participate in the Association of American Colleges and Universities (AAC&U) *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project. QCC's six-member project team was comprised of instructors who are HIP practitioners and experienced in assessment of student learning. Each instructor conducts research related to teaching and learning and reflects on one's own teaching practice in order to support student success. Instructors are scholars within the disciplines of mathematics, biology, sociology, English, speech and communication, and educational psychology. They also actively serve on various college committees and initiatives, including the College's Senate and General Education Task Force.

Participants

Study participants included students enrolled in ten course sections taught by five of the project instructors during the spring 2015 semester. These course sections represented five different disciplines (Sociology; English; Mathematics; Speech and Communication; and Biology) and were defined by their use of at least one of the following HIPs: writing-intensive; undergraduate research; and/or global and diversity learning. Of the 240 students enrolled in these courses, 122 were enrolled in control sections and 118 were enrolled in experimental sections of a study course.

Instruments

This study uses two different instruments. The first is the online Transparency Survey created by Winkelmes (2013b) to gauge students' perceptions of transparency for the Transparency in Teaching and Learning in Higher Education Project. This online survey consists of 44 questions that fall into one of five categories: Perceived Amount of Transparency in the Course; Perceived Improvement of Skills that Employers Value; Confidence to Succeed in School; Recognize When Need Help; and Belongingness. Since 2010, the Transparency Survey has been administered to more than 25,000 students across multiple institutions of higher education in the United States. As instructors at one of the seven colleges participating in the AAC&U *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project, QCC's project instructors were asked to administer this survey to their students.

The second instrument is the AAC&U Problem Solving VALUE Rubric, which was designed in 2007-2009 by AAC&U's Liberal Education and America's Promise (LEAP)

initiative to help faculty assess student work that "(designs, evaluates, and implements) a strategy to answer an open-ended question or achieve a desired goal" (Association of American Colleges & Universities). For the purposes of this study, it is intended to gauge students' engagement and learning gains through problem-based assignments.

The Problem Solving VALUE Rubric consists of six dimensions: Define Problem; Identify Strategies; Propose Solutions/Hypotheses; Evaluate Potential Solutions; Implement Solution; and Evaluate Outcomes. There are four possible scores for each dimension: 1 (Benchmark); 2 (Milestone); 3 (Milestone); and 4 (Capstone). Consistent with the guidelines of the AAC&U *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project, QCC's project instructors were asked to use this rubric in the design, implementation, and scoring of at least two problem-based assignments.

Procedure

In both the control and experimental sections of QCC's five HIP study courses, students were taught by the same course instructor, administered the same course content, and given the same problem-based assignments; however, the students in the experimental section of each of the five HIP study courses were introduced to more extensive transparent teaching-learning methods.

Students in the control and experimental sections of each of the five study courses were asked to respond to the online Transparency Survey at two different points in the Spring 2015 semester: the first survey (pre-test) was administered within the first two weeks of the semester; the second survey (post-test) was administered within the last two weeks of the semester. In some of the QCC study sections, instructors directed students to the surveys as online homework. In other sections, instructors encouraged students to complete the surveys during class time in a

computer lab. Consistent with the directions provided at the beginning of both surveys, a student's participation in the pre- and/or post-test surveys was voluntary and taken as evidence of consent to participate in the Transparency portion of the AAC&U *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project. At QCC, 101 students completed both a pre- and a post-test Transparency Survey.

The Transparency Survey and resulting data were hosted by the University of Nevada at Las Vegas under the direction of the Principal Investigator of the Transparency in Teaching and Learning in Higher Education Project, Mary-Ann Winkelmes. At the beginning of the summer of 2015, Winkelmes provided instructors in the AAC&U *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project with a report on their students' mean responses to the Transparency Survey. These responses were distinguished by experimental and control sections, broken down by survey categories, and compared to similar courses in similar disciplines across the AAC&U project. Each of the seven colleges that participated in the AAC&U *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project was also given a report of their project team's aggregate Transparency Survey results.

