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Applying TLC (a Targeted Learning Community) to Transform Teaching and Learning in Science

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Abstract
This article describes the development of a Targeted Learning Community (TLC) that supports first-year science students enrolled in a General Chemistry course. Drawing on student feedback and knowledge and expertise in their respective disciplines, four faculty members from two colleges at Kennesaw State University came together to develop a learning community that would prevent early attrition in the science majors and increase student metacognition. In this paper, the design of the TLC is presented, and the effect it had on faculty vitality is discussed.

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Many first-year students begin college with aspirations of pursuing careers in science, technology, engineering, or math (STEM) fields only to be discouraged by their lack of success in challenging gateway courses like General Chemistry. When the learning strategies that enabled these students to be successful in high school science classes are no longer sufficient, they are unable to earn passing grades, withdraw from the class, or change their majors altogether. Colleges have a mandate to retain students in the STEM majors (President's Council of Advisors on Science and Technology, 2012), yet many fail to provide comprehensive programs to address attrition rates and increase retention in these majors (Baldwin, 2009). Rather, high attrition and low achievement in these entry-level science courses are often treated with isolated remedial methods or Supplemental Instruction programs, initiatives that fail to address the ways in which other aspects of the learning environment contribute to students' learning outcomes (Light & Micari, 2013).

In contrast, learning communities—many with first-year seminars embedded in the curriculum, offer a more comprehensive approach to help students navigate the various transitions often associated with the first college year (Barefoot, Griffin, and Koch, 2012). As a recognized "high impact practice" (Kuh, 2008), learning communities offer a multi-layered approach to serving students, and they can serve as the ideal venue for providing curricular and cocurricular support to a targeted group of students like first-year science majors. The Targeted Learning Community (TLC) described in this paper was intentionally developed with the goal "to build community, enhance learning, and foster connections between students, faculty, and disciplines" (Smith, MacGregor, Matthews, and Gabelnick, 2004, p. 20) while expanding on what is known from the literature in first-year studies and chemical education.

The design for the TLC was originally inspired by Adam[1], a student enrolled in a first-year seminar with Steiner. In many ways, Adam was representative of numerous first-year students she had known—lost in a large lecture section of General Chemistry, homesick, and unsure why the study methods that helped him succeed in high school were not working in college. During a first-year seminar class meeting, Adam was visibly upset about his score on a General Chemistry test and, when approached, expressed his frustration with the wasted effort he had put into the course. He had attended tutoring sessions and met with his chemistry professor but was still unsure why his study methods were failing him. "I always wanted to major in chemistry," he said, "but obviously I can't hack it." Adam was a bright student who likely could have achieved success with the right support.

All full-time first-year students at Kennesaw State University who enter the institution with 15 credit hours or fewer are required to enroll in either a first-year

[1] A pseudonym.

seminar (which addresses life skills, strategies for academic success, campus and community connections, and foundations for global learning) or a learning community, comprised of two or three classes centered on a common theme and often involving integrative assignments. Many learning communities include first-year seminars among their courses, and frequently these seminars are tailored to fit the theme of the learning community. We viewed this model as an ideal opportunity to assist students like Adam by providing a learning community that delivered a full range of support. Though science faculty possess the discipline-specific knowledge to assist students, they may not have the time and resources necessary to meet the needs of struggling students. Similarly, faculty devoted to meeting the specific needs of first-year students may be enthusiastic about student success but lack the content knowledge to aid failing science students. By bringing together faculty from both disciplines—first-year studies and chemical education—we were able to provide the disciplinary knowledge and commitment to students that is essential to building an engaging, supportive learning community.

