Teaching with Technology:

Using a Virtual Learning Community and Peer Mentoring to Create an Interdisciplinary Intervention

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Abstract

This paper describes the development and implementation of engaging and supportive experiences to promote student engagement, persistence, and success at a commuter, open enrollment, public, minority-serving institution. Project components included faculty development at the SENCER Summer Institute (SSI) 2016, attended by a team comprised of an academic administrator, full-time faculty from English and math, and part-time faculty in chemistry; creation of a virtual learning community of freshmen enrolled in chemistry, English, and math, linked by the specific theme of the environmental impacts of de-icing roads with salt and the overarching theme of the impacts of human activities on the environment; and peer mentoring in chemistry. Faculty reflections and grade distributions indicate this is a promising approach and suggest strategies for overcoming challenges.

Motivation

This project was designed to use evidence-based interdisciplinary tactics to support a student population that is underrepresented in STEM. New York City College of Technology (City Tech) is a minority-serving institution, enrolling 17,279 full- and part-time students (Fall 2017). Over a third of our students were born in any one of 110 countries other than the United States, and nearly three-quarters (73%) report that a language other than English is spoken in their homes. Students self-report as 33% Hispanic, 30% Black (non-Hispanic), 20% Asian and 11%

White; 61% report household income less than $30,000 (2017–2018 Fact Sheet).

Project Development

Participating math, English, and chemistry faculty and an administrator worked together, and with colleagues at other institutions with a similar charge of developing an interdisciplinary intervention, to develop this project. Team activities were formally launched through participation at the SENCER Summer Institute (SSI) 2016, in Chicago, Illinois. In addition to an opportunity for faculty professional development, we hoped that the shared experience of participating in SSI 2016 would help the team form a sense of community, similar to the one anticipated for the students. This was the first SSI for two faculty members and an introduction to the concept of integrating civic engagement into the curriculum and the resources available through SENCER, and it was one faculty member's first exposure to the idea of structuring a learning community. By attending several lectures on the subject, she was able to reflect on just how important this could be for our students, especially concerning the construction of a sense of belonging to a community. During project development, we continued to meet with other similar teams at other institutions to learn about their experiences and to share ideas.

Project components included an early intervention modeled on the successes of learning communities and integrated by a shared focus on civic engagement with peer mentoring for academic support. While our college has several resources in place to support such a project, including an interdisciplinary culture, an established Peer-Led Team Learning (PLTL) program, and an administration that supports curricular innovation, our project nonetheless met with some logistical challenges. As explained below, we used an extant technological resource, City Tech's OpenLab, to help us overcome these obstacles. We achieved several successful outcomes.

Why These Courses?

The three courses participating in the project represent foundational courses in their disciplines. English Composition I is the first semester of a two-semester composition requirement. It is the only class required of all students at City Tech. Its goals include ethical research methods and uses of source material, awareness of

audience and of generic conventions, and the process of academic writing itself (drafting, peer review, revising). These skills are critical to success in STEM disciplines. English professor Rebecca Mazumdar chose to participate in this learning community, because she wanted students to see the importance of effective communication and the joy of curiosity. While this course is designed to deliver the former message, the latter is sometimes more of a stretch, especially since so many students do not self-identify as strong writers.

College Algebra and Trigonometry is part of the College's required STEM math sequence. Strong analytical skills are a must for success in STEM disciplines. Project participant Professor Nadia Benakli reported that students struggle to grasp algebra concepts and often fail to see the practical purpose of learning these concepts. They also have significant difficulties with trigonometry. While many of the students taking this course are STEM majors, they often do poorly on exams, with one-third of registered students typically not passing the course. Because this course acts as a gatekeeper of sorts, including it in this project potentially offered a greater likelihood of impact on student success.