Students in the control and experimental sections of each of the five study courses were also asked to complete problem-based assignments at least two times during the Spring 2015 semester. QCC's five project instructors designed these assignments with the AAC&U Problem Solving VALUE Rubric in mind, and their students were both given the rubric and evaluated via the rubric for each of these assignments. At the end of the semester, an IRB-approved and CITI-certified member of the QCC project team visited each course section to provide students with more information about the project's problem-solving dimension, and to ask for students'

consent to contribute their de-identified problem-based assignments to the study. At QCC, 94

students submitted signed consent forms. .

Upon the conclusion of the spring 2015 semester, QCC's five project instructors scored

their consenting students' problem-based assignments using the Problem Solving VALUE

Rubric. Each instructor then reported students' rubric scores to the AAC&U. While the AAC&U

has yet to analyze these rubric scores for QCC or for the larger *Advancing Student Success*

through Faculty Intentionality in Problem-Centered Learning Project, QCC has conducted a

separate analysis, using paired sample t-tests, on the college data. In this separate analysis, 77

students' problem-based assignments were taken into account: 40 in the control group, and 37 in

the experimental group.

<div align="center">Results</div>

1. What issues arise when an interdisciplinary group of community college faculty

implements transparent teaching-learning methods and problem-based assignments for

student engagement and benefit in HIP courses?

QCC's five project instructors were tasked with implementing transparent teaching-

learning methods and problem-based assignments for student engagement and benefit in HIP

courses, while also making distinctions between levels of transparency between the control and

experimental sections of their course. Instructors approached these requirements from their

respective disciplinary perspectives, course objectives, and adopted HIPs. The transparent

teaching-learning methods, which instructors used in varying degrees across the courses and

across the experimental and control sections of each course, ranged from instructors' use of in-

class discussion of the Problem Solving VALUE Rubric, provision of supplementary

instructional material, and scaffolding of assignments to instructors' use of Blackboard, direction

of in-class discussions on the problem-based assignments, and distribution of annotated problem-based assignment samples.

Given the problem-based portion of this AAC&U *Advancing Student Success through Faculty Intentionality in Problem-Centered Learning* Project, a common feature for all of the QCC study sections was the practical slant of the course content. For instance, instructors connected culture and fieldwork to career choice; literary symbolism to personal cultural heritage artifacts; the theory of natural selection to antibiotic resistance; weighted mean to FICA scores; and face negotiation theory to personal conflict solutions. Several instructors also used reflections to enable students to make connections between the content material and their personal lives. Another common layer of implementation was the alignment of course-specific problem-based assignments and their respective rubrics to the Problem Solving VALUE rubric.

Throughout the semester, instructor implementation was also steered by several logistical considerations. One of the dimensions in the VALUE rubric was especially challenging to incorporate within an assignment addressing all other dimensions; in addition, some faculty were able to create one assignment for only one of the dimensions. Other complications arose from allocating class time without sacrificing course content, as well as motivating students to complete the assigned work; these were addressed by sending students more frequent reminders. Determinants such as students' perceived information overload, the presentation of the academic concepts in an engaging manner, and the alignment of disciplinary perspectives and objectives with any and all of the dimensions of the Problem Solving VALUE rubric remained a challenge across the courses, the semester, and the project.

2. To what extent do students perceive their instructors' efforts to employ transparent teaching-learning methods, and does this perception impact their depth of problem-based learning in HIP courses in the community college context?

While the Transparency Survey consists of five categories, this analysis focuses on the findings related to only one category: Perceived Amount of Transparency in the Course. This category consists of nine questions measuring the instructor's transparency in: stating the purpose and the learning objectives of each assignment; providing detailed instructions on how to complete each assignment; and presenting detailed information on how assignments would be graded. QCC's cumulative results for these nine questions on both the pre- and post-test Transparency Surveys are reported in Figure 1, where the faded top bar is equal to "less transparent" (< 3.3/4), and the darker bottom bar corresponds to "more transparent" (> 3.3/4).

