# USING A FACULTY LEARNING COMMUNITY TO PROMOTE INTERDISCIPLINARY COURSE REFORM

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**ABSTRACT**
As part of a multi-institution, National Science Foundation (NSF) grant-funded project, Ferris State University (FSU) joins a national effort to reform mathematics curricula. Researchers from FSU developed and facilitated a faculty learning community (FLC) as one strategy to redesign the traditional approach to the quantitative reasoning skill development of students in the departments of mathematics, nursing, social work, and the College of Business. Over the course of one academic year, the FLC provided an interdisciplinary faculty connection to develop pedagogical approaches that integrated cross-curricular concepts and context from each discipline. The FLC not only produced uniquely designed, learning-centered approaches to teaching quantitative reasoning but created a sense of community and camaraderie that promoted faculty development and the scholarship of teaching.

**KEYWORDS**
Faculty Learning Community, mathematics

In 1990, Boyer characterized higher education as a series of department, discipline, and curricular silos. This fragmented approach to teaching and learning often results in a student experience that lacks coherence and relevance. Boyer challenged the academic community to think outside of these silos by focusing on discovering the most effective way to teach that also produced genuine student learning. Since Boyer's challenge, faculty have learned much about effective teaching and learning. They have learned that teaching is more than telling students what they need to know and that authentic learning occurs by engaging in real-world issues and solving relevant problems. A host of scholarly work reveals that faculty have experimented with a variety of strategies to enhance student learning. Unfortunately, there has been little incentive to cross academic boundaries and engage other departments and programs to reform curricula. The need for curricular reform so that higher education relates to the realities of society, the business world, and many professions has never been greater. College graduates need to know how to solve real problems, communicate effectively, work collaboratively, use technology, lead, and demonstrate professionalism (The National Association of Colleges and Employers [NACE], 2020). Thus, to produce career-ready college graduates, higher education must redesign curricula so that students engage real-world problems across their educational experience.

College mathematics courses are often considered a prerequisite to higher-level course work. This curricular structure expects that students carry over foundational quantitative reasoning skills into future course work and ultimately their future careers. However, some students are not able to carry over the needed skills into future courses, nor do they "see the connections between mathematics and their chosen disciplines" (Ganter & Barker, 2004). In addition to this disconnect, the mathematics content in prerequisite courses may not be relevant to the students' chosen field of study (Ganter & Barker, 2004). Although the mathematical skills students need in the non-mathematics majors vary, all students need a conceptual understanding of basic mathematics tools (Ganter & Barker, 2004).

As part of the Synergistic Undergraduate Mathematics via Multi-Institutional Interdisciplinary Teaching Partnerships (SUMMIT-P) Project, three faculty researchers from Ferris State University (FSU), a public university in central Michigan, have undertaken an interdisciplinary endeavor to reform mathematics education for the students completing majors in partner disciplines. SUMMIT-P is a multi-institution, National Science Foundation funded project to improve undergraduate mathematic courses. The work of SUMMIT-P is based on recommendations outlined in the *Curriculum Foundations Project* (CF) (Ganter & Barker, 2004) and focuses on reforming mathematics courses by emphasizing the conceptual understanding of mathematics as related to the partner discipline needs. Instructional methods feature active learning that is grounded in career-focused problem-solving skills, mathematical modeling, and communication. One element of this work was the development and implementation of a faculty learning community (FLC). Mathematics faculty along with faculty in the partner disciplines of nursing, social work, and business worked together to redesign how mathematics content is taught and to vertically integrate mathematical concepts into the partner discipline programs. FLCs are commonly used to facilitate faculty development of the scholarship of teaching and learning (SoTL). While that was a focus of this FLC, known as the *Mathematics and Partner Disciplines FLC*, it was also the vision of the facilitators that long-term partnerships would produce a sense of community and camaraderie among the participants and continue the effort to break down the department and subject-matter silos that exist at FSU.

This article describes the process undertaken at FSU to develop and implement a multi-disciplinary FLC to reform the approach to mathematics instruction. Consistent with the

literature on FLCs, the *Math and Partner Disciplines FLC* was characterized by (1) the role of the facilitators, (2) the development of goals and outcomes, (3) the approach to choosing participants and team division, and (4) the process for designing sessions and deciding on the deliverables. Each of these will be described in detail below. Finally, based on a review of participant feedback, we will reflect on the lessons learned and describe the next steps in our project.