General Chemistry I is an introduction to the principles of general chemistry for STEM majors. This course includes lecture and lab and has a pre- or co-requisite of College Algebra and Trigonometry or higher. Some of the enrolled chemistry students had already taken these English and Math classes in previous semesters. For this project, an adjunct instructor, Prof. Medialdea, taught the chemistry lecture and lab.

All three courses contribute important components to a successful college education. Moreover, all three often pose difficulties for students as shown by Fall 2017 pass rates (D or better).

TABLE 1: Pass rates (D or better), Fall 2017, in All Sections of Relevant Courses

Course	Pass rates (D or Better)	Number of Students (N)
English Composition I	73.6%	3127
College Algebra and Trigonometry	66.0%	896
General Chemistry I	82.0%	197

Why a Learning Community?

Research has demonstrated that learning communities are one of several high impact strategies that improve student success (Kuh, 2008). Participation in learning communities is positively linked to increased engagement, stronger relationships with instructors and peers, self-reported gains in academic skills and interpersonal development, higher grades, increased persistence, and overall satisfaction with the college, even at commuter campuses (Zhao and Kuh, 2004; MDRC, 2012). Learning communities can be used to target the problematic parts of the curriculum that act as gatekeepers for student progress (Lardner, 2005). While many models of learning communities exist, common features include co-enrolling students in two or more courses to promote community through shared intellectual activities (Zhao and Kuh, 2004; Tinto, 2003; MDRC, 2012; Ratcliff et al., 1995; Rao, n.d.). This model encourages students to connect ideas from diverse perspectives and different disciplines. Learning communities often include a common theme. Successful learning communities may also include additional academic and counseling support for students. Other common attributes include faculty professional development on effective pedagogical strategies that allow the development of assignments utilizing group work and joint or overlapping assignments. Because of their demonstrated success, learning communities often target at-risk groups with identified low persistence and low graduation rates (Zhao and Kuh, 2004; Tinto, 2003; MDRC, 2012; Ratcliff, 1995; Smith, 2001; Rao, n.d.).

Challenges to implementing successful learning communities include increased cost, staffing, and support structure needs (Smith, 2001). It may be difficult to recruit students willing to agree to block programming, particularly if they have family, employment, or other commitments. Sections with low enrollment risk cancellation. Enrollment Management may not want to link dual enrollment in courses with different class size limits, particularly at campuses where space is an issue, as the linked enrollment reduces the number of available seats in the larger class. Another challenge is that without deliberate faculty professional development to enhance the learning environment, learning communities can devolve into little more than block programming. Even at campuses with established learning communities there is also the challenge of sustaining them as initial champions move on or as resources become scarcer (MDRC, 2012; Smith, 2001).

Why Peer Mentoring?

We incorporated peer mentoring in chemistry. Peer-Led Team Learning (PLTL) is a national model of student support where more advanced, successful undergraduate students are trained as peer leaders to facilitate small group learning (Dreyfuss, 2013) Peer leaders do not provide answers, but instead ask leading questions to encourage students to work together to solve problems that are structured to help the students develop conceptual understanding and problem-solving skills. PLTL has been demonstrated to lead to increased student success, particularly among minority students (Snyder, Sloane, Dunk, and Wiles, 2016). We chose to include PLTL as an additional social and academic support structure to again promote social interactions and a community of learners. Peer meetings occurred during the chemistry lab sections after hands-on work was completed. Thus, students were already physically present, optimizing the opportunity for impact. We were able to take advantage of a peer mentor training course already established on campus: MEDU 2901 Peer Leader Training in Mathematics (MEDU 2901, 2019).