Figure 1: Perceived Amount of Transparency in the Course, QCC-CUNY[1]
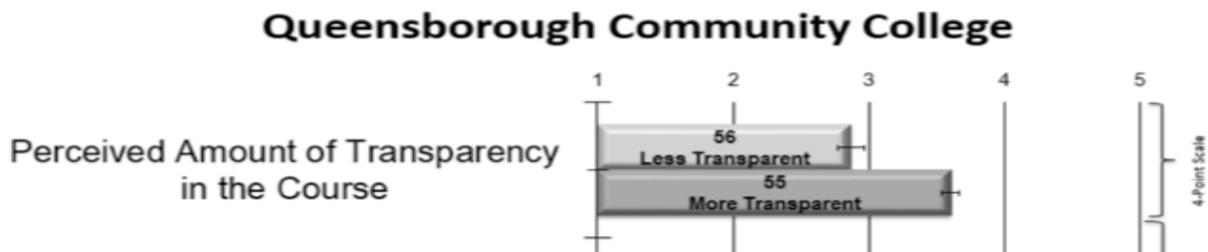
As Figure 1 demonstrates, when compared to the transparency mean of 3.3/4 for all QCC students, 55 students described their instructors' transparent teaching-learning methods as more transparent, while 56 students described them as less transparent.

The pre- and post-test Transparency Surveys' results of the individual control and experimental courses for each of the four disciplines are reported in Table 1.

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[1] Figure taken from the AAC&U "Transparency in Teaching and Learning in Higher Education Project" report.

Table 1: Mean Amount of Transparency

Course	Control or Intervention	Mean Amount of Transparency
Public Speaking	Control	3.04
Public Speaking	Intervention	3.06
Mathematics	Control	2.66
Mathematics	Intervention	2.70
Sociology	Control	3.66
Sociology	Intervention	3.61
English	Control	3.53
English	Intervention	3.48

A paired-sample t-test on the control and intervention means of the five disciplines was found to be not significant, suggesting that students' perceptions of the instructors' intentionality did not vary between the control and the experimental courses across the the disciplines.

3. Do problem-based assignments in HIP courses across the disciplines result in learning gains for community college students?

QCC instructors analyzed 77 students' problem-based assignments for the purposes of this study: 40 assignments were collected across the control groups, and 37 assignments were collected across the experimental groups. Upon the conclusion of the Spring 2015 semester, the instructors scored their respective students' assignments using the AAC&U Problem Solving Value Rubric.

The mean and SD for each of the six dimensions of the rubric for the pre and post problem-based assignments across both the control and the experimental groups are reported in Table 2.

Table 2: Mean and Standard Deviation of the Six Dimensions of the Rubric

	Control Pre		Experimental Pre		Control 2 Post		Experimental 2 Post	
	M	SD	M	SD	M	SD	M	SD
Define Problem	1.45	.15	1.38	.17	1.92	.18	1.83	.18
Identify Strategies	1.75	.10	1.40	.13	1.92	.15	2.21	.11
Propose Solutions	1.5	.13	1.64	.13	1.82	.12	2.16	.13
Evaluate Potential Solutions	1.35	.12	1.48	.12	1.97	.13	2.08	.13
Implement Solutions	.58	.12	.70	.16	.77	.16	.81	.18
Evaluate Outcomes	.87	.13	1.02	.13	1.32	.13	1.54	.17
TOTAL	49.83	17.42	47.16	12.83	65	19.22	65.83	19.45

A paired sample t-test was conducted between the pre- and post-assignments for the control groups and between the pre- and post-assignments for the experimental groups. Both t-tests resulted significant Control Pre and Post: $t(5) = -5.25, p < .005$. Experimental Pre and Post: $t(5) = -5.6, p < .005$. The data suggest that students across the control and the experimental groups improved their problem-solving skills with regard to their assignments.

In order to link research questions one and two, two separate paired sample t-tests were conducted respectively between the control and the experimental pre assignment data and between the control and the experimental post assignment data. Both tests were found to be not significant. Though the data suggest that the transparent teaching-learning methods were not adequately effective to demark a significant change in the students' problem solving skills between the control and experimental courses, it is believed that such a lack of significance could be also attributed to the design of the individual instructors' assignments. By looking, in fact, at the mode values of the rubric scores across both the pre and post control and experimental data and the mean values reported above, it became apparent that certain dimensions of the rubric did not elicit any score. For instance, the mode value for the fifth dimension of the rubric, Implement Solution, was a zero across both pre- and post-assignment groups. The fact that the majority of the students did not receive a score in this dimension was interpreted as an indication that the instructors did not clearly include this dimension in the design of their assignments. To test whether the lack of this dimension had a negative effect on the overall scores, a t-test was performed on the post control and experimental means eliminating the fifth dimension of the rubric; the t-test turned out to be significant, t*(4) = -2.27, p < .005.* This result suggest that the imperfect mapping between the dimensions of the rubric and the structural components of the assignments might have acted as a confounder to the effects of transparent teaching-learning methods on the students' performance.