## Faculty Learning Communities

> According to Cox (2004), FLCs are:
> a cross-disciplinary faculty and staff group of six to fifteen members (eight to twelve members is the recommended size) who engage in an active, collaborative, yearlong program with a curriculum about enhancing teaching and learning and with frequent seminars and activities that provide learning, development, the scholarship of teaching, and community building (p. 8).

There are many benefits to the FLC model over other forms of professional development. FLCs allow for faculty to provide direction and consequently deal with issues relevant to the cohort in real time (Daly, 2011). When someone facilitates an FLC and has no authority over the participants' advancement within the organization, it provides a safe atmosphere for discussion, vulnerability, and growth (Cox, 2003b; Daly, 2011; Bickerstaff, Lontz, Cormier, & Xu, 2014). FLCs help encourage experimentation in teaching and learning (Bickerstaff, Edgecombe, & the Scaling Innovations Team, 2012) in a context in which participants tend to find their internal motivation and take ownership of their growth as instructors (Daly, 2011). FLCs offer a productive environment for the development of teaching projects that address real problems (Cox, 2007). FLCs can also guide faculty in the work that develops competence in and produces SoTL (Cox, 2003a, Cox, 2007).

## The Mathematics and Partner Disciplines Faculty Learning Community

The project team, consisting of one faculty member each from the collaborating disciplines (mathematics, nursing, and social work), worked together to revise the existing mathematics curriculum. We started by exploring the role of quantitative reasoning in the nursing and social work professions. This exploration lead to identifying common quantitative reasoning skills that were embedded in discipline-specific courses. The purpose was to intentionally introduce the concepts and skills in the mathematics courses taken as prerequisites to discipline-specific courses. As the project team continued analyzing the current mathematics curriculum and brainstormed possible revisions, it became apparent that the team needed buy-in and assistance from other faculty in the partner disciplines to complete the task. Subsequently, the project team envisioned an FLC in which partner discipline faculty would assist with the revision of the mathematics curriculum and with the intentional incorporation of quantitative reasoning into their respective courses. The FLC was conceptualized in spring 2018. During the summer of 2018, the project team prepared for the FLC that would be implemented during the 2018 – 2019 academic year.

Reflecting on the process of planning, implementing, and evaluating the FLC has been useful in determining its impact on the mathematics curriculum and the curricula of the partner disciplines as well as on the participants and facilitators. We believe the participants and

facilitators engaged in professional development that culminated in SoTL. Richlin (2001) refers to SoTL as a cycle that begins with scholarly teaching and evolves into scholarship. Prior to the development of the FLC, the authors identified the opportunity to change mathematics content delivery for partner discipline students. Development of the FLC assisted the authors, who also served as FLC facilitators, to engage in the process of scholarly teaching, and writing about the process has helped us transition into the scholarship phase of the cycle.

## Faculty Center for Teaching and Learning

The Faculty Center for Teaching and Learning (FCTL) at FSU offers a host of resources to faculty and the university community. One such resource is the opportunity to participate in or facilitate an FLC. Consistent with Cox's (2004a) description of an FLC, FCTL supports both discipline-based and interdisciplinary faculty groups that have a defined focus or purpose. In spring 2018, the project team developed and submitted a proposal to the FCTL for the *Math and Partner Disciplines FLC*. The proposal was evaluated against predefined criteria, including how the FLC aligned with FCTL values, the measurability of the overall project outcomes, descriptions of the outcomes, activities, and assessments for each session, the expected deliverables or end products, and the assessment plan for the deliverables (FSU, n.d.). Once approved, the facilitators participated in FCTL training and planning sessions during summer 2018 to prepare for the year-long endeavor.

In addition to the mandatory training, the FCTL also provided resource support throughout the FLC. The FCTL helped with reserving rooms and equipment, ordering meals, and making copies for the FLC sessions. Professional development funds were available for participants who completed the FLC as demonstrated by consistent attendance and submitting deliverables. This was a significant factor to the success of our program. The co-facilitators did not receive professional development funds, but instead received a stipend that compensated them for the time invested in overseeing and running the FLC. The FCTL required attendance reports and periodic updates on the progress of the project which helped keep the project team accountable for all aspects of the FLC.