Using Technology to Overcome Initial Obstacles

City Tech has a long-standing robust learning community program for first-year students, and Professor Mazumdar in English had participated in those linked-enrollment learning communities for several years. We planned to link enrollment of the sections participating in the learning communities; however, student recruitment was difficult and the low enrollment resulted in cancellation of the LC. The Fall 2016 implementation of our project was thus delayed by a semester. The enrollment challenges motivated our decision to create a virtual online community, using the College's OpenLab, a "digital platform where students, faculty and staff can meet to learn, work, and share their ideas. Its goals are to support teaching and learning, enable connection and collaboration, and strengthen the intellectual and social life of the college community" (OpenLab, 2018). These sections would meet in person like traditional classes but would include a virtual learning component for students in all three

courses, providing asynchronous social and intellectual connections. The delay allowed us to hone the civic focus of our learning community; inspired by the winter weather, we decided to focus on the environmental effects of the salt used to de-ice snowy roads. Students in each course would work on projects related to this theme.

Implementation

Our learning community was launched in Spring 2017. It was unique because it would not be a shared-enrollment LC; our three distinct classes would need to find ways to interact through OpenLab, a digital shared space in which our students could share their work and ideas with each other, while still fulfilling the goals of each course.

Before the semester began, we agreed that we would make OpenLab participation 5% of our students' semester grades. We included the same instructions in all three syllabi. Students were provided with a step-by-step explanation of how to set up their OpenLab accounts and join the project; they also received an explanation of what was expected of them. These expectations are quoted at length here:

Here's what's expected of you:

1. Each week, you'll comment on a post to the blog. These blog posts will be authored by the professors participating in the project (Prof. Devers [now Prof. Mazumdar], Prof. Benakli, and Prof. Medialdea), and occasionally by the students enrolled in those professors' classes. To receive credit for a comment, the comment must be around 100 words, and should be a thoughtful response to the ideas, issues, or problem contained within the original post. You can also respond thoughtfully to the comments other students have posted to the original item. By the end of the semester, you should have at least 13 comments, at least one a week. Multiple comments in a single week will be considered 1 comment. (In other words, don't leave all 13 for the final week of the semester!)

   "Thoughtful responses" include specific academic maneuvers, like the following:

   a. comparing/contrasting the ideas in the blog post to the ideas you're discussing in class;

   b. offering a solution to a potential problem;

   c. identifying complications to potential solutions;

   d. selecting a quotation from the original text with which you agree or disagree, and using interpretation and analysis to defend your position;

   e. providing a solution to a problem and explaining your work; and

   f. applying the ideas in the reading to a real world problem

2. Once this semester, you'll be asked to post to the blog yourself, so that others can comment on your post. Your post could be an article you've found in recent news media, or a problem you'd like help solving. Your professor can help you brainstorm the types of material that would be appropriate for a blog post.

3. A word about online etiquette: write as though you're face-to-face with other students and faculty. Present your ideas with confidence, while maintaining respect for the ideas of others. Check your work for grammar and typos before posting it. And have fun! This project will allow us to discuss big issues with students in multiple classes across disciplinary boundaries.

We began with most posts coming from the instructors, with the hope that students would begin to post on their own. As the learning community started in the winter, the first OpenLab posts were about the chemistry of snow, ice control methods, and the impact of these methods on the environment such as manhole explosions due to road salt corroding electric wires. Students discussed eco-friendly ice melt alternatives such as beet juice. The students then moved to examine a broader theme, "the degree and nature of humans' impact on the environment." They shared posts on air pollution, plastic pollution, and climate change. They discussed possible solutions such as wind energy. In the math class, they solved problems with applications related to the themes discussed on OpenLab. By the end of the semester, there were 77 published posts, and 523 comments. The project site had 69 members (plus the three administrators); 33 members posted at least once.

In English Composition I, an assignment asked students to perform light research to locate a recent news article about a topic related to human impact on the environment. They were to post a summary and a link to the article on our project blog on OpenLab. Since the

blog allows for comments on posts, students were also assigned to comment on other students' articles, to begin to make connections. The assignment allowed them to practice essential skills important to composition (synthesis of ideas, clear communication, reading comprehension) and to participate in a community of learners discussing common ideas. The collection of articles on OpenLab also became a shared library of relevant sources for students' research projects.