Drawing on past teaching experiences in General Chemistry and interactions with students enrolled in the course, we determined that it was important to develop a learning community experience that would help students develop the skills they needed to be successful in General Chemistry while at the same time offering support during their challenging transition to college. The learning community we designed pairs a first-year seminar that focuses heavily on active learning strategies with a General Chemistry course that currently serves as the first gateway course to all upper-division chemistry and biology courses. The deliberate pairing of these two courses was intended to ensure students would learn effective study strategies at a most opportune time—while currently enrolled in General Chemistry and transitioning to college life. In the first-year seminar portion of the TLC, students explore the specific strategies that lead to success in General Chemistry, as well as learning time management, self-regulation, goal setting, career planning, and motivation strategies unique to students of science.

The particular focus we took in this TLC was based on research in our respective disciplines. For example, it has been shown that enhancing students' metacognition significantly impacts their problem solving ability, a major hurdle for many students in the General Chemistry course (Schoenfeld, 1992; Pintrich, 2002; Cooper & Sandi-Urena, 2009). Furthermore, the critical thinking skills that are associated with metacognition must be developed within the context of the subject area in which they will be used, since transfer of universal critical thinking skills is generally rare and ineffective (Rickey & Stacy, 2000). Students in the TLC, therefore, learned about effective science study strategies, then immediately applied those strategies to studying for their General Chemistry test as part of an integrative assignment in the first-year seminar. In this "Strategy Project,"

students planned their study time, chose their own study strategies from those they learned in the seminar, used active reading and note-taking methods, and documented and reflected upon their own resulting exam grade in General Chemistry.

Beyond academics, the TLC also provides opportunities for interactions to take place and "networks" to emerge among the students, peer leaders, and faculty associated with the learning community. This is particularly important because formal and informal networks play a role in the transition to the first year of college (Astin, 1993; Tinto, 1993, 1997; Thomas, 2000). Interactions and relationships that develop from these collaborations can contribute to both the persistence and academic success of first-year students, and they often begin in the classroom. For example, Tinto (1997) found that students' first interactions occurred in their classes, and through those initial connections, they developed friendships that extended beyond the classroom. The participants in Tinto's study indicated they would often talk about classes they were all taking, topics they were studying, and their projects and exams. Both institutional commitment and retention of first-year students are positively influenced by relationships and experiences that foster "social and intellectual integration" (Tinto, 1993, p. 116), which was particularly important to the development of our TLC, given the intimidating environment of the large (120 students in the section being studied) and academically challenging General Chemistry course. Early in the semester, activities both in and outside of class promoted "bonding" among the TLC students, and, as a result of this bonding, study and social groups formed naturally. Upon exiting class one day, one TLC student was overheard commenting to another, "I don't know how I would have been able to face [General Chemistry] without being in a learning community."

As we were planning the TLC, we supplemented our knowledge of best practices in our disciplines with feedback from former students who were not part of a learning community but had taken both General Chemistry and the first-year seminar. Through focus group interviews, we gathered information about the strategies students employed to pass General Chemistry; this feedback aided in the design and sequencing of the TLC and the activities incorporated in each course. For example, many focus group students mentioned the importance of using career and graduate school goals as a source of motivation when studying for General Chemistry got tough. Therefore, we made sure to involve our TLC students in goal-setting and career exploration early in the semester, including exposure to guest speakers and field trips that introduced students to scientific life and opportunities beyond the university.

We felt confident that the proposed TLC would effectively address the needs of first-year science students, however we were concerned about student "buy in" to the strategies and practices that we offered. Since students typically have "tried

and true" methods of studying that proved successful in high school, we were uncertain they would abandon those methods to try the ones we were proposing. Further, we struggled with the question of how to best provide adequate support for the socio-emotional aspect of the college transition. The answer to this question became apparent during a focus group session when a former student mentioned her positive experience as a peer leader in another first-year seminar. It was then that we identified the missing component in our TLC: the peer perspective. As we reflected on the student's comment, we realized a peer leader was indeed a vital component and could serve students in ways we could not. Ultimately, we acquired two peer leaders for the TLC: one who was highly successful in chemistry to provide academic support, and another who had intially struggled in General Chemistry (very much like Adam) to provide emotional support and encouragement. The excitement that the second peer leader, Christian[2], brought to the team was palpable. For the first time, he saw himself as a leader—someone who could use his academic struggles during the first year of college to help other students succeed in General Chemistry.