## Purpose and Goals

The purpose of the FLC was to engage faculty in the work of transforming mathematics education at the university under the leadership of the SUMMIT-P project team. Specifically, the vision was to reduce barriers that prevented students from using the concepts and skills learned in mathematics courses in their respective majors. Based on the principles of the Mathematical Association of America Curriculum Foundations Project (Ganter & Barker, 2004), the overarching goals for the project were to use the FLC sessions and activities to determine which mathematics concepts and skills to cover in courses in each of the partner disciplines and to develop an understanding of relevant and practical discipline-specific contexts in which to embed the mathematics concepts and skills.

## Outcomes

The facilitators approached the FLC from a teaching and learning perspective. By applying established best practices in course design, the identified session and terminal outcomes

were made observable and measurable, thus identifying behaviors that evidenced learning (McDonald, 2014). Each of the outcomes, therefore, established the level of success of the FLC activities. First-semester session outcomes began with a focus on active learning and teaching styles. In the second semester, the session outcomes evolved to produce active learning materials or exercises and a re-evaluation of teaching styles, and it culminated with a capstone presentation of a discipline-specific mathematics activity. The FLC design allowed faculty ample opportunity to reflect on and evaluate their own teaching practices in order to improve their practices. In fact, a goal of the project was to determine how participating in the FLC would influence classroom practices. In addition to specific assignments completed between sessions, participants needed to complete a set of deliverables.

## Role of the Facilitators

The project team, acting as co-facilitators, each had different experiences with FLCs; one had participated in and facilitated previous FLCs, another had attended several FLCs, and the third had no sustained experiences with an FLC. Because of the diverse experiences with FLCs and the importance of the facilitator role to the FLC process, it was very apparent that facilitator preparation would be a critical element of the FLC process. As a stipulation of FCTL approval, the co-facilitators attended a campus based, two-day FLC facilitator workshop. The activity-based workshop explored Cox's (2004) definition of an FLC and Ortquist-Ahrens and Torosyan's (2009) work on the role of the FLC facilitator. The co-facilitators also completed Sandell, Wigley, and Kovalchick's (2004) goals inventory, and the results lead to identifying key outcomes for the FLC. Other activities in the workshop included the intentional development of the outcomes, relevant evidence, and the facilitator and participant activities for each FLC session. Ultimately, the workshop aided in understanding the purpose of an FLC and the role of a facilitator, determining and dividing the facilitator responsibilities, and intentionally creating space for planning the details of the FLC. After the workshop, the co-facilitators had an in-hand plan and framework for implementing the FLC.

Defining the roles of the FLC facilitators included the division of both task and process responsibilities and ultimately aligned with the roles of a champion, organizer, and energizer (Petrone & Ortquist-Ahrens, 2004). However, we found it necessary to include a fourth role in the process—the role of an analyst. Each of these roles will be described below.

Understanding that a sense of shared responsibility would evolve from using a team approach, it was essential to engage each other with open and frequent dialogue, mindfulness, and flexibility, and to capitalize on individual strengths. The open and frequent dialogue encouraged collegiality, a non-threatening and engaging atmosphere, and genuine reflection on the FLC process. Approaching meetings with mindfulness produced clarity of communication and increased productivity. As tenured faculty, each of the facilitators held various leadership responsibilities and demands. Thus, it was important to be considerate of each other's time and maintain a flexible attitude, which demonstrated a commitment to the FLC process.

### *The Role of Champion*

The FLC facilitator acts as a champion by making connections from actions to outcomes and being a catalyst for change (Petrone & Ortquist-Ahrens, 2004). The champion role evolved from the mutual vision for changing the approach to quantitative reasoning in mathematics, nursing, social work, and business. Ready with content resources and department-specific

insight, the co-facilitators shared the responsibility for championing the effort. Collaboratively, we arranged the time, space, and resources to develop simulations, case studies, and assignments that involved mathematics concepts and would be embedded in both mathematics and the partner discipline curricula. A light meal and informal conversations created a nonthreatening climate, interpersonal connections, and a sense of community. Stories of family, children, pets, and the challenges of Michigan winters created commonality among all participants. The champion also works to create a challenging climate (Petrone & Ortquist-Ahrens, 2004). The facilitators accomplished this by preparing prompts and resources that stimulated the participants to think in terms of another discipline or to review the ongoing work from yet another perspective. Integral to the success of the envisioned curricular changes, each of the facilitators initiated ongoing communication with departments, deans, and advisors. It was essential to the success of the project to not only advocate for the FLC program but also to communicate to the university community about the cross-disciplinary work that was underway. This was accomplished in several ways, but one of the most significant was a visit by a partner SUMMIT-P institution during one of the early meetings of the FLC. During this visit, FSU administrators and other stakeholders attended a briefing session about the work the FLC was accomplishing.