Outcomes

Below, the grade distributions of students in the virtual learning community are compared to all students taking the course in Spring 2017. There is some evidence that the goal of promoting persistence was achieved, as the withdrawal rate in all three learning community courses was lower than the overall withdrawal rate for the course. The higher chemistry grades of students receiving PLTL in lab suggest this support did help students succeed (no separate lab grade is given—there is just a grade in lecture with 25% of the grade based on the lab). There were significant improvements in College Algebra and Trigonometry grades in the LC section compared to all students, suggesting that incorporating civic engagement and interdisciplinarity was particularly effective here.

Observations Successes and Challenges

English professor Mazumdar, who has worked with linked-enrollment Learning Communities before, compares this one to previous ones. In linked-enrollment LCs, students form peer bonds or cliques. Sometimes, that can hinder their ability to pay attention in class, but the benefits are that they have the chance to form supportive friendships with classmates. This can be hard to do on a non-residential campus where students are often present only for the duration of classes. However, she did not see that cross-course bonding happening this semester. Students could respond to each other on OpenLab, but they likely never saw those screen names IRL or in-real-life. As the project continues, she would like all three classes to meet, perhaps for some ice-breaker/meet-and-greet activities, and to give the three instructors the opportunity to deliver essential information about the project. She hopes that this would encourage OpenLab participation, since they would be interacting with recognizable peers.

Math professor Benakli noted that initially, many students expressed unwillingness to participate in the project. Some of them were not happy that they had to "write" in a math class. Others complained that writing was not something they "do in other classes." With some encouragement, and a reminder that 5% of their grades depended on their participation in the blog, Professor Benakli had almost 100% participation. Many students did enjoy sharing and having someone else (other than a friend) read, listen, and comment on their posts. Several students submitted more comments than the required weekly contributions. The end of the year feedback was very positive.

Professor Benakli also observed another benefit of the project. Sometimes, she and her students would spend the first five minutes in class discussing one of the recent posts. Using the blog as a "warm up" activity helped the students to feel relaxed (which is unusual in a math class) and mentally prepare to focus on the lesson. Professor Benakli notes that she found herself enjoying

TABLE 2: Pass Rates of Participating Sections (LC) vs. All Sections

Course	% A-C	% A-D	% F	% W/WU	N
General Chemistry I (LC)	73%	81%	5%	14%	37
General Chemistry I LAB (LC)	80%	88%	0%	12%	25
General Chemistry I (Fall—Spring 2017)	77.2%	80.5%	4.7%	14.9%	215
English Composition I (LC)	59%	65%	35%	0%	17
English Composition I (Fall—Spring 2017)	71.3%	67.8%	9.7%	18.5%	1160
College Algebra & Trigonometry (LC)	84%	92%	8%	0%	37
College Algebra & Trigonometry (Fall— Spring 2017)	50.1%	63.4%	21.3%	14.8%	894

teaching this section more than previous ones, and that students did much better on their exams. She admits that perhaps this had nothing to do with the virtual learning community, but it speaks to the benefit to both students and faculty of linking classroom activities to larger issues in the community. In the future, she hopes to recruit other colleagues to participate in such a virtual learning community.

Chemistry professor Medialdea was pleased that her students expressed a strong interest in learning more about the environmental impacts of human activities, which seemed to enhance their interest in chemistry. She also noted that several students commented on an increased appreciation for the value of learning math and English as well as enrolling in additional chemistry courses.

Responding to Challenges

Recommendations and Future Plans

Several aspects of the project showed promise and will be retained as we repeat the project in a future semester. The use of OpenLab was one of the project's successes. Students found confidence in the blog, as a safe environment for contributing to discussions and as a source of like-minded peers. Furthermore, the project's common thread (road salts and their environmental impact) expanded to the broader topic of human impact on the environment, which enhanced student interest in it. The OpenLab site allowed the project to be flexible enough to respond to this student interest. Several topics like climate change involve multiple academic disciplines and would work well with this type of shared learning environment. Future permutations of this project face no limitations on the possible civic issues that such an interdisciplinary approach can address.