As the semester progressed, it soon became apparent that this collaboration was having an effect on us all. Although we were focused on creating the best program for students, this project also presented the opportunity for us to grow as educators. Taking time to reflect on and adjust our classroom practices allowed us to put into place newly learned pedagogies. For example, self-regulated learning is one of the key learning strategies taught in the first-year seminar within the TLC. To allow for transfer of this strategy from the first-year seminar to the discipline-specific course, modifications were made to the General Chemistry course. These modifications require that Dean devote some of her class time to reinforcing learning strategies—a practice she had long hoped to introduce to her Chemistry class but for which she could never devote the time due to the breadth of her course content. This is one of many examples that demonstrates how we borrowed from each others' disciplines to transform our practices—practices that will likely impact how we teach all of our classes, not just those in the TLC.

This effect of learning community building has been well documented (Jedele, 2010). When faculty from diverging disciplines and perspectives come together with the common goals of improving student outcomes and experiences, the result can be transformative for everyone involved. Through our collaborations, the whole became greater than the sum of its parts. Bridges between the two colleges were built, networks of faculty and peer leaders were forged and, perhaps most importantly, our mutual commitment to students was reinforced through the support we received from each other. Stevenson, Duran, Barrett, & Colarulli (2005) call for increased faculty development opportunities

[2] A pseudonym.

surrounding learning communities, noting the benefits of thinking outside disciplinary boundaries to collaborate on a common goal. In working together to design our TLC, we have learned from “best practices” recommendations in each discipline and strengthened our common interest in bringing these disciplines together, thus renewing our commitment to student success. It was word of mouth that initially brought the original two faculty members together. However, this group would not have formed if we had not all been passionate about sharing our interest in improving classroom culture and student success in our courses. Therefore, it is important for faculty wishing to collaborate to make their values visible so they can be recognized by other faculty who share the same ideals.

We plan to study the effect of our TLC on student metacognition, achievement, attitude, and retention in the sciences during its first offering in fall 2013. Due to the small number of students involved in two sections of the learning community (n=48), a mixed methods approach will be used, which will allow for triangulation among qualitative and quantitative data. For the purposes of the study, students in the TLC will be matched on a variety of demographic and achievement variables (including SAT math score), to first-year students enrolled in the same instructor’s General Chemistry course but who are not enrolled in the TLC. This comparison group will provide a point of reference against which the effects of the TLC can be evaluated. Based on the findings from this initial study, we hope to expand the TLC model to other gateway courses at our institution that currently have high failure rates.

The findings from the ongoing study of our TLC will be two-fold. First, the study will provide a more nuanced understanding of first-year student success, as well as the ways in which faculty can develop similar TLCs to meet the needs of other students in the early college experience. Secondly, the findings from our study will also allow General Chemistry instructors to better understand how they can use learning communities to equip their students with academic and affective strategies to bridge the gap between high school chemistry and General Chemistry. Broadening the scope of the TLC across other disciplines will assure that continued quality instruction is developed for our students and supports are in place to allow these students to transition into a new learning environment. At this point of implementation, the impact on the faculty involved has been tremendous. Although experts in our fields, we learned much from the partnership that formed, and changes in classroom practices and pedagogies already reflect this.

Many universities face challenges related to retention and achievement in gateway courses, including, but not limited to, science courses (Light & Micari, 2013). By applying high-impact practices like learning communities and targeting them to the at-risk population of beginning science majors, universities may be able to address these concerns in a way that reflects the students’ whole college experience. We hope that the design of this learning community will be used by

others to bring together faculty from diverse disciplines in a joint commitment to first-year student success.

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