***The Role of Organizer***

The organizer "focuses on the operational and logistical aspects" of the FLC (Petrone & Ortquist-Ahrens, 2004, p.65). Through a collaborative effort, the organizer's responsibilities evolved into three categories, each assumed by one of the co-facilitators. The mathematics facilitator prepared the content for each session. The social work facilitator communicated to the FCTL staff for reserving rooms, ordering food, and making document copies. The nursing facilitator communicated reminders to participants and monitored the completion of session assignments and deliverables. Associated with the responsibilities of this third category was the development of an FLC course in the university learning management system (LMS). Framing the FLC as an academic course allowed information to be available through the FSU LMS. Participants could also submit deliverables as assignments in the LMS. This helped the facilitators to easily track participant completion of tasks and gather qualitative feedback about the FLC. The discussion board feature of the LMS was useful for exchanges between participants or between participants and facilitators. The LMS gradebook and messaging system also helped facilitate direct communication with participants.

***The Role of Energizer***

Petrone and Ortquist-Ahrens (2004) defined the role of energizer as one who monitors and directs the interaction of participants. This role, although shared by all three facilitators, tended to find focus in the high energy and humorous personality of the mathematics partner on the team. In the FLC sessions, the facilitators each joined a workgroup and participated in the ongoing process. As embedded team members, the facilitators would listen attentively to workgroup dialogue, ask qualifying questions, and model effective communication skills. With the goal of nurturing a climate of collegiality, the process required carefully listening to the voices of participants as the workgroup explored how mathematics concepts are embedded in the other disciplines and discussed the discipline-specific language used to describe mathematical ideas.

### *The Role of Analyst*

The role of analyst evolved as we collected feedback from participants about the FLC sessions, activities, and evaluated assignments. With expertise in qualitative data analysis, the social work partner assumed this role. The analyst collected and analyzed participant feedback to help the facilitators make mid-year adjustments and organize content for subsequent FLC sessions. The analyst also provided periodic reports to the FCTL on the progress being made in the FLC. In the end, analysis of the final feedback facilitated the assessment of outcomes.

## Choosing Participants

The facilitators initially planned to select participants for the FLC through an application process. However, because of the nature and purpose of this particular FLC, the facilitators decided to intentionally recruit key faculty from each of the partner disciplines. Ideally, there should have been equal representation from each of the participating disciplines, but recruiting efforts resulted in three faculty from mathematics, two from social work, two from nursing, and two from business. Although not an element of the original project proposal, business faculty were recruited because of previous collaborative work between the team leader and the business department to create a quantitative reasoning course for business students. A total of 12 faculty (nine participants and three facilitators) participated in each FLC session.

## Design of Sessions

For each session, the facilitators identified outcomes for the session, the evidence to be produced by participants that demonstrated meeting the outcomes, and the facilitator and participant activities that would produce the expected evidence. The sessions were two hours in length and started with lunch and conversation. Pre-defined session activities gave participants time to explore thoughts and processes in a team environment. During the initial session, the schedule for the FLC sessions was developed to best align with participant schedules. In-person attendance during sessions was a critical element for the FLC, which required a significant amount of collaborative work. However, due to circumstances related to weather, illness, child care, or professional responsibilities, some participants did attend sessions virtually using video technology.

## Teamwork

Teamwork was central to the goals and outcomes of the FLC. A goal of the curricular reform project was to embed experiential learning activities into the mathematics courses that included concepts from more than one partner discipline. The goal was to first introduce partner discipline concepts through active learning exercises in the mathematics courses and then revisit the concepts in the discipline-specific course work. Thus, the facilitators chose to divide the FLC participants into three teams each with representatives from three different disciplines. The interprofessional teams combined their skills, knowledge, and resources during the FLC sessions to complete activities that produced high-quality deliverables and modeled the university core value and general education competency of collaboration. Collaborative work was concentrated in the pre-defined working sessions and deliverables, and minimal teamwork occurred outside an FLC session. However, individual deliverable expectations did require out-of-session work.

## Deliverables

Activities that produce growth and development are a fundamental component of FLCs. These kinds of activities also provide evidence that learning is taking place during the FLC. In the case of the *Math and Partner Disciplines FLC*, the purpose of the activities was for participants to demonstrate their plans to make changes to course content and instruction. By the end of the FLC, each participant produced five deliverables.