The team looks forward to implementing the project again, and to revising some elements of the intervention. In our self-reflections on the project, team members have considered the possibility that a different math class, like statistics, may be better suited for the project, as well as the possibility that students in a more advanced chemistry class, General Chemistry II, may have a better grasp of basic concepts and may therefore be better prepared to engage with larger themes. A benefit of this virtual learning community model is that the shared class blog sidesteps logistical challenges presented in linked-enrollment situations. Participating classes aren't restricted by prerequisites.

One significant change we want to make moving forward is the implementation of a single, overarching project. We didn't have one in place when the semester began, and it proved impossible to establish it as the semester progressed. We believe a "traveling" project could fit nicely with this type of learning community. Students in chemistry could collect data through lab work, send those data to students in math who can determine the implications of the data and how best to present them. Then, that information can be sent to the English students who use it to write persuasive pieces to local community leaders. To complete the circle, students in chemistry could then act as peer reviewers to help the writers refine and edit their formal assignments. The success of such a project relies on starting the first step, data collection, early enough in the semester so that each student group will have ample time with the information and can produce discipline-specific work in response to it. Professor Mazumdar would like the students to meet each other in person in order to develop a sense of community and shared experience; this would also mean that students would have a better sense of whom they were accountable to when passing data and information along to the next class.

Related to that sense of community, participating faculty learned that it also invites some interesting pedagogical questions. Specifically, the OpenLab site, which operates like a blog on which students can publish both original posts and comments, became a venue for discussions that were not relevant to course content. One student in particular used it to advertise his band's events. This activity raised issues concerning the policing of this virtual world, one which we admittedly had hoped would be a safe and welcoming community space where students could create the sort of learning environment that can be so elusive on a commuter campus. To address this, the next iteration of the project will include a social page where students can share and comment on extracurricular topics. This will keep the academic blog focused on class topics but allow the overall project site to remain amenable to the community building that supports student retention.

To get a better sense of our impact, assessment of future iterations of the project could take place at both the beginning and end of the term, and—if possible—perhaps a year or more after students take the class. Students could answer questions or submit a writing sample on the first day of the semester, so that instructors can gauge their knowledge and skill levels. The same assessment instrument could then be used at the end of the term to collect comparative data (pre/post knowledge checks). Outcomes related to other items, such as critical thinking, abilities to integrate course content with real-world scenarios, and collaboration/teamwork improvements could also be evaluated. To compare this project with other sections of the same courses, the same assessment procedure would need to be used in those sections as well. Instructors can also use the SENCER-SALG to assess students' interest in STEM courses as well as in the larger project theme: human impact on the environment. Another option is adoption of reflection exercises that unify course goals, where students could write in a journal (or other medium) to demonstrate their thinking, learning, and personal growth. Instructors could also qualitatively code the student responses, and identify emergent themes within their responses as well as evidence of intellectual growth as the semester progressed; additional quantitative assessment of the blog posts could include the average number of posts per student and the overall percentage of student participation.

Longer-term assessment could be one or both of the following: another follow-up SALG to determine persistence of interest in STEM classes or themes, or the collection of retention and graduation rates for enrolled students (compared with those of students in other comparable sections, for example).

One of the biggest advantages of this form of learning community is scale-up; therefore, part of our continuing work on the project will include recruiting other faculty to participate.

Broader Implications

By using OpenLab, or another platform such as BlackBoard, instructors of different courses across the campus can establish a virtual learning community without the logistical challenges of linked enrollment. This can even be expanded to cross-campus collaborations.

About the Authors

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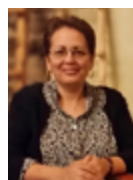
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Acknowledgements

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