Discussion and Conclusion

This study examined the use of transparent teaching-learning methods and problem-based assignments in courses utilizing at least one HIP at QCC, CUNY. Given that QCC is a minority-serving institution, this study aimed to synthesize and potentially extend prior theoretical and

empirical claims about the utility of transparent teaching-learning methods, problem-based curricula, and HIPs for traditionally underserved students and in the community college context.

Implementation

This study revealed that QCC instructors can implement multiple teaching-learning interventions at the same time and across experimental and control sections of the same course. It also demonstrates that instructors can implement these interventions in ways consistent with their respective disciplinary perspectives, course objectives, and adopted HIPs. Central to this successful implementation was the flexibility afforded each instructor in defining transparent teaching-learning methods and designing problem-based assignments. Also central to this successful implementation was instructors' continual use of reflection, emphasis on the real-world practical utility of course content, and orientation to the AAC&U Problem Solving VALUE rubric.

Complicating matters of implementation were issues related to class time; more specifically, how much class time could and should be allocated to transparent teaching-learning methods, problem-solving skills, disciplinary perspectives and objectives, and standard course curricula. Additionally, while instructors were capable of managing multiple teaching-learning interventions, students were at times overwhelmed by the additional information and requirements.

Transparent Teaching-Learning Methods

This study did not reveal significant differences in students' perceptions of transparency across the control and experimental course sections at QCC, as measured by Winklemes' Transparency Survey. Moreover, performance difference between the control and experimental

course sections on problem-based assignments, as assessed through the AAC&U Problem Solving VALUE rubric, was also found not significant.

There are several possible explanations for these results. First, there might be a point of diminishing returns related to transparent teaching-learning methods. Transparent teaching-learning methods were not removed for the control groups; rather, the students in the experimental section of each of the five HIP study courses were introduced to *more extensive* transparent teaching-learning methods. Thus, one possibility is that the control sections of each of the five study courses were already "transparent enough," in which case the added transparency in the experimental sections had no effect.

Problem-Based Assignments

This study did reveal significant differences in QCC students' development of problem-solving skills over the course of the semester in both the control and experimental course sections, as measured by paired sample t-tests between the means of the control sections' pre- and post-assignments, and between the means of the experimental sections' pre- and post-assignments. While these findings do not yet demonstrate that students' learning, retention of course content, or general satisfaction in their coursework improved with the use of problem-based assignments, they do support the idea that students' problem-solving skills can be effectively developed and improved when made central to course design and implementation.

Contributions and Conclusion

Significant study findings lay at the intersection of transparent teaching-learning methods and problem-based assignment. For example, this study demonstrates that both transparency and problem solving are multifaceted constructs. While the AAC&U Problem Solving VALUE Rubric and the Transparency Survey are helpful in operationalizing both constructs, there is still

considerable room for choice and interpretation both among instructors and across the disciplines. The variation in transparency methods and problem types may be responsible for the above results.

Likewise, transparent teaching-learning methods and problem-based curricula are not mutually-exclusive interventions. After all, one of the many ways that instructors make their curricula transparent to students is by demonstrating its utility in the analysis and resolution of historical and contemporary problems. As a result, it might be difficult to disentangle the results of transparent teaching-learning methods and problem-based assignments when the two are combined in the same research study, as they were in this study.

Finally, there are several other, perhaps unexpected, factors that might explain the presence or absence of significance in this study, and these uncontrolled factors may have outweighed transparency or favored problem solving in students' experiences in the study courses. For this reason, transparent teaching-learning methods deserve additional attention and continued implementation, particularly in the community college context. Research indicates that community college students are more likely to be uninformed or misinformed about college-level academic practices and the expectations required for their success (Karp and Bork 2012; Kirst and Bracco 2004). Moreover, they are among the more vulnerable college students in terms of resources and preparation levels. This makes an abundance of transparency regarding what is to be done, how, and why particularly important in the community college context.

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