### *Types of Deliverables*

**Syllabus.** A syllabus, by definition, includes course outcomes, learning activities, and a schedule of those activities (Gunert-O'Brien, Mills, & Cohen, 2008). Each participant submitted a syllabus for one course that demonstrated how active learning was incorporated into the course and assessed.

**In-class Activities.** During the fall semester, the initial FLC sessions focused on team building exercises and arriving at an understanding of how mathematics concepts and skills are used in the partner disciplines. After establishing a sense of community among participants, session activities primarily involved participants collaborating in teams to produce a learning activity that involved using mathematics concepts in a partner discipline context. The activities that were developed would be integrated into mathematics and partner discipline courses. Each FLC session included activities in which participants worked together in large and small groups to refine the developing mathematics scenarios. The fall sessions laid the foundation for the development of the final deliverables by facilitating a review of pedagogy and supporting literature such as the CF reports (Ganter & Barker, 2004; Ganter & Haver, 2011; Pratt's, 1988; Teaching Perspective Inventory (TPI), and the Taxonomy of Significant Learning, Fink, 2013). Other in-session activities included scheduling peer observations in mathematics and partner discipline courses, developing discipline-specific class activities that incorporate the mathematics scenarios, analyzing course outlines to identify where to best include the activities being developed, and reflecting on the learning taking place during both in-class and out-of-class activities. Groups were paired to critique each other's scenario and provide feedback on revisions and refinements. The FLC culminated with participants simulating the in-class activities in the capstone session. A detailed example of a scenario is provided below.

**Journals.** Throughout the FLC, participants completed reflective journaling assignments as a way for them to share their thoughts and feelings about class materials, identify how their participation in the FLC was influencing their practice, and identify which concepts they understood. The journaling was also used as a guide for facilitators to gather feedback and focus participant learning in future sessions.

**Peer Observation Reflection.** During the spring semester, each participant conducted two classroom teaching observations of their FLC peers. These peer observations provided participants with opportunities to learn from each other about learning and instruction in the partner disciplines. The observer provided feedback to the participant being observed. Each participant observed with the intent of learning about the partner discipline, the pedagogy of the host instructor, and the class content for the observation period. Each visitor provided a written reflection of their observation and thoughts to the host instructor.

**Teaching Perspective Inventory.** The participants completed a pre- and post-survey Teaching Perspective Inventory (TPI) designed to help understand their perspectives on adult learning. The five non-mutually exclusive categories of teaching perspectives are: Transmission,

Apprenticeship, Developmental, Nurturing, and Social Reform (Pratt, 1998). After completing the survey and analyzing the results, participants discussed their beliefs, intentions, and actions based on their particular perspective. For example, a social work faculty who identified with a "developmental" teaching perspective focused on teaching that centered on those aspects of the assignments that allowed students to demonstrate their thinking, reasoning, and judgment. In this perspective, students are evaluated in large part on how they subjectively create individual and sometimes overlapping groups of knowledge or meaning, and the role of the instructor is to help guide students toward a goal of making deep meaning. On the other hand, nursing is a profession that places emphasis on having students master a body of knowledge that is taught in a "step-by-step" manner by a "content expert" and has a strong emphasis on student performance (i.e., meeting pre-established criteria or standards). In this perspective, the teacher has mastery over content and is expected to deliver that content in a way that transfers the mastery of an objective body of knowledge and set of skills to the student. It should be noted, however, that the two nurses who participated in the FLC do not fit this framework; instead, both identified with the Nurturing perspective in both their pre- and post-TPI. It is also of note that these two faculty members came to the teaching profession after working in the field as nurses for several years, where nurturing and empathy are as central to the job as being able to perform a technical skill such as detecting an irregular heartbeat. It might be that because of their applied experience in the field, their pedagogical focus on technical skill, while strong, is accompanied by an even stronger emphasis on learner efficacy and self-esteem because they view it as central to a student's ability to acquire the requisite skill set. As one nurse put it, "I did not change my dominant areas. I think this lends itself to the profession of nursing and how it is taught. Several nursing theories mention nurturing and caring, which is evident in my teaching style." For the other participants from nursing, her pre- and post- TPI scores remained exactly the same, again with the Nurturing perspective being the highest.

Traditional mathematics education is more similar to nursing than it is, for example, to social work. As Pratt (1998) notes, it, too, has a fixed set of rules and facts that apply to "…a fixed body of knowledge and core skills…" (p. 179); interestingly, only one mathematics faculty was identified in both his pre- and post-TPI as having the Transmission perspective. The other math faculty identified with the Apprenticeship perspective in his pre-TPI and the Transmission and Developmental perspectives in his post-TPI. He noted, "I believe my experiences with other faculty [in the partner disciplines] have changed my thoughts…this (post-TPI) was a dramatic shift from my previous report."

Though this current work does not focus specifically on shifts in faculty teaching perspectives, preliminary results suggest that significant shifts did occur for some faculty, and that even when shifts in teaching perspectives were not made, faculty reported that they embraced aspects of other teaching perspectives as a result of their collaborations with faculty from other disciplines.

In addition to revealing shifts in teaching perspectives, results of the TPI also served as a discussion point for pedagogical issues that arose during FLC sessions and helped to establish community among the participants. During one of the first meetings of the FLC, the participants discussed their TPI results and the connections between their teaching perspective and their discipline. This was an important step in forming our community and the FLC interdisciplinary working groups. It created an understanding and empathy for each participant's perspectives and the needs of students in their discipline.

***Example of a Deliverable***

An in-class activity produced by one FLC team (comprised of mathematics, nursing, and social work faculty) simulated running an emergency shelter for hurricane victims. This real-life scenario was designed to evolve over several weeks through different activities in a course in each of the respective disciplines. Students consider issues that plague an area that had been devastated by Hurricane Katrina in 2005. The focus of the scenario is an emergency shelter that can serve up to 100 victims. Poor, predominantly African American communities had more difficulty recovering as compared to more affluent white communities, which had better infrastructure and more resources to help with recovery. To provide a foundation for understanding the issues in the learning activity, students are encouraged to watch the film *Trouble the Water* (Lessin & Deal, 2008). Each of the partner disciplines on the team adapted the in-class activity to explore discipline-specific issues in their respective courses, although each version was slightly different in focus and presentation.

**Social work.** The in-class Hurricane Katrina activity is used in a beginning level course that explores the values and ethics of social work. The activity begins with exploring the primary mission of the profession: to enhance the well-being and meet the basic needs of all people, with particular attention to those who are vulnerable, oppressed, and living in poverty. After studying the National Association of Social Workers (NASW) values and ethical responsibilities for the profession, the students analyze the scenario from macro, mezzo, and micro levels to identify the embedded ethical principles of service, social justice, dignity and worth of a person, as well as the importance of human relationships, integrity, and competence. Next, the students compare racial demographics and poverty statistics between 2015 and 2017. The activity culminates with students exploring both the evident and probable ethical issues that occurred before and after Hurricane Katrina devastated New Orleans and surrounding areas.

**Nursing.** The Hurricane Katrina scenario is incorporated in a first-semester nursing course in which students explore the roles and responsibilities of the professional nurse. Through the scenario, nursing students are introduced to leadership concepts, collaboration, nursing theory, evidence-based practice, principles of patient-centered care, professional standards and values, and the use of the nursing process to guide their critical thinking. In small groups, students first consider the ethical, logistical, and legal issues that might be initially and subsequently encountered.

As the scenario evolves, the students simulate the role of a charge nurse who is working with untrained workers to receive displaced residents after Hurricane Katrina. The nurse leads a team to determine needed supplies and the quantities required to offer aid and comfort to 100 victims. Students use the mathematics concepts of linear functions, units, and proportional reasoning to determine the dosage and quantity of antimalarial medication tablets needed for shelter residents for ten days. To ensure medication safety for all concerned, the team writes a summary to be used as a guide for untrained aid workers and to educate the shelter residents. Another element of the scenario allows students to explore infection control principles when the class teams analyze an outbreak of gastrointestinal symptoms after shelter residents consume a chili dinner prepared by volunteers. The scenario concludes with a postmortem team debrief to discuss the lessons learned and what could have been done differently, including ethical and legal concerns.

**Mathematics.** The hurricane scenario was also adapted for a quantitative reasoning course for business, social work, and nursing students. The scenario begins with students considering the ethical and legal issues encountered by social work students and the medication

calculation scenario for nursing students that is described above. The scenario is revisited over several weeks and introduces various functions. After completing the ethical and legal issues and medication calculation scenario, the mathematics students complete an activity based on managing the finances of the shelter and trying to recoup costs after the disaster. They raise $15,000 and want to invest it in a bank account. With the introduction of exponential functions, teams must calculate various types of interest. In a follow-up assignment, logarithms are used by the students as they develop a plan for the shelter's future. They must consider purchasing and financing an additional building and calculate a monthly mortgage and a payoff time frame. The final situation of the scenario introduces linear analysis. In this situation, students compare the cost of operating two different kitchens and find the minimum cost of producing 460 beef meals and 340 chicken meals. The students must define the variables, write an objective function, identify constraints, and solve the presented problem. Students conclude the scenario by writing a summary for colleagues that explains how to minimize kitchen costs.

### Assessment of Outcomes

Assessing FLC outcomes and specific deliverables can be complex (Goto, Marshall, and Gaule, 2010) and perhaps especially difficult in multi-disciplinary FLCs. In an attempt to minimize the impact of the assessment challenges presented by the interdisciplinary nature of the FLC, our approach involved measuring the extent to which participants met pre-defined learning objectives. However, it should be noted that the facilitators understood, and even expected, that participants would use a constructivist path to accomplish the objectives. For example, the course assignments that included the scenarios developed by participants were not defined by the facilitators but were created by individual faculty. In doing so, participants were able to develop discipline-specific content for their courses. As noted by Goto, et al. (2010), the very nature of FLCs is such that they are rarely organized in a hierarchical fashion around a single authoritative leader; instead, authority is dispersed among the participants. This structure for the FLC was appealing for several reasons; chief among them was that each participant was considered a discipline-specific content expert. While facilitators required specific deliverables from the participants and provided a guiding framework for developing the deliverables, participants were free to work among themselves to develop both the structure and content of their products. Since no two deliverables might look the same, the creative freedom of this expectation presents a challenge for assessment. While it is true that deliverables could vary significantly even within one discipline, several activities were assigned each week to assess the extent to which participants met the pre-defined objectives.

## Participant Feedback

Participants provided rich feedback during and at the conclusion of the year-long FLC. The concluding reflection prompted participants to consider what they learned about themselves and their teaching. A qualitative review of the journal entries and narrative reflections by the co-facilitators revealed that these assignments not only met the original goals but that participants valued the transformation they experienced. Our qualitative analysis suggested six themes present in the reflections: relevance, applicability, learning to learn, similarities and differences in course challenges, teaching styles, and language. These themes were affirming to the process and overall objectives and capture the meaning of the FLC experience for the participants.

Relevance and applicability were closely related themes that emerged from the reflections. Participants spoke of how the FLC content and expectations helped them change their thinking about what is important in a course. One participant also shared that he had learned a lot about choosing which topics were most relevant in his courses because it challenged the way "we often teach as though everything is equally relevant." For one participant, the focus of student learning evolved from the ability to solve a mathematics problem to "what students really need to know to be successful in their other courses." Another participant indicated a heightened awareness for "the life lessons we are trying to impart." The participants wanted students to learn how to transfer their knowledge from one situation to another. Thus, it is clear that the FLC participants learned that the infusion of mathematics concepts into a course was a vehicle for helping students succeed not just in other areas of academic study but also in life.

Nearly all participants addressed the commonality of the challenges they experienced in teaching courses. Attendance issues, classroom engagement, completion of assignments, and how to help students apply previous knowledge and learn new skills are examples of topics that often filtered into the work of developing cross-disciplinary assignments. One participant noted, "We all seemed to talk about how students learn, and there were a lot of similarities regardless of discipline." Another participant said

> I especially enjoyed, overall, that we were able to share our challenges in the classroom, which turned out not to be really, very discipline-specific. Engaging students in their learning process was a topic we discussed quite a bit, and I found this helpful and affirming.

Several exercises and assignments required the participant to align their TPI results with their teaching style(s). It was fascinating to see how each participant favored a teaching style that aligned with the subject matter they taught and how they became aware of other styles they unknowingly used. After reviewing the feedback from an in-class observation, a participant stated,

> I knew early on that a lot of my teaching focused on transmission, but I didn't realize until I was observed that I also do a lot of modeling when it comes to ….critical thinking and problem-solving when I share 'tricks of the trade.' I don't think I put this together before and I think it can be useful in helping to take the fear out of math.

Another theme that emerged was how each of the participants used discipline-specific language to communicate mathematics concepts. One of the mathematics faculty addressed this variation and the importance of grasping the impact language has on the understanding of concepts, saying "I learned the importance of language and feel a little embarrassed that I didn't realize my partner colleagues have difficulty understanding what is meant by a concept, then my students must really struggle at times." Another participant was "amazed at how discipline-specific our language is. In order to accomplish cross-over, it is important to be aware of this."

Finally, many of the participants spoke of learning several things, some of which were about themselves. Through the collaborative process, participants said they learned "a lot about how students learn by participating," and did so by "watching other colleagues teach." One commented that they learned "about integration from Fink's taxonomy; that is where I think this FLC was most helpful." The emergence of this theme of mutual learning clearly highlights the importance of breaking down discipline, department, and college barriers to learning about the needs of students from other disciplines. This theme supports the underlying tenet of the SUMMIT-P project and aligns with the nationwide call to rethink the nature of mathematics

courses and consider how students could benefit from a curriculum that is both rigorous and relevant (Ganter & Haver, 2011).

## Lessons Learned

The facilitators learned a great deal from the FLC experience, some of which was related to FLCs themselves. For example, having a well-organized and funded center for teaching and learning contributes significantly to the success of an FLC, both in terms of training for the facilitators and providing professional development funds for participants, meals, space, and other infrastructure needs for the FLC to conduct its work. The FCTL is one of the institution's strongest assets. As such, it was natural for the facilitators to turn to the FCTL as a means to extend the SUMMIT-P collaboration beyond themselves. Readers who are considering interdisciplinary projects may want to identify the assets on their own campus that will enhance their work and strengthen interdisciplinary collaborations.

In addition to having funding support from and access to space at the FCTL, the co-facilitators were also provided two-day training by FCTL staff that focused explicitly on facilitating an FLC. While receiving guidance from the staff, participating in the training also allowed the co-facilitators to clarify goals and objectives and outline the activities to meet them.

The sheer joy experienced by the co-facilitators that resulted from inter-disciplinary collaboration cannot be overstated. Academics often teach and research in silos. Moving beyond those bounds and interacting with so many different people from different disciplines was both instructive and joyful. While developing a shared understanding of course content across disciplines was no easy feat, it proved to be one of the most beneficial outcomes of the FLC. This shared understanding allowed the FLC participants and co-facilitators to bond in ways that were unanticipated at the start of the process, and the richness of the course content that emerged from the scenarios was an indication that there had been a significant increase in understanding across disciplines. This understanding not only facilitated academic development, but also personal development among both the participants and the co-facilitators.

Despite all of the benefits of participation, there were some unanticipated "hiccups" that arose throughout the course of the year. One of the most significant of these was the discipline-specific languages that were spoken by the participants (and at times, the co-facilitators). For example, the term "variable" is defined and used differently in accounting than it is in mathematics or social work. While a mathematician refers to the slope or rate of change of a function, it may be referred to differently in another discipline. For example, within business disciplines, reference to marginal costs describes slope. These language challenges were significant enough near the end of the first semester that the co-facilitators adjusted the session schedules to accommodate a more robust discussion of the topic. After addressing language barriers, the facilitators and the participants were surprised that, in addition to finding connections between their disciplines and mathematics, they also found connections among the partner disciplines.

Some unforeseen challenges were more impactful than those presented by language differences. There was one participant who was "arm-twisted" by the department chair into participating, and this was evidenced by a lack of enthusiasm for the project and a lack of engagement (e.g., a number of sessions were missed). That participant did not end up completing the FLC.

Despite the challenges identified above, the facilitators learned a great deal about the faculty within their university community. It was clear that all of the participants were dedicated to student learning, even participants who did not finish the FLC. Conversations within the FLC were free of "disciplinary microaggressions," as they were focused on enriching the student learning experience. The core that connected all of the disciplines—business, mathematics, nursing, and social work— was student learning.

## Conclusion

FLC's benefit facilitators and participants when executed effectively. While SoTL is often a product of FLC's, the *Math and Partner Disciplines FLC* used a team approach to reform mathematics education at FSU to establish a foundation for ongoing partnerships across the university. The growth and development in the SoTL, cross-disciplinary connections, and sense of community that resulted from participation in an FLC cannot be understated. As supported by the goals of FLC's outlined by Cox (2004) and in the cases presented in this article, a greater understanding of a discipline-specific subject resulted in in-depth learning across both mathematics and partner disciplines.

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